Additional files for the Manuscript:

Unravelling the Complex Nature of Resilience Factors and their Changes between Early and Later Adolescence

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Additional file I

In our previous report[1] we used a distress index computed by Brodbeck and colleagues (2011)[2]. This index was however only computed for age 14. As we here wanted to compare two occasions, we decided to compute a separate general distress factor including information for both occasions, so that we could apply invariance constraints over the two time points. This was for example necessary to compare the latent means. Moreover, in comparison to Brodbeck and colleagues (2011)[2] we simplified the index (e.g. through only using the short form rather than the complete version of the used depression scale), to ensure feasibility of the computation of the invariance models (particularly because of the increased computation time with regard to the multiple imputed data sets).

As the rumination questionnaire underwent revision between our two occasions, different versions of the questionnaire were used at the two occasions. The ruminative reflection factor stayed the same for both time points, however, we had to use another ruminative brooding factor than in Fritz, Fried et al. (2018)[1] as only two of the five originally used items were available for both occasions. Here we report results based on a ruminative brooding approach that has been established by Burwell and Shirk (2007; 6 items)[3] for a version of the rumination questionnaire that matches the one used at our second occasion, as five of the six identified items of that approach were available for both of our occasions. We also analysed the network models excluding the brooding variable, which revealed similar results, see Additional file II.

Additional file II

The following three figures depict CA+ and CA- networks as presented in the main manuscript, however this time excluding the brooding variable. The models were estimated separately for age 14 and 17, as well as (1) once without the general distress variable, (2) once with the general distress variable, and (3) once corrected for the general distress variable. At age 14, the network invariance test was not significant for the networks without the general distress variable (M = .14, p = .41; see Figure 1), but the global network expected influence differed between the CA+ and the CA- RF networks (EI_{CA+} = 2.59, EI_{CA-} = 2.96, EI = 0.37, p = .02). More specifically, the CA+ network was less positively connected than the CA- network. Those findings were only partially similar in the networks for age 17, as neither of the two tests revealed significant differences between the CA+ and the CA- group (M = .12, p = .64; EI_{CA+} = 2.93, EI_{CA+} = 2.79, EI = 0.14, p = .31). When we compared the RF networks for age 14 and age 17, the two CA+ network were not invariant over time, in other words, they did vary over time (M = .23, p = .002). Moreover, the RFs in the age 14 network were less positively interrelated than in the age 17 network (EI_{14} = 2.59, EI_{17} = 2.93, EI = 0.34, p = .003). The age 14 and age 17 CA- networks did however not differ with regard to their global network structure (M = .15, p = .45; EI_{14} = 2.96, EI_{17} = 2.79, EI = 0.17, p = .26).

For the networks with the general distress variable, the network invariance test (M = .19, p = .12; see Figure 2) was not significant at age 14. However, the global network expected influence differed significantly between the CA+ and the CA- networks (EI_{CA+} = -0.19, EI_{CA-} = 0.75, EI = 0.94, p < .01). Those findings were only partially similar in the networks for age 17, as neither of the two tests revealed significant differences between the CA+ and the CA- group (M = .15, p = .51; EI_{CA+} = 0.13, EI_{CA-} = 0.55, EI = 0.42, p = .19). When we compared the networks for age 14 and age 17, we did not find any significant global network structure differences; neither for adolescents with (M = .15, p = .19; EI_{14} = -0.19, EI_{17} = 0.13, EI = 0.32, p = .35) nor for adolescents without a history of adversity (M = .14, p = .62; EI_{14} = 0.75, EI_{17} = 0.55, EI = 0.20, p = .50).

For the networks corrected for the general distress variable, the network invariance test for the CA+ and the CA- group (M = .19, p = .10; see Figure 3) was not (or only very marginally) significant, at age 14. In contrast, the global network expected influence differed between the CA+ and the CA- networks (EI_{CA+} = 1.36, EI_{CA-} = 2.09, EI = 0.73, p = .001). Those findings were again only partially similar in the networks for age 17, as neither of the two tests revealed significant differences between the CA+ and the CA- group (M = .12, p = .82; EI_{CA+} = 1.69, EI_{CA-} = 1.92, EI = 0.24, p = .27). When we compared the networks for age 14 and age 17, we once more did not find any significant global network structure differences; neither for adolescents with (M = .12, p =

.53; EI_{14} = 1.36, EI_{17} = 1.69, EI = 0.33, p = .17) nor for adolescents without a history of adversity (M = .14, p = .58; EI_{14} = 2.09, EI_{17} = 1.92, EI = 0.17, p = .41).

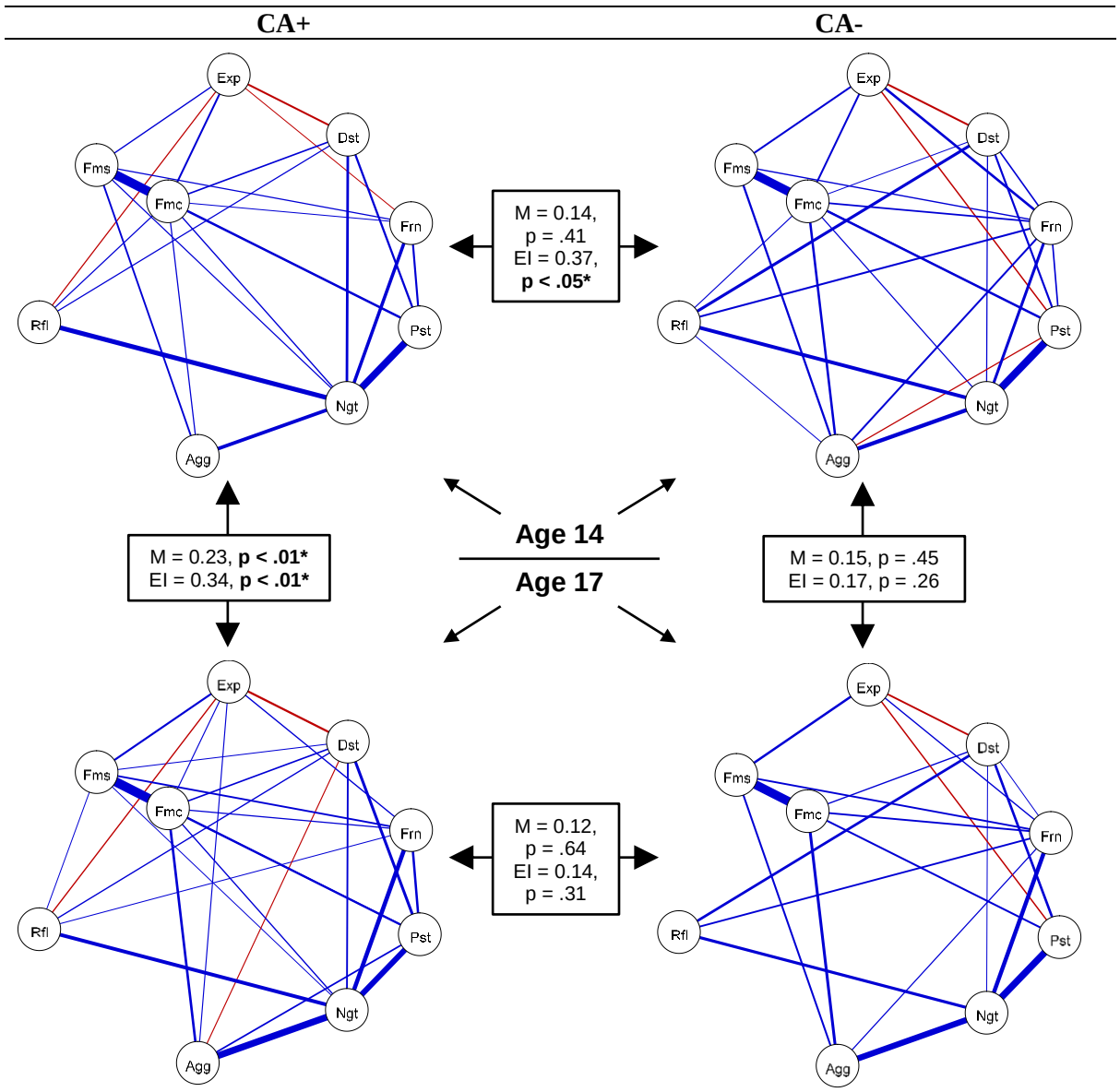

Figure 1. CA+ (*n* = 631) and CA- (*n* = 499) resilience factor networks for age 14 (upper panel) and age 17 (lower panel) without the brooding and the general distress variable. Width of the lines = association strength. Positive interrelations = blue, negative interrelations = red. **Legend:** Frn = friend support, fms = family support, fmc = family cohesion, ngt = negative self-esteem, pst = positive self-esteem, rfl = reflection, brd = brooding, dst = distress tolerance, agg = aggression, exp = expressive suppression. The boxes depict the maximal interrelation difference between the respective two networks (M), the difference in global network expected influence (EI) between the respective two networks (EI), and the corresponding p-values (5000 comparison samples).

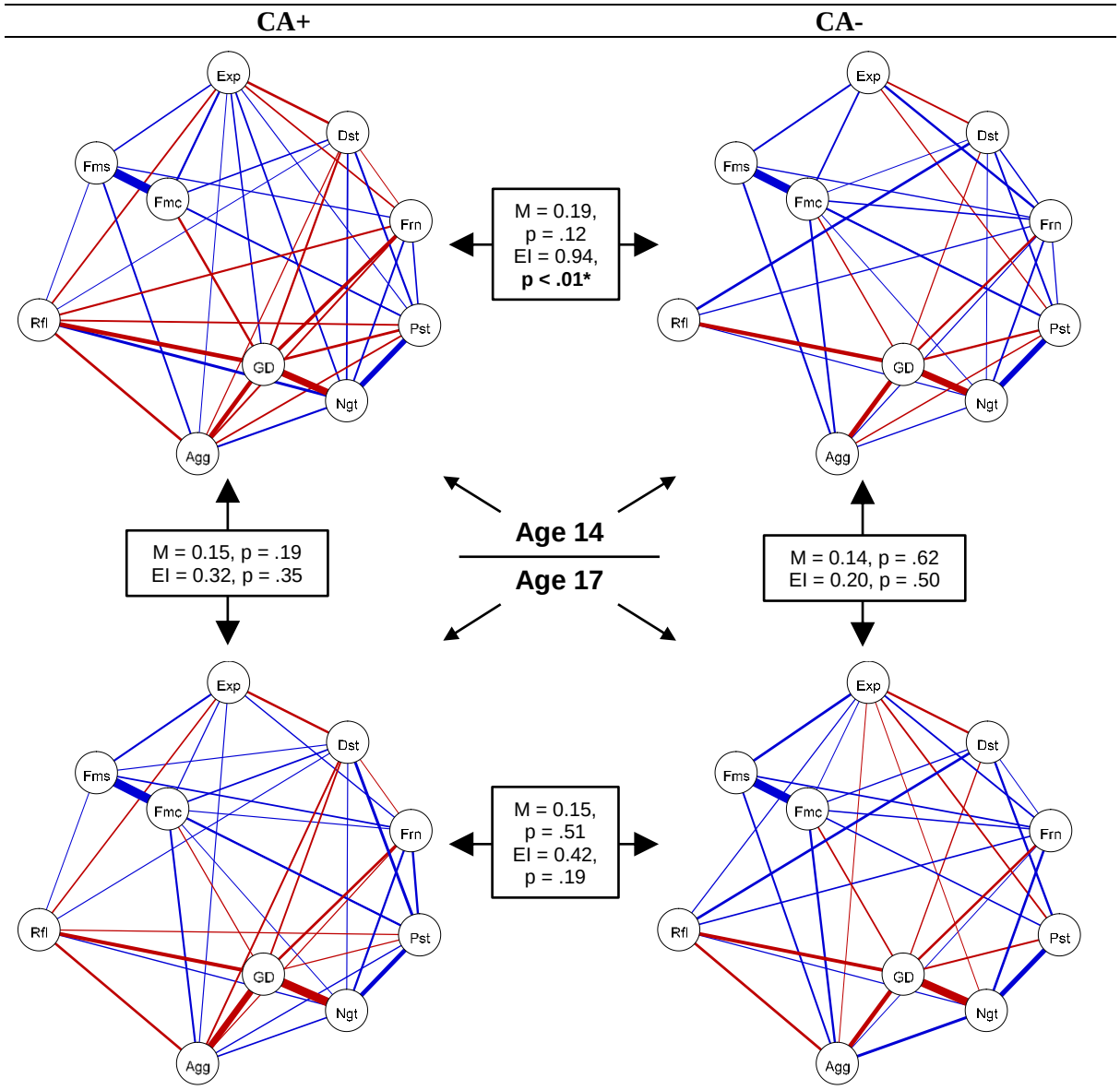

Figure 2. CA+ (*n* = 631) and CA- (*n* = 499) resilience factor networks for age 14 (upper panel) and age 17 (lower panel) without the brooding variable, but with the general distress variable. Width of the lines = association strength. Positive interrelations = blue, negative interrelations = red. **Legend:** Frn = friend support, fms = family support, fmc = family cohesion, ngt = negative self-esteem, pst = positive self-esteem, rfl = reflection, brd = brooding, dst = distress tolerance, agg = aggression, exp = expressive suppression, GD = general distress. The boxes depict the maximal interrelation difference between the respective two networks (M), the difference in global network expected influence (EI) between the respective two networks (EI), and the corresponding p-values (5000 comparison samples).

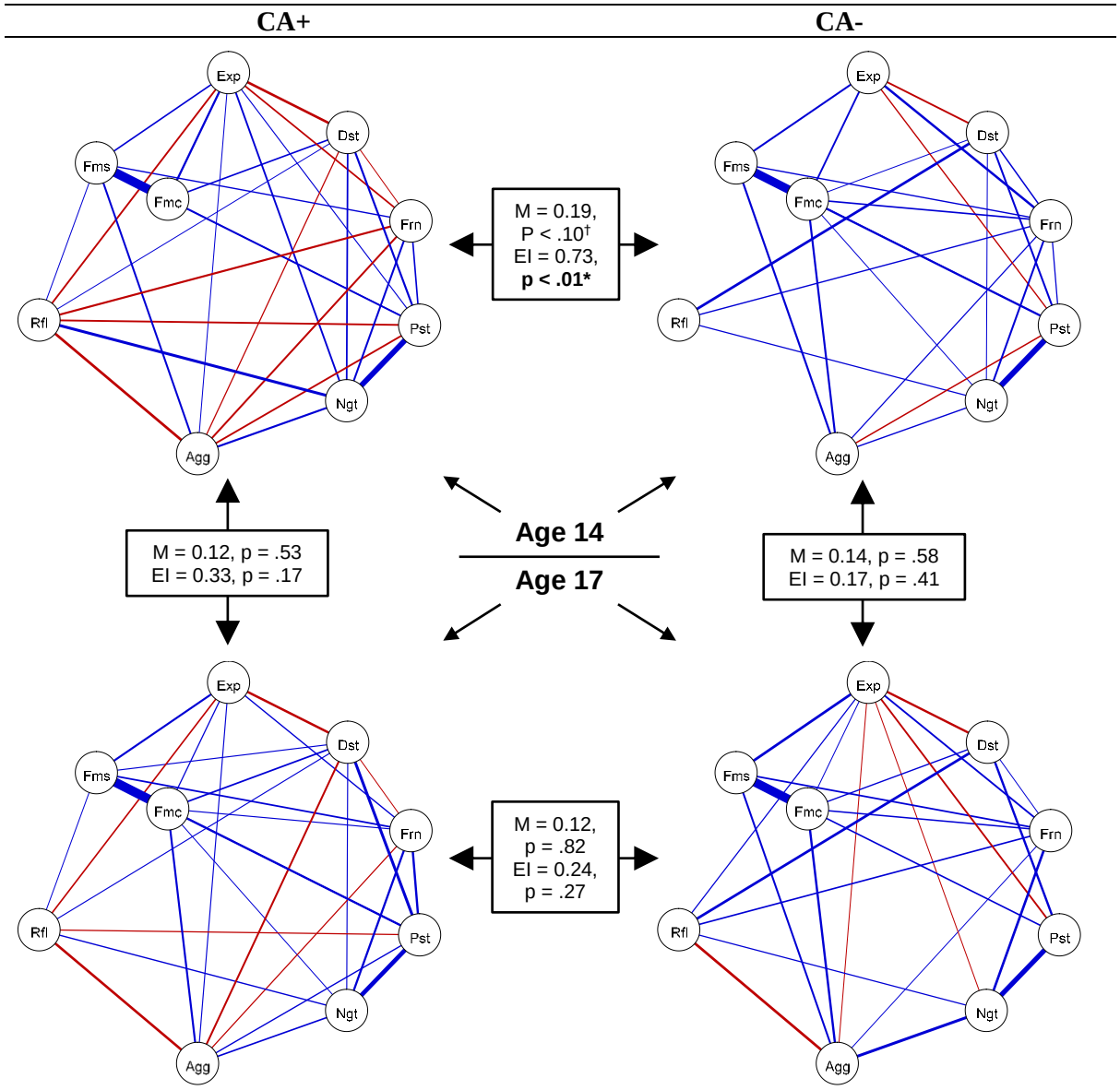

Figure 3. CA+ (*n* = 631) and CA- (*n* = 499) resilience factor networks for age 14 (upper panel) and age 17 (lower panel) without the brooding variable and corrected for the general distress variable. Width of the lines = association strength. Positive interrelations = blue, negative interrelations = red. **Legend:** Frn = friend support, fms = family support, fmc = family cohesion, ngt = negative self-esteem, pst = positive self-esteem, rfl = reflection, brd = brooding, dst = distress tolerance, agg = aggression, exp = expressive suppression. The boxes depict the maximal interrelation difference between the respective two networks (M), the difference in global network expected influence (EI) between the respective two networks (EI), and the corresponding p-values (5000 comparison samples).

Additional file III

We conducted all analyses in R version 3.5.1, and used the below packages (see Table 1), and further dependencies these packages load.

Table 1

Used R packages, including their version number and reference

Package (version number)	**Reference**
mice (3.5.0)	van Buren, S. & Groothuis-Oudshoorn K. (2011)[4]
dplyr (0.7.7)	Wickham, H., François, R., Henry, L. & Müller (2018)[5]
pastecs (1.3.21**)**	Grosjean, P. & Ibanez, F (2018)[6]
coin (1.2-2)	Hothorn, T., Hornik, K., van de Wiel, M. A. & Zeileis, A (2008)[7]
reshape (0.8.8)	Wickham, H (2007)[8]
sjPlot (2.6.2)	Lüdecke, D (2018)[9]
lavaan (0.6-4)	Rosseel, Y (2012)[10]
semTools (0.5-1.933)	Jorgensen, T. D., Pornprasertmanit, S., Schoemann, A. M. & Rosseel, Y (2018)[11]
ggplot2 (3.1.0)	Wickham, H (2016)[12]
qgraph (1.5)	Epskamp, S., Cramer, A. O. J., Waldorp, L. J., Schmittmann, V. D. & Borsboom, D (2012)[13]
bootnet (1.1.0)	Epskamp, S., Borsboom, D. & Fried, E. I (2018)[14]
NetworkComparisonTest (2.0.1)	van Borkulo, C. D (2018)[15]

Additional file IV

We evaluated differences between those participants who had full data and participants who had missingness, either due to attrition or incidental missingness, as stipulated in Table 2. All RFs and the general distress variable had a small number of participants with entire missingness at both time points (50 to 78 participants). A minor subset of participants did not provide data at occasion1, but at occasion 2 for some of the scales (10 to 30 participants per scale). There was more attrition for people who provided data at occasion 1 but not at occasion 2 (123 to 294 per scale). There was a range of participants with incidentally missing items, which differed largely per scale (from 4 for aggression to 152 for general distress).

We also investigated whether the missingness was predictable (see Table 3). We identified that missingness on all RFs and general distress could be explained by CA. Moreover, for seven RFs and distress missingness was also explained by being male and by having a low mood (MFQ levels). A psychiatric history prior to the age of 14 explained additionally missingness in six RFs and general distress. Overall, we excluded 50 participants who had more than 85% of missing items across the scales, which resulted in 1188 remaining participants. Among those 1188 all had less than 59% missing items. On average the items had 9% missingness.

Table 2

Missingness patterns (N= 1238)

Variable	No data	Full data	Missing T2	Missing T1	Incidental M
FRN	051	941	192	030	024
FMS	054	915	190	028	051
FMC	054	917	190	028	049
PST	050	955	180	027	026
NGT	050	961	180	027	020
BRD	050	1004	123	029	032
RFL	050	1000	123	030	035
DST	073	849	294	010	012
AGG	050	975	180	029	004
EXP	078	854	292	014	000
GD	050	830	179	027	152

Note. Incidental M. = incidental missingness, FRN = friendship support, FMS = family support, FMC = family cohesion, PST = positive self-esteem, NGT = negative self-esteem, BRD = brooding, RFL = reflection, DST = distress tolerance, AGG = aggression, EXP = expressive suppression, GD = general distress.

Table 3

Missingness predictors

		U/ χ^2 (df)	*p*	Cross tabs (1 = no missing; 2 = missing)
GD	CA	7.0557 (1)	<0.01**	1 2 CA- 374 127 CA+ 429 209
	Gender	5.9034 (1)	<0.05*	1 2 female 458 216 male 345 219
	MFQ	123280	<0.001***	1 M: 15.3300 2 M: 17.8711485
	Age-14 prior psychiatric history (PP; yes = PP+; no = PP-)	5.6529 (1)	<0.05*	1 2 PP- 623 286 PP+ 180 116
FRN	CA	11.361 (1)	<0.001***	1 2 CA- 423 78 CA+ 486 152
	Gender	10.95 (1)	<0.001***	1 2 female 521 153 male 388 176
	MFQ	103140	<0.05*	1 M = 15.7665 2 M = 17.3571429
	Age-14 PP	3.9534 (1)	<0.05*	1 2 PP- 699 210 PP+ 210 86
FMS	CA	20.05 (1)	<0.001***	1 2 CA- 421 80 CA+ 464 174
	Gender	3.9295 (1)	<0.05*	1 2 female 498 176 male 387 177
	MFQ	109500	<0.001***	1 M: 15.5386 2 M: 17.8088737
	Age-14 PP	5.8008 (1)	<0.05*	1 2 PP- 684 225 PP+ 201 95
FMC	CA	19.544 (1)	<0.001***	1 2 CA- 421 80 CA+ 465 173
	Gender	4.7008 (1)	<0.05*	1 2 female 500 174 male 386 178
	MFQ	109270	<0.001***	1 M: 15.5271 2 M: 17.843003
	Age-14 PP	5.9935 (1)	<0.05*	1 2 PP- 685 224 PP+ 201 95
PST	CA	7.9443 (1)	<0.01**	1 2 CA- 425 76 CA+ 498 140
	Gender	12.51 (1)	<0.001***	1 2 female 530 144 male 393 171
	MFQ	102010	0.094	1 M: 15.8959 2 M: 16.9495798
	Age-14 PP	3.736 (1)	0.053	1 2 PP- 709 200 PP+ 214 82
NGT	CA	10.722 (1)	<0.01**	1 2 CA- 430 71 CA+ 498 140
	Gender	10.222(1)	<0.01**	1 2 female 530 144

				male 398 166
	MFQ	99465	0.062	1 M: 15.8263 2 M: 17.2489270
	Age-14 PP	1.8092 (1)	0.18	1 2 PP- 709 200 PP+ 219 77
AGG	CA	11.568 (1)	<0.001***	1 2 CA- 436 65 CA+ 505 133
	Gender	18.327 (1)	<0.001***	1 2 female 562 112 male 413 151
	MFQ	84244	0.13	1 M: 15.9066 2 M: 17.1881720
	Age-14 PP	2.3499 (1)	0.13	1 2 PP- 745 164 PP+ 230 66
BRD	CA	9.5907 (1)	<0.01**	1 2 CA- 446 55 CA+ 525 113
	Gender	4.2525 (1)	<0.05*	1 2 female 544 130 male 427 137
	MFQ	83354	<0.05*	1 M: 15.8412 2 M: 17.4947368
	Age-14 PP	1.4102 (1)	0.24	1 2 PP- 740 169 PP+ 231 65
RFL	CA	7.2547 (1)	<0.01**	1 2 CA- 442 59 CA+ 525 113
	Gender	3.7544 (1)	0.053	1 2 female 541 133 male 426 138
	MFQ	83594	<0.05*	1 M: 15.8002 2 M: 17.6649485
	Age-14 PP	1.8251 (1)	0.18	1 2 PP- 738 171 PP+ 229 67
DST	CA	13.384 (1)	<0.001***	1 2 CA- 399 102 CA+ 446 192
	Gender	0.29893 (1)	0.59	1 2 female 465 209 male 380 184
	MFQ	112880	<0.001***	1 M: 15.2343 2 M: 18.3012048
	Age-14 PP	8.6094 (1)	<0.01**	1 2 PP- 658 251 PP+ 187 109
EXP	CA	20.024 (1)	<0.001***	1 2 CA- 407 94 CA+ 443 195
	Gender	0.47049 (1)	0.49	1 2 female 471 203 male 383 181
	MFQ	111640	<0.001***	1 M: 15.2452 2 M: 18.3487654
	Age-14 PP	9.8232 (1)	<0.01**	1 2 PP- 666 243 PP+ 188 108

Note. CA = childhood adversity, MFQ = Mood and Feelings Questionnaire, FRN = friendship support, FMS = family support, FMC = family cohesion, PST = positive self-esteem, NGT = negative self-esteem, BRD = brooding, RFL = reflection, DST = distress tolerance, AGG = aggression, EXP = expressive suppression, GD = general distress.

Additional file V

Part A. We decided to use factor scores, instead of sum scores, for two reasons. Firstly, to remove as much measurement error as possible from the latent resilience factor (RF) variables. In most published network analysis manuscripts author have used item level data. Yet, here we were not interested in the individual items but in RF constructs which were derived from a previous systematic review. As all RFs (except for expressive suppression) consisted of more than 3 items we could apply factor analyses to effectively reduce measurement error. A similar method would have been to use latent network modelling, which does the same but estimates the factor scores and the network models in one step.[16] Upon closer inspection we concluded that latent network modelling is as yet only (or at least particularly) applicable to smaller models. The second reason for using factor scores was that when using sum scores one assumes that all items have the same importance and hence go with the same weight into the construct (i.e. tau equivalence). However, when using factor scores, the factor loadings enable every item to have a unique weight for the latent construct, which means that items can differ in importance, enhancing construct validity. We felt that this point was particularly important as many of our used (sub-)scales did not consist of a large number of items (with exception for the general distress factor).

For completeness, we additionally performed our analyses based on sum scores. We added the results for mean change analyses with sum scores to Supplement Vb and the results for network analyses with sum scores to Supplement XV. The sum score results were overall similar to the results for fully invariant factor scores.

Part B. As we aimed to compare two time points, we estimated longitudinal CFAs (LCFAs) separately for each RF and the general distress variable. Given that all of the RF items (as well as the general distress items) were assessed with three to six answer categories, we computed categorical LCFAs and treated the items as ordinal (i.e. ordered categorical) indicators.[17–20] Accordingly, we used the weighted least squares mean and variance adjusted (WLSMV) estimator. The categorical LCFAs were specified as shown in Figure 4 (which is modelled along examples of [17]). We identified the model as suggested by Wu and Estabrook[20], using the theta parametrization. We estimated, a configural (i.e. baseline) model, a strong invariance and a full invariance model. For the strong invariance LCFAs we equated item loadings and item thresholds across the two time points (i.e. age 14 and 17), fixed all item intercepts to 0, the item variance of the first time point to 1, the latent factor mean of the first time point to 0, and the latent factor variance of the first time point to 1 (item covariances and the latent factor covariance were freely estimated). For the full invariance LCFAs we again equated item loadings and item thresholds across the two time points (i.e. age 14 and 17) and fixed all item

intercepts to 0, this time however we fixed all item variances to 1, both latent factor means to 0, and both latent factor variances to 1 (item covariances and the latent factor covariance were again freely estimated). A model specification overview can be found in Table 4. Table 5 depicts the fit indices for all models. We only applied modification indices when they were theoretically justified. We intended to pool over the fit indices of the 10 result sets (i.e. one for each imputation data set). We however discovered that for many of our models the pooling of fit indices resulted in either a negative or a close to negative chi-square statistics. When the chi-square statistic is negative, it needs to be set to zero, as the pooled fit otherwise cannot be computed. Unfortunately, a zero chi-square results in an arbitrary model fit. Therefore, we decided to report the fit indices of the separate models, which we consider more informative in this case (see Table 5). We do additionally provide the pooled standardized root mean residual (pooled SRMR) as this fit measure does not rely on the chi-square statistic (i.e. it represents the standardized difference between the observed and the predicted correlation) and is therefore reliable for our models. All models seemed to fit acceptably. Factor scores derived from the aggression models were however so poorly distributed that we had to binarize those scores. Distribution plots (i.e. box-and-whisker plots with individual data points) for the RFs (except for expressive suppression and aggression) and the general distress variable are depicted in Figure 5.

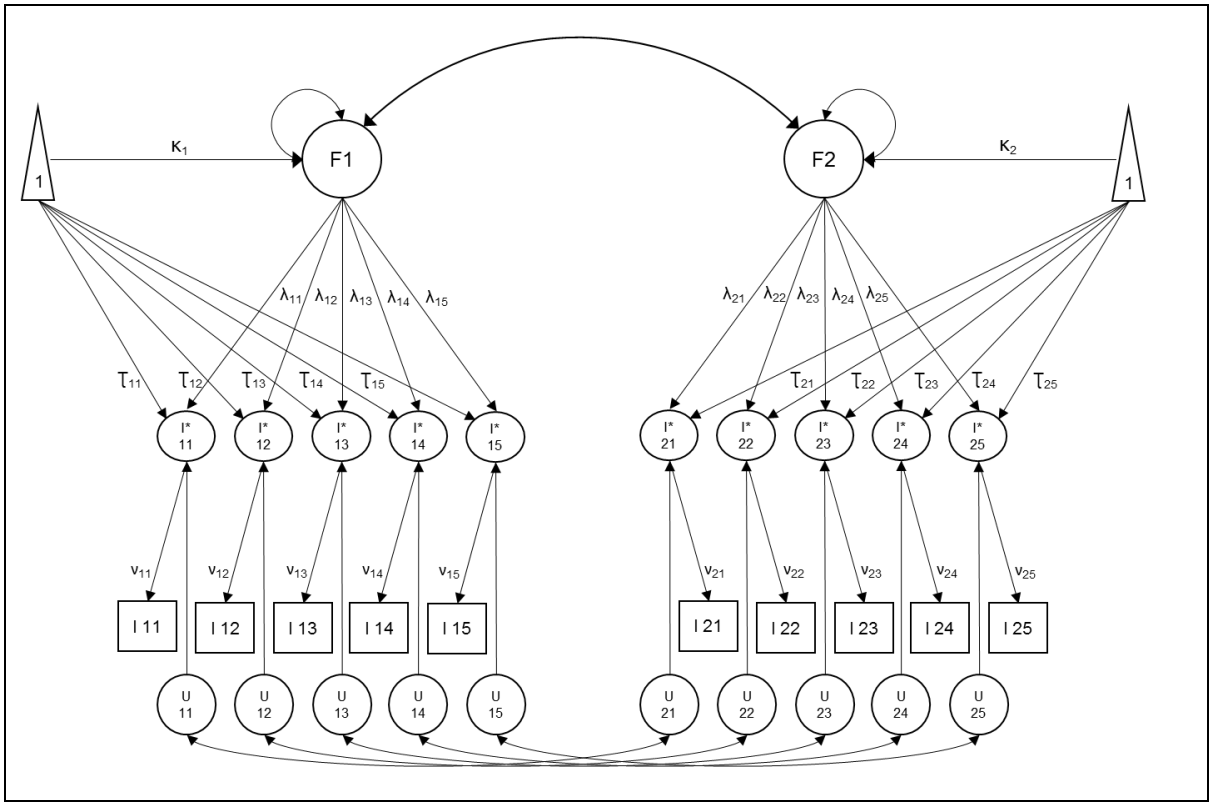

Figure 4. Longitudinal, categorical CFA model, with 5 categorical items assessed at two time points. The model is defined as follows: F = **common latent factor** (with the factor number indicating the corresponding time point); κ = **common latent factor means** (with the subscript number indicating the corresponding latent factor); I = **categorical observed items**; I* = **continuous latent item responses** inferred from the categorical observed items and described by the item thresholds; λ = **item loadings**; τ= **item intercepts**; ν = **item thresholds** (the number of thresholds is not depicted as every ordinal item has multiple thresholds, namely one less than the number of measured categories); U = **unique latent (item) factors;** for indicators with two numbers, the first number refers to the time point and the second to the item number; ↔ = two-sided arrows indicate (auto-co)variances. The Figure is modelled along examples of Liu, Millsap, West, Tein, Tanaka and Grimm [17]: https://doi.org/10.1037/met0000075.

Table 4

Model specifications for the three estimated invariance levels of the categorical LCFAs

		(1) Configural Model
Estimated parameters:		
1.	λ	= **factor loadings:** all freely estimated
2.	ν	= **items thresholds:** all freely estimated
3.	auto-covar(U)	= **unique latent (item) factor auto-covariances:** between the corresponding time 1 and time 2 unique latent (item) factors are all freely estimated
4.	auto-covar(F)	= **common latent factor auto-covariance:** between the corresponding time 1 and time 2 common latent factor is freely estimated

Parameters fixed for both time points:

1. τ = **item intercepts:** all fixed to zero
2. var(U) = **unique latent (item) factor variances**: are all fixed to one
3. κ = **common latent factor means:** all fixed to zero
4. var(F) = **common latent factors variances**: are all fixed to one

Parameters fixed for only the first but estimated for the second time point:

-

Equated parameters across time:

-

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(2) Strong Invariance Model

Estimated parameters:

1. auto-covar(U) = **unique latent (item) factor auto-covariances:** between the corresponding time 1 and time 2 unique latent (item) factors are all freely estimated
2. auto-covar(F) = **common latent factor auto-covariance:** between the corresponding time 1 and time 2 common latent factor is freely estimated

Parameters fixed for both time points:

1. τ = **item intercepts:** all fixed to zero

Parameters fixed for only the first but estimated for the second time point:

1. var(U) = **unique latent (item) factor variances:** fixed to one only for the first, but not the second time point
2. κ = **common latent factor means:** fixed to zero only for the first, but not the second time point
3. var(F) = **common latent factor variances:** fixed to one only for the first, but not the second time point

Equated parameters across time:

1. λ = **factor loadings:** all equated across time
2. ν = **items thresholds:** all equated across time

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(3) Full Invariance Model

Estimated parameters:

1. auto-covar(U) = **unique latent (item) factor auto-covariances:** between the corresponding time 1 and time 2 unique latent (item) factors are all freely estimated
2. auto-covar(F) = **common latent factor auto-covariance:** between the corresponding time 1 and time 2 common latent factor is freely estimated

Parameters fixed for both time points:

1. τ = **item intercepts:** all fixed to zero
2. var(U) = **unique latent (item) factor variances:** all fixed to one
3. κ = **common latent factor means:** all fixed to zero
4. var(F) = **common latent factor variances:** all fixed to one

Parameters fixed for only the first but estimated for the second time points:

-

Equated parameters across time:

1. λ = **factor loadings:** all equated across time
2. ν = **items thresholds:** all equated across time

Table 5

Longitudinal, Categorical Confirmatory Factor Analyses Conducted with the WLSMV Estimator

Model	**CFI**	**TLI**	**RMSEA**	**RMSEA 90% CI**	**RMSEA 90% CI**	**Chi^2**
Friendship support [21]*, 5 items, 0 unique item covariances*						
CM-1	0.976	0.962	0.079	0.070	0.089	244.996
CM-2	0.975	0.961	0.086	0.077	0.096	285.431
CM-3	0.982	0.973	0.083	0.074	0.092	264.909
CM-4	0.974	0.960	0.086	0.077	0.095	283.386
CM-5	0.978	0.965	0.085	0.076	0.094	275.672
CM-6	0.974	0.959	0.083	0.074	0.093	268.033
CM-7	0.979	0.967	0.076	0.067	0.085	227.553
CM-8	0.979	0.967	0.080	0.071	0.089	247.474
CM-9	0.975	0.960	0.084	0.075	0.093	270.736
CM-10	0.967	0.949	0.090	0.081	0.099	307.232
CM1-10	Pooled SRMR: 0.057					
SIM-1	0.975	0.974	0.066	0.058	0.073	270.276
SIM-2	0.971	0.971	0.075	0.067	0.082	335.870
SIM-3	0.980	0.979	0.072	0.065	0.079	313.837
SIM-4	0.972	0.971	0.073	0.065	0.080	319.411
SIM-5	0.977	0.976	0.070	0.063	0.078	301.303
SIM-6	0.973	0.972	0.069	0.061	0.076	290.286
SIM-7	0.976	0.975	0.066	0.058	0.073	268.221
SIM-8	0.973	0.972	0.073	0.065	0.080	319.566

SIM-9	0.973	0.972	0.071	0.063	0.078	303.678
SIM-10	0.966	0.965	0.074	0.067	0.082	331.894
SIM1-10	Pooled SRMR: 0.057					
FIM-1	0.975	0.978	0.061	0.054	0.068	275.396
FIM-2	0.968	0.972	0.073	0.066	0.080	374.584
FIM-3	0.970	0.974	0.081	0.074	0.088	448.215
FIM-4	0.969	0.972	0.071	0.064	0.078	358.451
FIM-5	0.974	0.977	0.068	0.061	0.075	333.487
FIM-6	0.974	0.977	0.063	0.056	0.070	278.475
FIM-7	0.978	0.981	0.058	0.051	0.065	255.501
FIM-8	0.975	0.978	0.065	0.058	0.072	304.653
FIM-9	0.971	0.974	0.067	0.061	0.075	326.333
FIM-10	0.968	0.971	0.067	0.060	0.074	323.691
FIM1-10	Pooled SRMR: 0.060					
Family support [22]*, 5 items, 0 unique item covariances*						
CM-1	0.990	0.985	0.057	0.047	0.066	138.928
CM-2	0.992	0.987	0.052	0.043	0.062	122.789
CM-3	0.994	0.99	0.046	0.036	0.056	100.896
CM-4	0.993	0.99	0.046	0.037	0.056	102.619
CM-5	0.991	0.987	0.054	0.044	0.063	128.006
CM-6	0.992	0.988	0.048	0.039	0.058	108.791
CM-7	0.990	0.985	0.056	0.047	0.066	138.048
CM-8	0.989	0.983	0.059	0.049	0.068	146.971
CM-9	0.991	0.986	0.052	0.043	0.062	123.619
CM-10	0.992	0.988	0.051	0.042	0.061	119.283
CM1-10	Pooled SRMR: 0.029					
SIM-1	0.985	0.983	0.06	0.052	0.068	212.679
SIM-2	0.99	0.989	0.049	0.041	0.057	153.589
SIM-3	0.989	0.988	0.051	0.043	0.059	162.287
SIM-4	0.989	0.988	0.051	0.043	0.059	161.544
SIM-5	0.989	0.987	0.052	0.044	0.061	169.785
SIM-6	0.99	0.989	0.047	0.039	0.055	144.249
SIM-7	0.987	0.985	0.055	0.047	0.063	185.314
SIM-8	0.987	0.986	0.054	0.046	0.063	180.133
SIM-9	0.988	0.987	0.051	0.043	0.060	165.77
SIM-10	0.991	0.990	0.048	0.040	0.056	148.522
SIM1-10	Pooled SRMR: 0.029					

FIM-1	0.981	0.981	0.063	0.056	0.071	269.238
FIM-2	0.984	0.985	0.056	0.049	0.063	221.745
FIM-3	0.981	0.981	0.063	0.056	0.071	271.247
FIM-4	0.984	0.984	0.057	0.05	0.064	227.918
FIM-5	0.985	0.986	0.055	0.048	0.063	218.267
FIM-6	0.989	0.989	0.046	0.039	0.054	166.872
FIM-7	0.983	0.984	0.057	0.05	0.065	230.402
FIM-8	0.985	0.986	0.054	0.046	0.061	207.083
FIM-9	0.988	0.989	0.048	0.040	0.055	174.514
FIM-10	0.982	0.983	0.061	0.054	0.069	257.422
FIM1-10	Pooled SRMR: 0.041					
Family cohesion [22]*, 7 items, 1 unique item covariance*						
CM-1	0.983	0.977	0.053	0.047	0.059	288.144
CM-2	0.97	0.959	0.066	0.06	0.072	414.681
CM-3	0.984	0.978	0.055	0.048	0.061	303.946
CM-4	0.97	0.959	0.071	0.065	0.077	470.339
CM-5	0.983	0.976	0.053	0.047	0.06	292.398
CM-6	0.98	0.973	0.056	0.05	0.062	314.174
CM-7	0.988	0.983	0.047	0.041	0.054	244.447
CM-8	0.98	0.973	0.056	0.05	0.063	318.451
CM-9	0.981	0.974	0.055	0.049	0.061	308.343
CM-10	0.985	0.979	0.052	0.046	0.058	280.724
CM1-10	Pooled SRMR: 0.043					
SIM-1	0.978	0.976	0.054	0.049	0.06	368.208
SIM-2	0.964	0.96	0.066	0.06	0.071	502.767
SIM-3	0.978	0.975	0.057	0.052	0.063	399.398
SIM-4	0.964	0.96	0.071	0.065	0.076	571.349
SIM-5	0.979	0.976	0.053	0.048	0.059	358.802
SIM-6	0.975	0.973	0.056	0.051	0.062	391.492
SIM-7	0.98	0.978	0.055	0.049	0.06	374.379
SIM-8	0.975	0.972	0.057	0.051	0.063	398.621
SIM-9	0.977	0.974	0.055	0.05	0.061	381.047
SIM-10	0.981	0.979	0.052	0.047	0.058	348.549
SIM1-10	Pooled SRMR: 0.044					
FIM-1	0.969	0.969	0.061	0.056	0.067	499.191
FIM-2	0.964	0.964	0.062	0.057	0.067	506.42
FIM-3	0.962	0.962	0.071	0.066	0.076	631.775

FIM-4	0.959	0.959	0.071	0.066	0.076	639.074
FIM-5	0.973	0.973	0.057	0.052	0.063	443.698
FIM-6	0.967	0.967	0.062	0.057	0.068	511.904
FIM-7	0.963	0.963	0.071	0.065	0.076	627.937
FIM-8	0.965	0.965	0.063	0.058	0.069	525.539
FIM-9	0.973	0.973	0.057	0.052	0.063	443.87
FIM-10	0.966	0.966	0.066	0.061	0.071	563.688
FIM1-10	Pooled SRMR: 0.055					
Positive self-esteem [23]*, 5 items, 0 unique item covariances*						
CM-1	0.994	0.99	0.069	0.06	0.079	194.745
CM-2	0.995	0.993	0.059	0.05	0.068	148.122
CM-3	0.996	0.994	0.055	0.046	0.064	132.42
CM-4	0.996	0.994	0.056	0.047	0.066	137.011
CM-5	0.997	0.995	0.052	0.042	0.061	121.014
CM-6	0.996	0.993	0.057	0.048	0.067	141.289
CM-7	0.997	0.995	0.05	0.04	0.059	113.795
CM-8	0.997	0.995	0.051	0.042	0.061	118.093
CM-9	0.996	0.994	0.055	0.046	0.065	134.281
CM-10	0.996	0.994	0.055	0.046	0.065	133.806
CM1-10	Pooled SRMR: 0.022					
SIM-1	0.993	0.992	0.062	0.055	0.07	234.615
SIM-2	0.994	0.994	0.054	0.047	0.062	189.538
SIM-3	0.995	0.995	0.05	0.043	0.059	168.888
SIM-4	0.995	0.995	0.053	0.045	0.061	182.032
SIM-5	0.996	0.995	0.05	0.042	0.058	167.425
SIM-6	0.996	0.995	0.049	0.041	0.057	159.632
SIM-7	0.996	0.996	0.044	0.036	0.053	140.022
SIM-8	0.996	0.995	0.047	0.039	0.055	152.146
SIM-9	0.996	0.996	0.047	0.039	0.055	150.135
SIM-10	0.995	0.995	0.051	0.043	0.059	171.582
SIM1-10	Pooled SRMR: 0.022					
FIM-1	0.993	0.994	0.054	0.047	0.062	219.431
FIM-2	0.994	0.994	0.053	0.045	0.06	210.452
FIM-3	0.994	0.995	0.053	0.046	0.06	212.1
FIM-4	0.993	0.994	0.058	0.051	0.065	243.325
FIM-5	0.993	0.993	0.06	0.053	0.068	260.99
FIM-6	0.995	0.995	0.048	0.041	0.055	182.094

FIM-7	0.994	0.994	0.054	0.047	0.062	219.7
FIM-8	0.995	0.996	0.045	0.037	0.052	165.949
FIM-9	0.996	0.996	0.044	0.037	0.052	162.66
FIM-10	0.994	0.994	0.054	0.047	0.061	216.742
FIM1-10	Pooled SRMR: 0.029					
Negative self-esteem [23]*, 5 items, 0 unique item covariances*						
CM-1	0.999	0.999	0.025	0.013	0.036	50.578
CM-2	0.999	0.999	0.025	0.013	0.036	50.643
CM-3	0.999	0.999	0.025	0.012	0.036	50.203
CM-4	1	0.999	0.023	0.01	0.035	47.206
CM-5	1	0.999	0.02	0	0.032	42.357
CM-6	1	0.999	0.02	0.003	0.032	43.016
CM-7	1	1	0.015	0	0.028	36.877
CM-8	0.999	0.999	0.024	0.012	0.036	49.542
CM-9	0.999	0.999	0.027	0.015	0.038	54.188
CM-10	1	1	0.018	0	0.03	40.01
CM1-10	Pooled SRMR: 0.023					
SIM-1	0.999	0.999	0.031	0.022	0.04	89.463
SIM-2	0.999	0.999	0.031	0.022	0.04	88.917
SIM-3	0.999	0.999	0.028	0.018	0.037	80.439
SIM-4	0.999	0.999	0.024	0.013	0.033	70.227
SIM-5	0.999	0.999	0.023	0.012	0.033	68.249
SIM-6	0.999	0.999	0.024	0.014	0.033	70.689
SIM-7	0.999	0.999	0.024	0.013	0.033	69.754
SIM-8	0.999	0.999	0.03	0.021	0.039	87.168
SIM-9	0.999	0.999	0.028	0.019	0.037	80.832
SIM-10	0.999	0.999	0.021	0.009	0.031	63.684
SIM1-10	Pooled SRMR: 0.023					
FIM-1	0.989	0.989	0.084	0.078	0.092	463.987
FIM-2	0.988	0.989	0.088	0.081	0.095	503.638
FIM-3	0.985	0.986	0.091	0.084	0.098	527.52
FIM-4	0.986	0.987	0.094	0.087	0.101	559.567
FIM-5	0.986	0.987	0.094	0.088	0.102	567.829
FIM-6	0.986	0.987	0.09	0.084	0.098	525.236
FIM-7	0.989	0.989	0.089	0.082	0.096	506.841
FIM-8	0.988	0.989	0.086	0.079	0.093	474.214
FIM-9	0.984	0.985	0.104	0.097	0.111	678.34

FIM-10	0.986	0.987	0.094	0.087	0.101	557.688
FIM1-10	Pooled SRMR: 0.063					
Brooding old [3,24]*, 4 items, 0 unique item covariances*						
CM-1	0.977	0.956	0.067	0.054	0.08	93.868
CM-2	0.971	0.947	0.078	0.065	0.091	122.255
CM-3	0.977	0.957	0.068	0.055	0.081	96.623
CM-4	0.98	0.962	0.071	0.059	0.084	105.314
CM-5	0.977	0.956	0.076	0.063	0.089	117.05
CM-6	0.973	0.949	0.078	0.066	0.091	123.139
CM-7	0.977	0.957	0.069	0.056	0.082	98.864
CM-8	0.973	0.949	0.071	0.058	0.084	104.333
CM-9	0.969	0.942	0.077	0.065	0.09	121.504
CM-10	0.971	0.946	0.078	0.065	0.091	122.079
CM1-10	Pooled SRMR: 0.054					
SIM-1	0.936	0.929	0.085	0.075	0.095	238.995
SIM-2	0.927	0.918	0.096	0.086	0.106	298.739
SIM-3	0.936	0.928	0.088	0.078	0.098	252.866
SIM-4	0.937	0.93	0.097	0.087	0.107	303.33
SIM-5	0.935	0.927	0.098	0.088	0.107	307.155
SIM-6	0.932	0.924	0.096	0.086	0.106	296.329
SIM-7	0.936	0.928	0.089	0.08	0.099	261.496
SIM-8	0.93	0.922	0.088	0.078	0.098	254.419
SIM-9	0.938	0.93	0.085	0.075	0.095	237.518
SIM-10	0.928	0.919	0.095	0.085	0.105	291.417
SIM1-10	Pooled SRMR: 0.062					
FIM-1	0.942	0.948	0.073	0.064	0.082	225.822
FIM-2	0.934	0.94	0.082	0.074	0.091	279.996
FIM-3	0.946	0.952	0.072	0.063	0.081	221.084
FIM-4	0.941	0.947	0.084	0.076	0.093	292.813
FIM-5	0.939	0.945	0.085	0.076	0.094	296.591
FIM-6	0.937	0.943	0.082	0.074	0.091	280.363
FIM-7	0.941	0.947	0.077	0.068	0.086	247.179
FIM-8	0.939	0.945	0.074	0.065	0.083	231.274
FIM-9	0.942	0.948	0.073	0.064	0.082	227.791
FIM-10	0.937	0.943	0.08	0.071	0.089	265.313
FIM1-10	Pooled SRMR: 0.064					
Brooding new [3,24]*, 5 items, 0 unique item covariances*						

CM-1	0.992	0.988	0.048	0.038	0.057	106.843
CM-2	0.992	0.987	0.048	0.038	0.058	107.93
CM-3	0.991	0.986	0.05	0.04	0.059	113.783
CM-4	0.992	0.988	0.048	0.039	0.058	108.199
CM-5	0.991	0.986	0.05	0.041	0.06	115.891
CM-6	0.992	0.988	0.047	0.037	0.057	104.157
CM-7	0.993	0.99	0.043	0.033	0.053	92.914
CM-8	0.993	0.988	0.045	0.035	0.055	98.435
CM-9	0.992	0.988	0.046	0.036	0.056	101.432
CM-10	0.993	0.989	0.044	0.034	0.054	94.903
CM1-10	Pooled SRMR: 0.032					
SIM-1	0.99	0.989	0.045	0.037	0.053	142.215
SIM-2	0.99	0.99	0.043	0.035	0.051	133.586
SIM-3	0.988	0.987	0.047	0.039	0.056	153.827
SIM-4	0.99	0.99	0.044	0.036	0.052	138.354
SIM-5	0.988	0.987	0.048	0.04	0.056	156.958
SIM-6	0.991	0.99	0.043	0.035	0.051	133.694
SIM-7	0.99	0.99	0.043	0.035	0.052	135.477
SIM-8	0.991	0.99	0.042	0.034	0.05	129.786
SIM-9	0.99	0.989	0.043	0.035	0.052	135.846
SIM-10	0.99	0.99	0.043	0.035	0.051	132.763
SIM1-10	Pooled SRMR: 0.031					
FIM-1	0.986	0.987	0.049	0.041	0.056	186.199
FIM-2	0.981	0.983	0.055	0.048	0.063	227.768
FIM-3	0.981	0.983	0.055	0.048	0.062	224.08
FIM-4	0.984	0.985	0.052	0.045	0.059	205.898
FIM-5	0.981	0.983	0.056	0.049	0.064	233.487
FIM-6	0.983	0.984	0.054	0.047	0.061	217.252
FIM-7	0.983	0.985	0.053	0.046	0.06	211.592
FIM-8	0.982	0.983	0.054	0.047	0.061	218.171
FIM-9	0.983	0.984	0.053	0.046	0.06	210.824
FIM-10	0.983	0.984	0.053	0.045	0.06	209.935
FIM1-10	Pooled SRMR: 0.042					
Reflection [3,24], 5 items, 1 unique item covariance						
CM-1	0.992	0.986	0.046	0.037	0.057	95.986
CM-2	0.991	0.985	0.048	0.038	0.058	101.052
CM-3	0.99	0.983	0.05	0.04	0.06	105.905

CM-4	0.992	0.987	0.046	0.036	0.057	95.777
CM-5	0.992	0.986	0.047	0.037	0.057	98.052
CM-6	0.992	0.987	0.045	0.036	0.056	93.022
CM-7	0.994	0.989	0.041	0.031	0.052	81.375
CM-8	0.992	0.986	0.046	0.036	0.056	94.02
CM-9	0.992	0.986	0.048	0.038	0.058	99.497
CM-10	0.991	0.986	0.047	0.038	0.058	98.857
CM1-10	Pooled SRMR: 0.045					
SIM-1	0.986	0.984	0.05	0.042	0.058	156.491
SIM-2	0.985	0.984	0.05	0.042	0.059	159.87
SIM-3	0.985	0.983	0.051	0.043	0.059	161.732
SIM-4	0.985	0.983	0.052	0.044	0.061	170.309
SIM-5	0.986	0.984	0.05	0.042	0.059	160.03
SIM-6	0.986	0.984	0.05	0.042	0.058	157.737
SIM-7	0.988	0.986	0.046	0.038	0.055	141.928
SIM-8	0.986	0.984	0.049	0.041	0.057	153.663
SIM-9	0.986	0.984	0.051	0.043	0.059	163.984
SIM-10	0.986	0.984	0.05	0.042	0.058	158.201
SIM1-10	Pooled SRMR: 0.045					
FIM-1	0.966	0.968	0.071	0.064	0.079	330.033
FIM-2	0.968	0.969	0.069	0.062	0.076	313.059
FIM-3	0.963	0.965	0.073	0.065	0.08	340.539
FIM-4	0.967	0.968	0.072	0.065	0.079	336.733
FIM-5	0.968	0.969	0.07	0.063	0.077	319.366
FIM-6	0.97	0.971	0.067	0.06	0.074	298.213
FIM-7	0.969	0.97	0.069	0.062	0.076	311.317
FIM-8	0.967	0.968	0.069	0.062	0.077	315.391
FIM-9	0.967	0.969	0.071	0.064	0.078	327.705
FIM-10	0.965	0.966	0.072	0.065	0.079	336.78
FIM1-10	Pooled SRMR: 0.063					
Distress tolerance [25], 5 items, 1 unique item covariance						
CM-1	0.968	0.947	0.101	0.092	0.111	356.552
CM-2	0.969	0.948	0.105	0.096	0.114	379.225
CM-3	0.967	0.946	0.105	0.095	0.114	377.534
CM-4	0.968	0.947	0.103	0.094	0.113	369.052
CM-5	0.97	0.95	0.102	0.092	0.111	358.546
CM-6	0.971	0.951	0.101	0.092	0.111	354.518

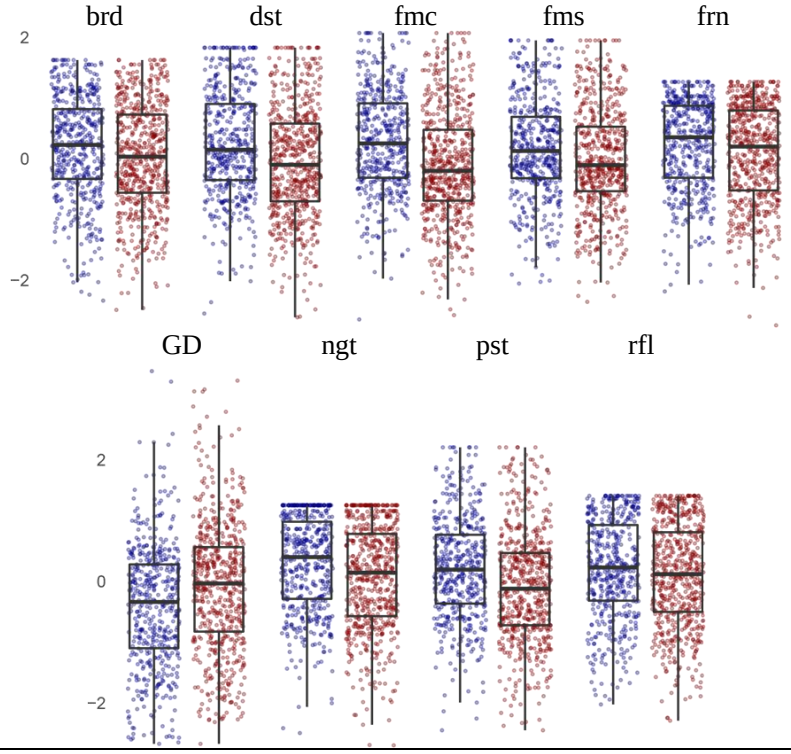
CM-7	0.97	0.95	0.1	0.091	0.109	346.656
CM-8	0.972	0.954	0.097	0.088	0.107	329.16
CM-9	0.972	0.953	0.102	0.093	0.111	360.153
CM-10	0.97	0.95	0.101	0.092	0.11	353.137
CM1-10	Pooled SRMR: 0.059					
SIM-1	0.968	0.968	0.079	0.072	0.086	376.783
SIM-2	0.97	0.97	0.079	0.072	0.086	378.301
SIM-3	0.966	0.966	0.083	0.076	0.09	411.1
SIM-4	0.969	0.969	0.079	0.072	0.087	379.576
SIM-5	0.97	0.97	0.079	0.072	0.086	377.378
SIM-6	0.97	0.97	0.079	0.072	0.086	377.037
SIM-7	0.97	0.97	0.077	0.07	0.085	364.221
SIM-8	0.973	0.973	0.074	0.067	0.082	337.75
SIM-9	0.971	0.971	0.079	0.072	0.087	382.255
SIM-10	0.969	0.969	0.08	0.072	0.087	383.474
SIM1-10	Pooled SRMR: 0.060					
FIM-1	0.970	0.974	0.071	0.064	0.078	361.965
FIM-2	0.975	0.978	0.068	0.061	0.075	338.295
FIM-3	0.969	0.973	0.073	0.066	0.08	381.179
FIM-4	0.973	0.977	0.068	0.061	0.075	338.4
FIM-5	0.973	0.977	0.07	0.063	0.077	351.802
FIM-6	0.974	0.977	0.069	0.062	0.076	344.05
FIM-7	0.971	0.975	0.07	0.064	0.077	358.149
FIM-8	0.978	0.981	0.063	0.056	0.07	295.438
FIM-9	0.974	0.978	0.07	0.063	0.077	355.542
FIM-10	0.975	0.978	0.067	0.06	0.074	328.527
FIM1-10	Pooled SRMR: 0.064					
Aggression [26]*, 4 items, 0 unique item covariances*						
CM-1	0.999	0.997	0.036	0.022	0.051	38.412
CM-2	0.998	0.995	0.052	0.039	0.065	62.624
CM-3	0.999	0.998	0.035	0.021	0.05	36.937
CM-4	0.997	0.994	0.057	0.044	0.07	72.567
CM-5	0.996	0.992	0.051	0.038	0.064	61.034
CM-6	0.999	0.998	0.032	0.017	0.047	33.314
CM-7	0.998	0.997	0.055	0.042	0.069	69.342
CM-8	0.998	0.996	0.046	0.033	0.06	53.348
CM-9	0.998	0.996	0.045	0.031	0.058	50.375

CM-10	0.999	0.997	0.04	0.026	0.054	43.08
CM1-10	Pooled SRMR: 0.052					
SIM-1	0.993	0.992	0.063	0.053	0.073	136.864
SIM-2	0.993	0.991	0.071	0.061	0.081	167.668
SIM-3	0.994	0.993	0.058	0.048	0.068	119.667
SIM-4	0.992	0.991	0.071	0.061	0.081	167.166
SIM-5	0.989	0.988	0.065	0.055	0.075	144.604
SIM-6	0.994	0.993	0.059	0.049	0.069	122.171
SIM-7	0.995	0.994	0.074	0.064	0.084	179.659
SIM-8	0.994	0.993	0.063	0.053	0.073	136.06
SIM-9	0.992	0.991	0.068	0.058	0.079	157.416
SIM-10	0.994	0.993	0.062	0.052	0.073	134.713
SIM1-10	Pooled SRMR: 0.076					
FIM-1	0.993	0.993	0.059	0.05	0.069	155.276
FIM-2	0.993	0.994	0.061	0.052	0.07	161.385
FIM-3	0.993	0.993	0.059	0.05	0.068	154.017
FIM-4	0.993	0.993	0.061	0.052	0.07	162.482
FIM-5	0.99	0.99	0.058	0.049	0.067	148.267
FIM-6	0.992	0.992	0.06	0.051	0.07	159.709
FIM-7	0.994	0.994	0.073	0.064	0.083	221.604
FIM-8	0.994	0.994	0.058	0.049	0.067	148.019
FIM-9	0.992	0.993	0.062	0.053	0.071	166.672
FIM-10	0.993	0.993	0.063	0.054	0.073	172.324
FIM1-10	Pooled SRMR: 0.119					
General distress [27,28]*, 41 items, 2 unique item covariances*						
CM-1*	0.989	0.988	0.026	0.025	0.027	5752.268
CM-2*	0.989	0.988	0.026	0.025	0.027	5784.608
CM-3*	0.987	0.987	0.026	0.025	0.027	5707.489
CM-4*	0.989	0.989	0.026	0.025	0.027	5728.317
CM-5*	0.989	0.988	0.026	0.025	0.027	5795.843
CM-6*	0.987	0.987	0.027	0.026	0.028	5900.122
CM-7*	0.990	0.989	0.026	0.025	0.027	5787.842
CM-8*	0.989	0.989	0.026	0.025	0.027	5723.574
CM-9*	0.988	0.987	0.027	0.026	0.028	5892.805
CM-10*	0.987	0.987	0.027	0.026	0.028	5981.058
CM1-10	Pooled SRMR: 0.044					
SIM-1	0.987	0.987	0.027	0.026	0.028	6211.303

SIM-2	0.987	0.987	0.027	0.026	0.028	6249.019
SIM-3	0.986	0.986	0.027	0.026	0.028	6137.497
SIM-4	0.988	0.988	0.027	0.026	0.028	6173.344
SIM-5	0.987	0.987	0.027	0.026	0.028	6217.918
SIM-6	0.986	0.986	0.028	0.027	0.029	6323.823
SIM-7	0.988	0.988	0.027	0.026	0.028	6273.396
SIM-8	0.988	0.988	0.027	0.026	0.028	6148.299
SIM-9	0.986	0.986	0.028	0.027	0.029	6341.883
SIM-10	0.986	0.986	0.028	0.027	0.029	6432.838
SIM1-10	Pooled SRMR: 0.044					
FIM-1	0.953	0.953	0.052	0.051	0.053	14055.219
FIM-2	0.953	0.954	0.052	0.051	0.053	14248.743
FIM-3	0.949	0.949	0.051	0.050	0.052	13603.930
FIM-4	0.953	0.953	0.053	0.052	0.054	14707.235
FIM-5	0.952	0.953	0.053	0.052	0.053	14350.666
FIM-6	0.952	0.953	0.050	0.050	0.051	13508.845
FIM-7	0.953	0.953	0.055	0.054	0.056	15307.465
FIM-8	0.955	0.955	0.052	0.051	0.053	14073.361
FIM-9	0.951	0.952	0.052	0.051	0.053	14046.556
FIM-10	0.951	0.951	0.052	0.051	0.053	14007.992
FIM1-10	Pooled SRMR: 0.107					

Note. WLSMV = weighted least squares estimator with mean- and variance corrected test statistics and robust standard errors. CFI = Comparative fit index, TLI = Tucker-Lewis index, RMSEA = Root mean square error of approximation, CI = Confidence interval, CM = configural model, SIM = strong invariance model, FIM = full invariance model. *For the configural model of the general distress factor, we had to enforce the loadings to be positive to ensure that they would not switch negative. We had to do this, as for some of the imputation data sets, the loadings switched negative and when pooling over the coefficients the positive and negative loadings would have averaged each other out.

(a)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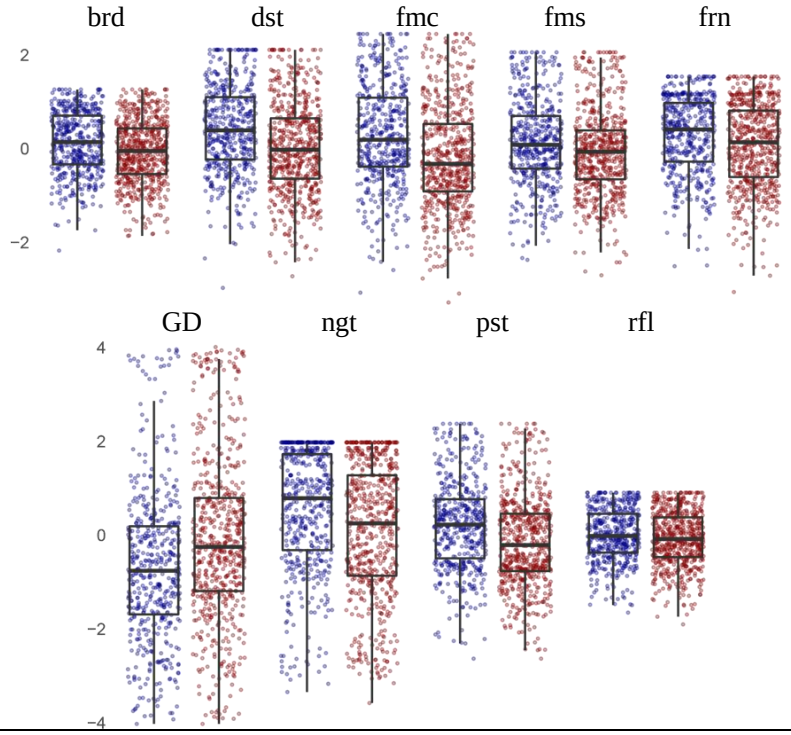
(b)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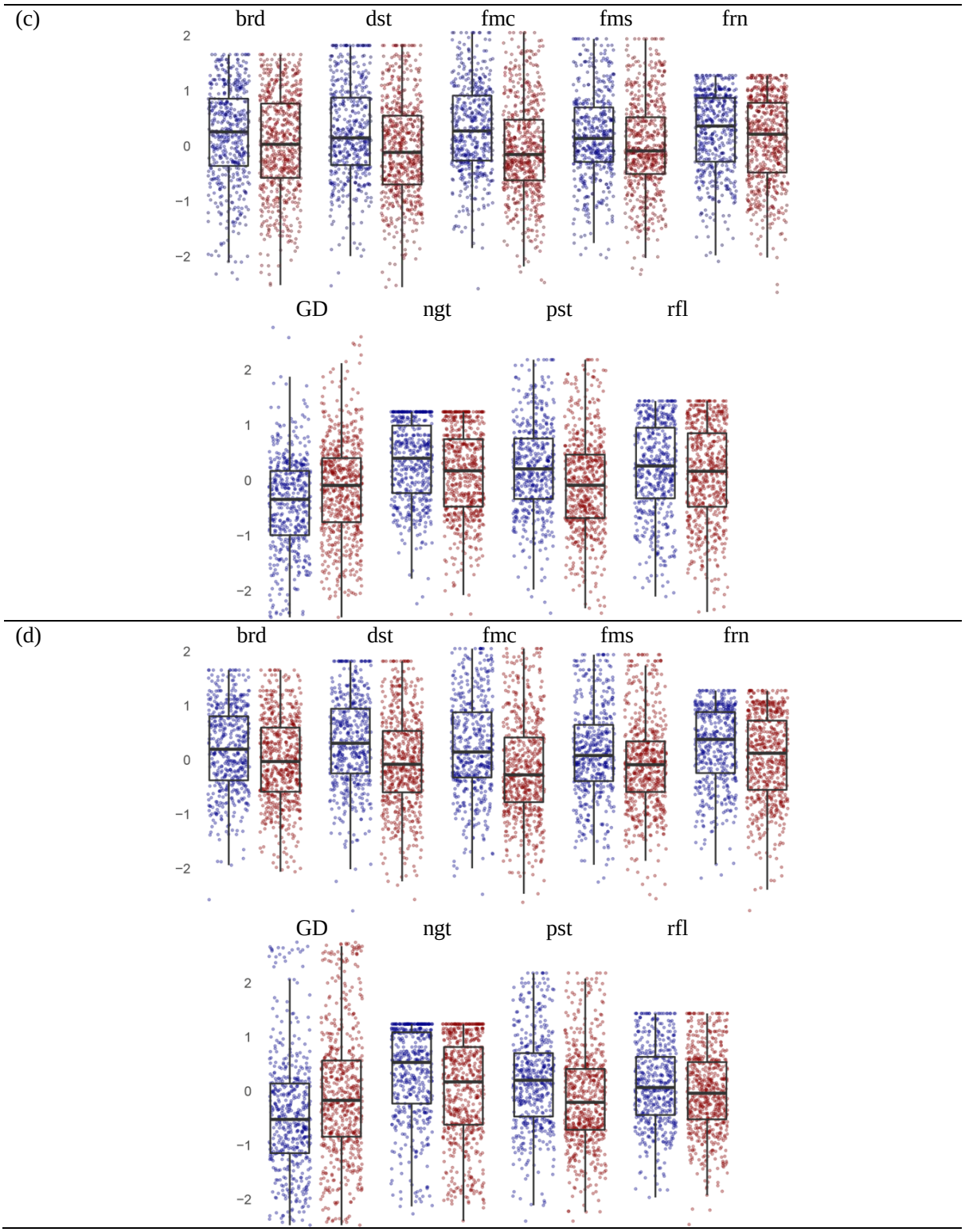


Figure 5. Box-and-whisker plots with individual data points for the RFs (except expressive suppression and aggression) and the general distress variable, separately for CA+ (n = 631) and CA- (n = 499). Panel (a) depicts the distributions for the strongly invariant scores for age 14 and panel (b) for age 17. Panel (c) depicts the distributions for the fully invariant scores for age 14 and panel (d) for age 17. CA- group = blue data points, CA+ group = red data points. Center line = median (50% quantile); lower box limit =25% quantile; upper box limit = 75% quantile; lower whisker = smallest observation greater than or equal to the lower box limit - 1.5 x Inter Quartile Range (IQR); upper whisker = largest observation less than or equal to upper box limit + 1.5 x IQR; outliers = data points beyond the end of the whiskers. **Legend:** Brd = brooding, dst = distress tolerance, fmc = family cohesion, fms = family support, frn = friend support, ngt = negative self-esteem, GD = general distress, pst = positive self-esteem, rfl = reflective rumination.

Additional file VI

We compared the RF and general distress mean levels between age 14 and age 17, separately in the CA+ and CA- groups, based on strongly invariant factor scores, fully invariant factor scores, and sum scores. Results for the strongly invariant factor scores can be found in the main manuscript (see also Figure 1 in the main manuscript). We believe that the strongly invariant model is the most adequate model for latent mean comparisons, as it is the least constrained one of the sufficiently constrained models.

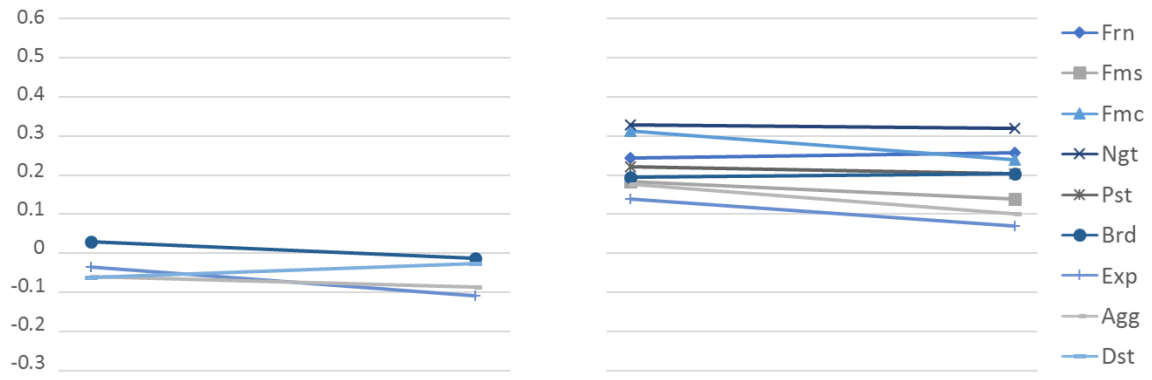
Fully invariant factor scores. For the fully invariant factor scores, the results looked somewhat different. This time, change was particularly notable in the CA+ group. In the CA- group only reflection and distress tolerance changed. While reflection deceased over time, distress tolerance increased over time, as for the strongly invariant scores. In the CA+ group instead of two this time six RFs changed between age 14 and 17. All inter-personal RFs (i.e. friendship support, family support and family cohesion) and three intra-personal RFs (negative self-esteem, positive self-esteem, and reflection) decreased between age 14 and 17 (see Figure 6a). Of those six decreasing RFs in the CA+ group, only two reached a p-values below 0.025 (namely family cohesion and reflection). Importantly, none of the RFs changed significantly different in the CA+ and the CA- group (as tested with interaction effects), which indicates that the detected changes in the CA+ group, which were non-significant in the CA- group, were so minor that they did not differ significantly between the two groups. Of note, the binarized aggression and expressive suppression RFs are the same variables as reported in the main manuscript.

Sum scores. For the sum scores, the results looked again somewhat different from the strongly invariant factor scores. However, the change patterns were the same as for the fully invariant factor scores (see Figure 6b). Importantly, once more none of the RFs changed significantly different in the CA+ and the CA- group (as tested with interaction effects). Hence, the same conclusion seems to hold as for fully invariant factor scores, namely that the detected changes in the CA+ group, which were non-significant in the CA- group, were so minor that they did not differ significantly between the two groups. Hence, overall we conclude that when investigating fully invariant factor scores and sum scores there seemed to be more variability in the CA+ group between age 14 and 17, yet, those changes were so minor that they did not differ between the two groups.

A. Fully invariant factor scores

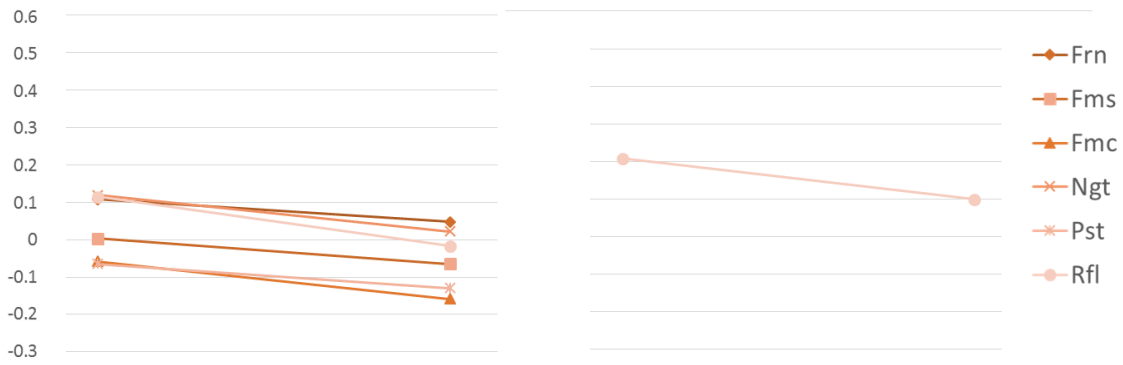
CA+ **CA-**

No RF change



Increasing RFs

Decreasing RFs



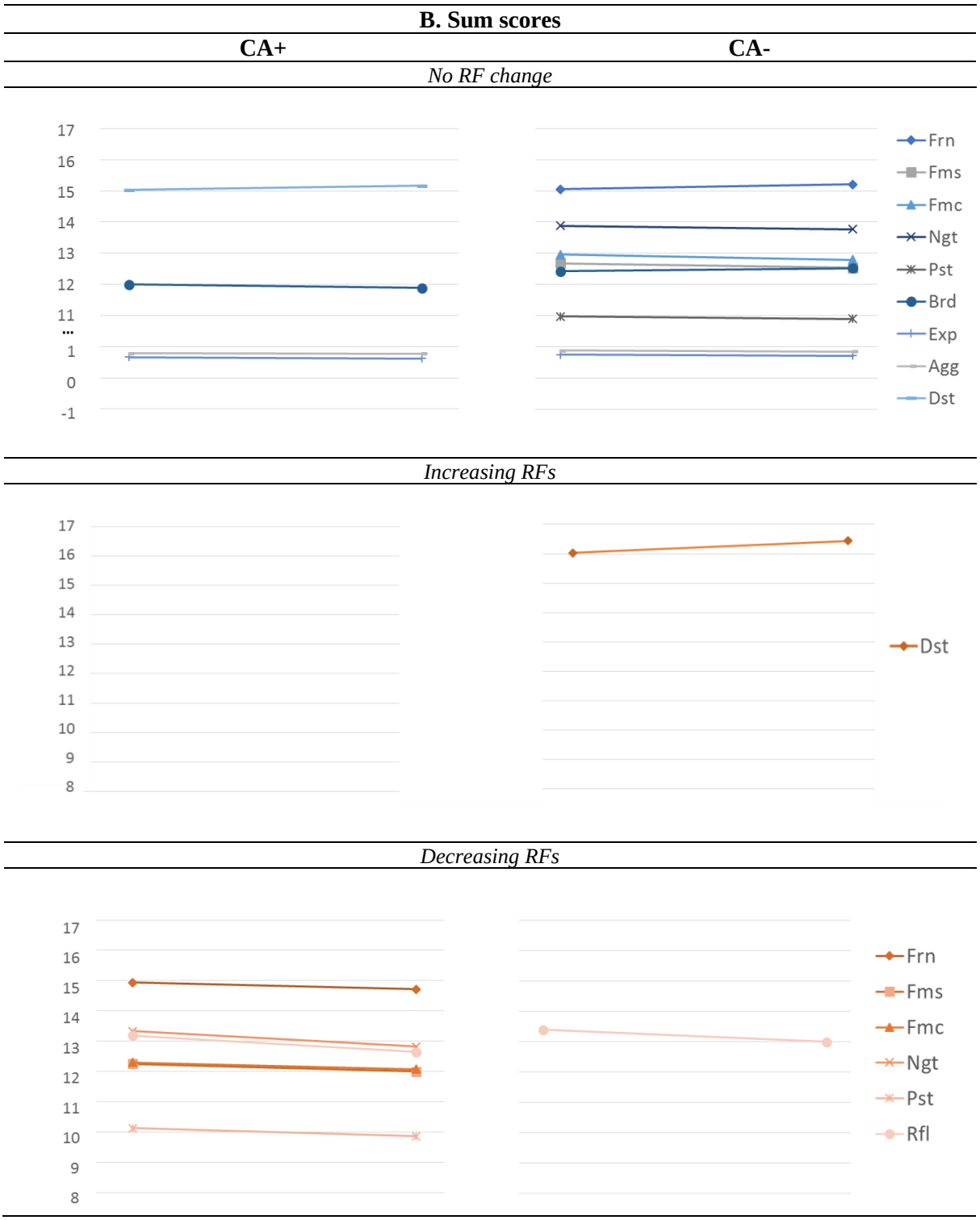


Figure 6. RF and general distress mean level comparisons: age 14 versus age 17. CA = childhood adversity. Panel A scores are derived from fully invariant confirmatory factor analyses; panel B scores are sum scores. All RFs are scored in such a way that high values are protective (e.g. high levels of high friendship support or high levels of low negative self-esteem) and low values are harmful (e.g. low levels of high friendship support or low levels of low negative self-esteem). **Legend:** Frn = friend support, fms = family support, fmc = family cohesion, ngt = negative self-esteem, pst = positive self-esteem, rfl = reflection, brd = brooding, dst = distress tolerance, agg = aggression, exp = expressive suppression.

Additional file VII

RF networks without the general distress variable. At age 14, the network invariance test was not significant for the RF networks without the general distress variable (M = .15, p = .30; see Figure 7), but the global network expected influence (EI) differed between the CA+ and the CA- RF networks (EI_{CA+} = 3.21, EI_{CA-} = 3.53, EI = 0.31, p = .03). More specifically, the global network expected influence was higher in the CA- than in the CA+ network. Those findings were only partially similar in the RF networks for age 17, as neither of the two tests revealed significant differences between the CA+ and the CA- group (M = .12, p = .56; EI_{CA+} = 3.54, EI_{CA-} = 3.35, EI = 0.19, p = .16). At age 14 six interrelations differed between the CA+ and the CA- networks: namely friendship support and brooding (CA+: less positive; CA-:more positive), friendship support and expressive suppression (CA+: negative; CA-: positive), positive self-esteem and brooding (CA+: null; CA-: positive), positive self-esteem and expressive suppression (CA+: null; CA-: negative), brooding and aggression (CA+: null; CA-: positive), as well as reflection and distress tolerance (CA+: null; CA-: positive). At age 17, the interrelation between friendship support and positive self-esteem (CA+: positive, CA-: null) differed between the CA+ and the CA- network.

Interestingly, when we compared the RF networks for age 14 and age 17, we did find a global network structure differences for adolescents with (M = .22, p = .003; EI_{14} = 3.21, EI_{17} = 3.54, EI = 0.33, p = .001), but not for adolescents without a history of adversity (M = .17, p = .24; EI_{14} = 3.53, EI_{17} = 3.35, EI = 0.18, p = .22). In the CA+ network five RF interrelations changed from age 14 to age 17, namely the interrelation between friendship support and expressive suppression (from negative to positive), positive and negative self-esteem (from more to less positive), positive self-esteem and aggression (from null to positive), negative self-esteem and brooding (from more to less positive), and the interrelation between negative self-esteem and aggression (from less to more positive). In the CA- network, three RF interrelations changed from age 14 to age 17, namely the interrelation between friendship support and negative self-esteem (from positive to more positive), negative self-esteem and aggression (from positive to more positive), and the interrelation between brooding and reflection (from more to less positive).

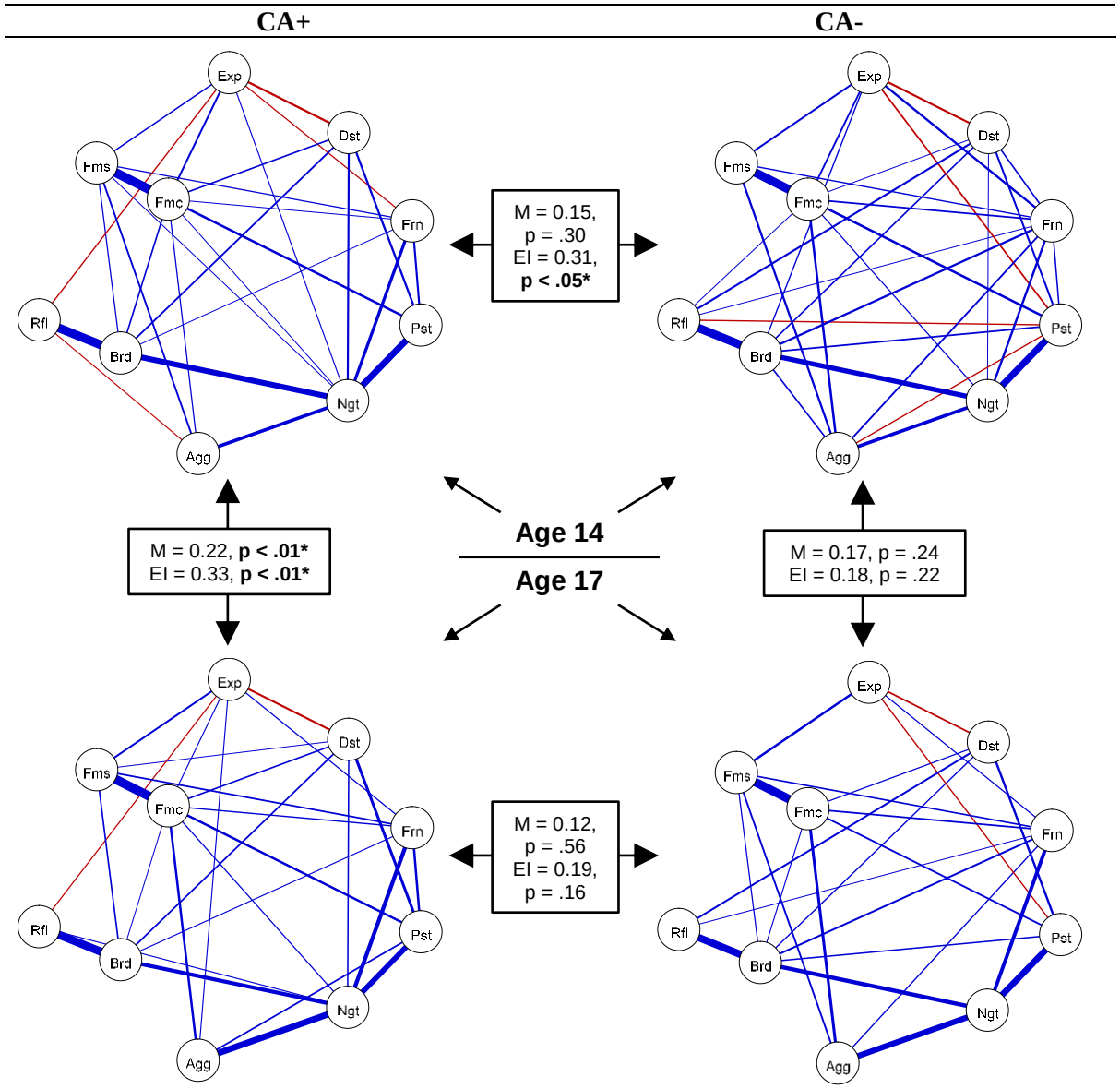


Figure 7. CA+ (*n* = 631) and CA- (*n* = 499) resilience factor networks for age 14 (upper panel) and age 17 (lower panel) without the general distress variable. Width of the lines = association strength. Positive interrelations = blue, negative interrelations = red. **Legend:** Frn = friend support, fms = family support, fmc = family cohesion, ngt = negative self-esteem, pst = positive self-esteem, rfl = reflection, brd = brooding, dst = distress tolerance, agg = aggression, exp = expressive suppression. The boxes depict the maximal interrelation difference between the respective two networks (M), the difference in global network expected influence (EI) between the respective two networks (EI), and the corresponding p-values (5000 comparison samples). The above networks with faded interrelations can be found in Supplement IX.

RF networks with the general distress variable. At age 14, the network invariance test was not significant for the RF networks with the general distress variable (M = .14, p = .47; see Figure 8). However, the network expected influence was significantly higher in the CA- than in the CA+ network (EI_{CA+} = 0.87, EI_{CA-} = 1.43, EI = 0.56, p = .04). Those findings were only partially similar in the networks for age 17, as neither of the two tests revealed significant differences between the CA+ and the CA- group at age 17 (M = .16, p = .34; EI_{CA+} = 0.97, EI_{CA-} = 1.16, EI = 0.19, p = .54). At age 14, four interrelation differed between the CA+ and the CA- network, namely the interrelations between friendship support and brooding (CA+: null, CA-: positive), friendship support and expressive suppression (CA+: negative, CA-: positive), positive self-esteem and expressive suppression (CA+: null, CA-: negative), as well as between reflection and distress tolerance (CA+: null, CA-: positive). At age 17 two interrelations differed between the CA+ and the CA- network, namely friendship support and positive self-esteem (CA+: positive, CA-: null), as well as aggression and general distress (CA+: more negative, CA-: less negative).

When we compared those networks for age 14 and age 17, the network invariance test was still significant (M = .20, p = .01), but the global network expected influence did no longer differ (EI_{14} = 0.87, EI_{17} = 0.97, EI = 0.11, p = .71) in the CA+ group. In the CA- group, neither of the two tests was significant (M = .12, p = .79; EI_{14} = 1.43, EI_{17} = 1.16, EI = 0.26, p = .36). In the CA+ network five individual RF interrelations changed from age 14 to age 17, namely the interrelations between friendship support and expressive suppression (from negative to positive), family cohesion and general distress (from more to less negative), negative self-esteem and brooding (from more to less positive), brooding and general distress (from more to less negative), as well as between aggression and general distress (from less to more negative). In contrast in the CA- network, only two RF interrelation changed from age 14 to age 17, namely the interrelation between negative self-esteem and general distress (from less to more negative), as well as the interrelation between brooding and general distress (from more to less negative).

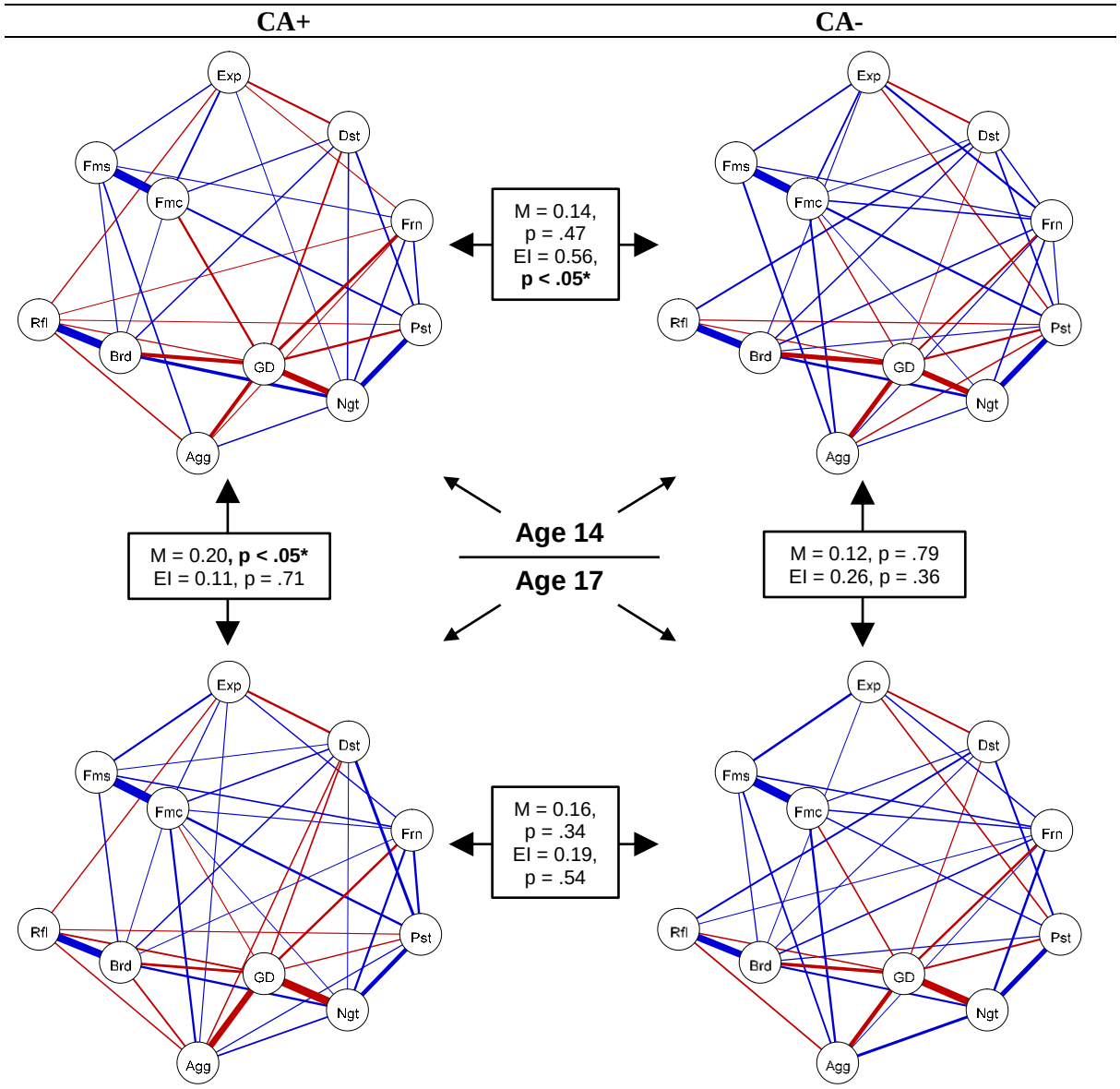


Figure 8. CA+ (*n* = 631) and CA- (*n* = 499) resilience factor networks for age 14 (upper panel) and age 17 (lower panel) with the general distress variable. Width of the lines = association strength. Positive interrelations = blue, negative interrelations = red. **Legend:** Frn = friend support, fms = family support, fmc = family cohesion, ngt = negative self-esteem, pst = positive self-esteem, rfl = reflection, brd = brooding, dst = distress tolerance, agg = aggression, exp = expressive suppression, GD = general distress. The boxes depict the maximal interrelation difference between the respective two networks (M), the difference in global network expected influence (EI) between the respective two networks (EI), and the corresponding p-values (5000 comparison samples). The above networks with faded interrelations can be found in Supplement IX.

Additional file VIII

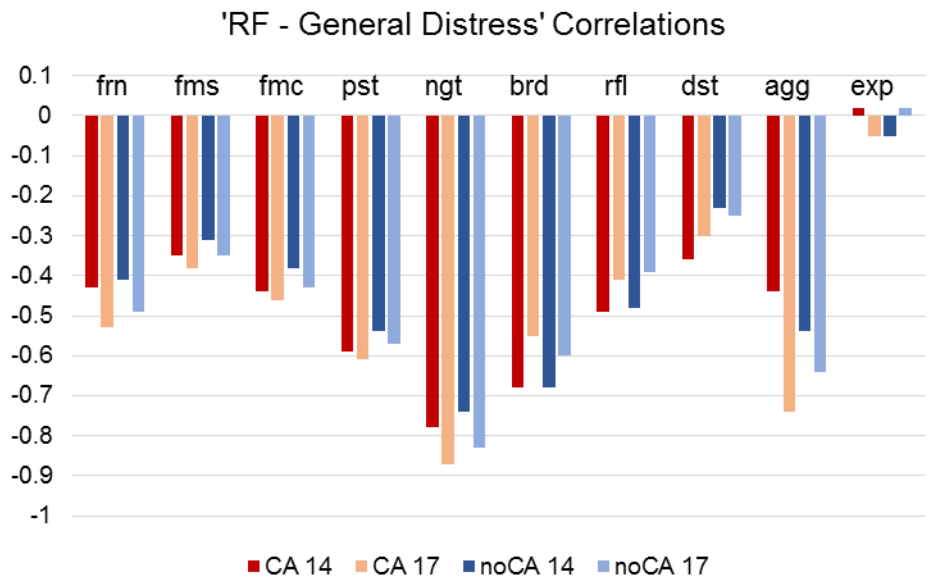
As can be seen in Table 6, all RFs were negatively correlated with general distress, except for expressive suppression for CA+ adolescents at age 14 and CA- adolescents at age 17, as it then was positively correlated with general distress. Regularized partial correlations of the RFs, which we used for the network models, were also mostly negative for the relationships between the RFs and general distress. Yet, expressive suppression and family support were in both groups no longer related with general distress, neither at age 14 nor at 17. Thus, the overall results pattern was still similar, showing that even after the correction for all other RFs, most RFs were clearly negatively associated with general distress. As can be seen in Figure 9, negative self-esteem, positive self-esteem, brooding and aggression seemed to be most strongly correlated with general distress. However, in terms of partial correlations, positive self-esteem no longer appeared to be among those factors with the highest interrelations with general distress.

Table 6

Correlations and Regularized Partial Correlations between the RFs and the General Distress Variable

CA	**frn**	**fms**	**fmc**	**pst**	**ngt**	**brd**	**rfl**	**dst**	**agg**	**exp**
					Correlations					
yes: age 14	-0.43	-0.35	-0.44	-0.59	-0.78	-0.68	-0.49	-0.36	-0.44	0.02
yes: age 17	-0.53	-0.38	-0.46	-0.61	-0.87	-0.55	-0.41	-0.30	-0.74	-0.05
no: age 14	-0.41	-0.31	-0.38	-0.54	-0.74	-0.68	-0.48	-0.23	-0.54	-0.05
no: age 17	-0.49	-0.35	-0.43	-0.57	-0.83	-0.60	-0.39	-0.25	-0.64	0.02
					Regularized Partical Correlations					
yes: age 14	-0.17	0.00	-0.12	-0.11	-0.42	-0.25	-0.03	-0.08	-0.22	0.00
yes: age 17	-0.13	0.00	-0.03	-0.04	-0.58	-0.14	-0.08	-0.06	-0.42	0.00
no: age 14	-0.10	0.00	-0.04	-0.11	-0.39	-0.30	-0.03	-0.02	-0.29	0.00
no: age 17	-0.12	0.00	-0.06	-0.09	-0.51	-0.20	-0.05	-0.04	-0.26	0.00

Note. CA = Childhood adversity (yes: n = 631, no: n = 499). Frn = friend support, fms = family support, fmc = family cohesion, pst = positive self-esteem, ngt = negative self-esteem, brd = brooding, rfl = reflection, dst = distress tolerance, agg = aggression, exp = expressive suppression.



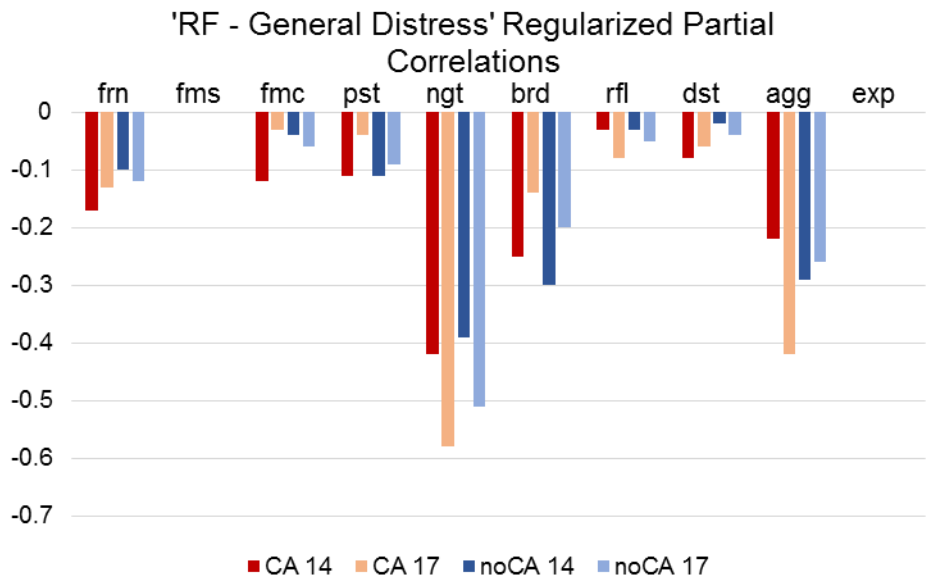


Figure 9. Visualizing the correlations and regularized partial correlations between RFs and general distress, for CA+ (n = 631) and CA- (n = 499) adolescents at age 14 and age 17.

Additional file IX

To test the stability of the *expected influence (EI)* coefficients we applied a subset bootstrap (2000 bootstraps) to identify the maximum sample percentage that can be dropped to reveal (with a 95% chance) a relationship of ≥0.7 between the subset and the original EI coefficients. The analyses showed that at both age 14 and 17 EI coefficients were sufficiently stable, as more than 50 percent of the sample could be dropped (see Table 7).

To test the accuracy of the network models we bootstrapped the 'RF-RF' and 'RF-general distress' interrelations (2000 bootstraps) and investigated the bootstrap confidence intervals (CIs). Overall, the CIs had an acceptable width, which indicates that the estimated models have an appropriate interrelation accuracy. At age 14, family cohesion and family support were most strongly interrelated, followed next by the brooding and reflective rumination interrelation, and then by the positive and negative self-esteem interrelation, for both the CA+ and the CA- group (see Figure 10 and Figure 11). In the models without general distress, negative self-esteem and aggression were additionally very highly interrelated, at age 17 (see Figure 10). In the models with general distress, negative self-esteem and general distress were also strongly interrelated (see Figure 11).

Table 7

Expected Influence (EI) Stability

CA	**Age**	**MDP_{EI}**	**Case range for MDP_{EI}**	**MDP_{EI}**	**Case range for MDP_{EI}**
		Without general distress		*With general distress*	
Yes	14	0.750	(caseMin = 0.721, caseMax = 1)	0.750	(caseMin = 0.721, caseMax = 1)
No	14	0.749	(caseMin = 0.721, caseMax = 1)	0.749	(caseMin = 0.721, caseMax = 1)
Yes	17	0.750	(caseMin = 0.721, caseMax = 1)	0.750	(caseMin = 0.721, caseMax = 1)
No	17	0.749	(caseMin = 0.721, caseMax = 1)	0.749	(caseMin = 0.721, caseMax = 1)

Note. CA = childhood adversity. MDP = Maximum drop proportion.

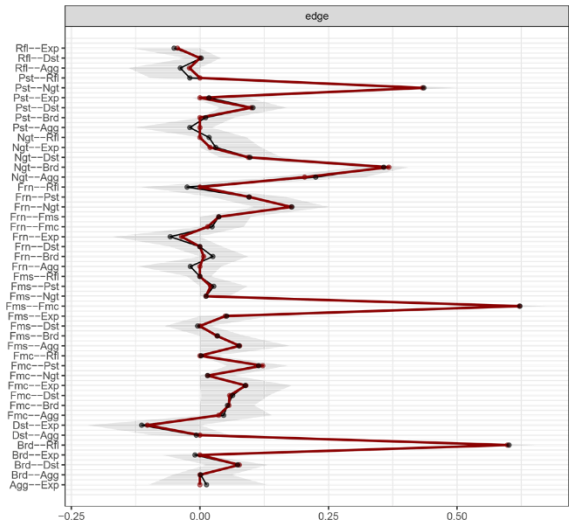
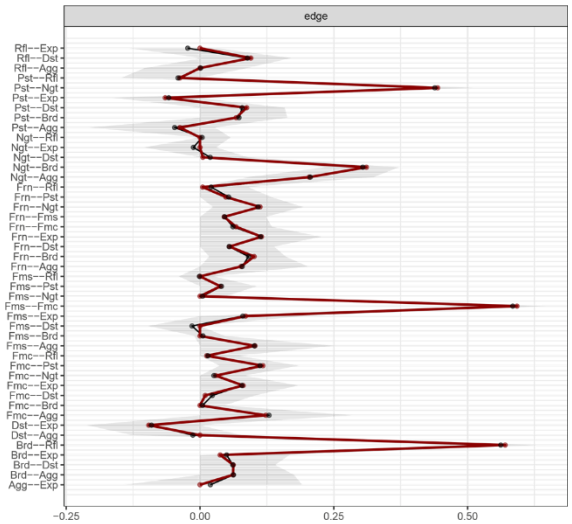
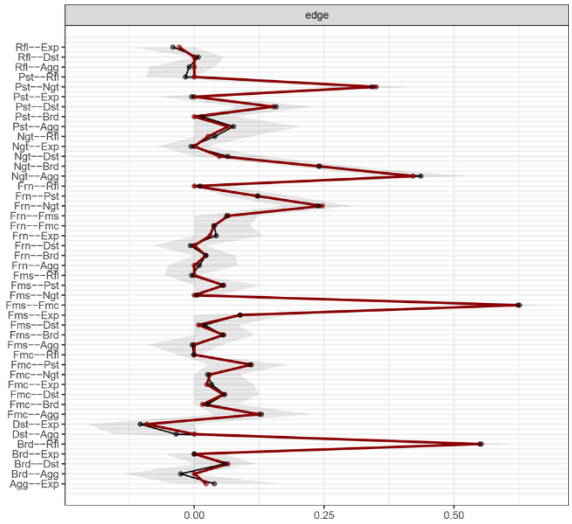
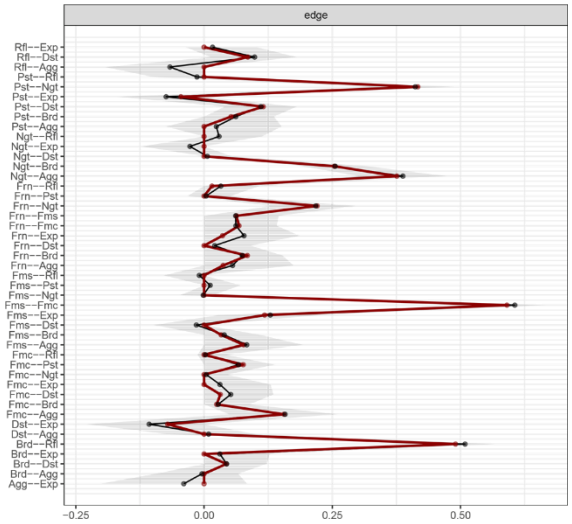
CA+	CA-
Age 14, without general distress	
	
Age 17, without general distress	
	

Figure 10. Interrelation accuracy plots for CA+ (n = 631) and CA- (n = 499) networks without the general distress variable, for both age 14 and age 17. The plots depict the sample RF interrelations (i.e. edge weights) which are represented by the red dots, the means of the bootstrapped RF interrelations (i.e. edge weights) which are represented by the black dots, and the belonging bootstrap confidence intervals (CIs) which indicate the RF interrelation accuracy.

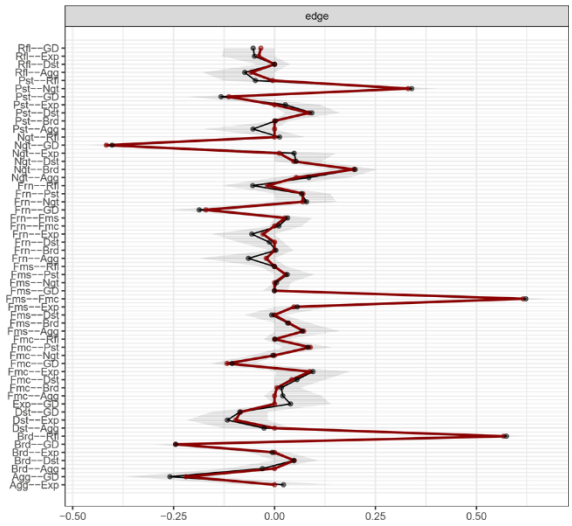
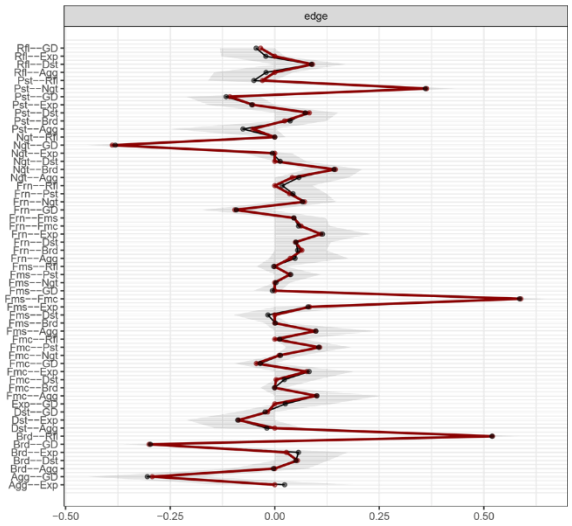
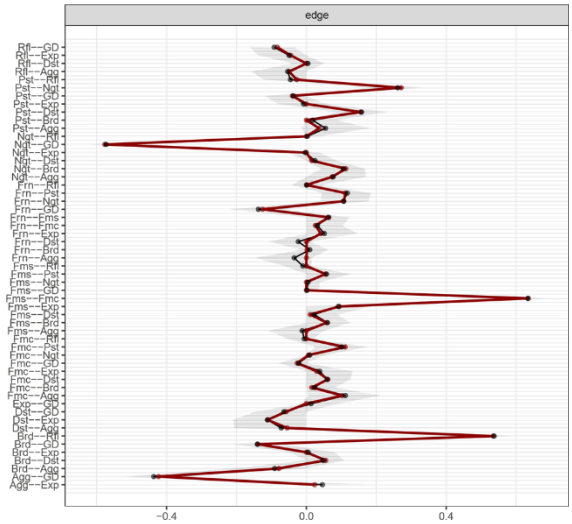
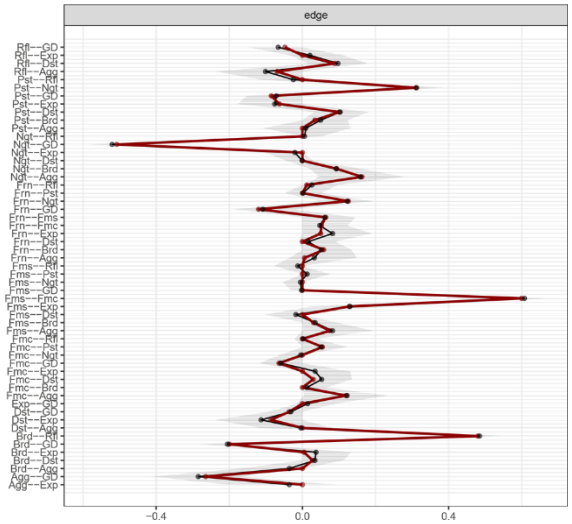
CA+	CA-
Age 14, with general distress	
	
Age 17, with general distress	
	

Figure 11. Interrelation accuracy plots for CA+ (n = 631) and CA- (n = 499) networks with the general distress variable, for both age 14 and age 17. The plots depict the sample 'RF-RF' and 'RF-general distress' interrelations (i.e. edge weights) which are represented by the red dots, the means of the bootstrapped interrelations (i.e. edge weights) which are represented by the black dots, and the belonging bootstrap confidence intervals (CIs) which indicate the 'RF-RF' and 'RF-general distress' interrelation accuracy.

Additional file X

The connectivity analyses for expected influence (EI) coefficients showed that the family, ruminative brooding and negative self-esteem RFs had the highest coefficients, in both groups and at both time points (see Table 8). For both group, expressive suppression had the lowest EI coefficient, at both time points. We did not detect any particular age or group patterns (see Figure 12).

Table 8

Expected Influence (EI) for Networks Corrected for General Distress

CA	frn	fms	fmc	pst	ngt	brd	rfl	dst	agg	exp
yes: age 14	0.10	0.83	0.84	0.60	0.71	0.85	0.45	0.13	0.05	-0.02
yes: age 17	0.35	0.92	0.99	0.71	0.59	0.70	0.41	0.13	0.06	0.03
no: age 14	0.48	0.85	0.95	0.51	0.63	0.84	0.58	0.19	0.22	0.16
no: age 17	0.37	0.90	0.86	0.44	0.69	0.73	0.51	0.16	0.29	0.03

Note. CA = Childhood adversity (yes: n = 631, no: n = 499). Frn = friend support, fms = family support, fmc = family cohesion, pst = positive self-esteem, ngt = negative self-esteem, brd = brooding, rfl = reflection, dst = distress tolerance, agg = aggression, exp = expressive suppression.

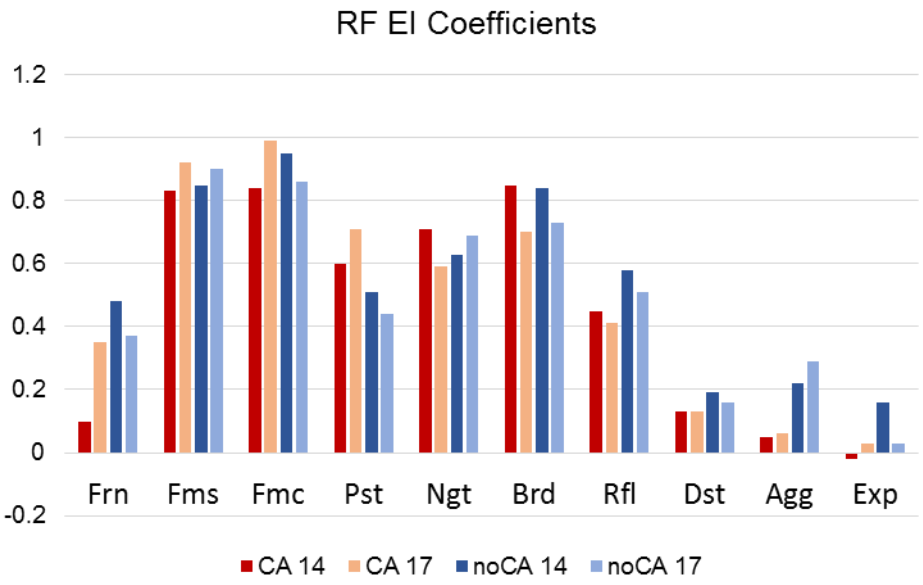


Figure 12. Visualizing expected influence (EI) coefficients for CA+ (n = 631) and CA- (n = 499) networks corrected for the general distress variable, for both age 14 and age 17. Frn = friend support, fms = family support, fmc = family cohesion, pst = positive self-esteem, ngt = negative self-esteem, brd = brooding, rfl = reflection, dst = distress tolerance, agg = aggression, exp = expressive suppression.

Additional file XI

The following three figures depict CA+ and CA- networks with factor scores derived from the configurable CFA models. The models were estimated separately for age 14 and 17, as well as (1) once without the general distress variable, (2) once with the general distress variable, and (3) once corrected for the general distress variable. At age 14, the network invariance test was not significant for the networks without the general distress variable (M = .16, p = .24; see Figure 13), but the global network expected influence differed between the CA+ and the CA- RF networks (EI_{CA+} = 3.22, EI_{CA-} = 3.54, EI = 0.32, p = .03). More specifically, the RFs in the CA+ network were less positively interrelated. Those findings were only partially similar in the networks for age 17, as neither of the two tests revealed significant differences between the CA+ and the CA- group (M = .12, p = .57; EI_{CA+} = 3.55, EI_{CA-} = 3.34, EI = 0.21, p = .13). When we compared the RF networks for age 14 and age 17, the two CA+ network were not invariant over time, in other words, they did vary over time (M = .24, p < .001). Moreover, the RFs in the age 14 network were less positively interrelated than in the age 17 network (EI_{14} = 3.22, EI_{17} = 3.55, EI = 0.33, p = .001). The age 14 and age 17 CA- networks did however not differ with regard to their global network structure (M = .17, p = .23; EI_{14} = 3.54, EI_{17} = 3.34, EI = 0.20, p = .17).

For the networks with the general distress variable, the network invariance test (M = .17, p = .15; see Figure 14) was not significant at age 14. However, the global network expected influence differed between the CA+ and the CA- networks (EI_{CA+} = 0.69, EI_{CA-} = 1.39, EI = 0.70, p = .01). Those findings were only partially similar in the networks for age 17, as neither of the two tests revealed significant differences between the CA+ and the CA- group (M = .17, p = .26; EI_{CA+} = 0.91, EI_{CA-} = 1.17, EI = 0.26, p = .40). When we compared the CA+ networks for age 14 and age 17, the network invariance test was significant (M = .19, p = .03), but the network expected influence did not differ (EI_{14} = 0.69, EI_{17} = 0.91, EI = 0.22, p = .49). The age 14 and age 17 CA- networks did again not differ with regard to their global network structure (M = .12, p = .84; EI_{14} = 1.39, EI_{17} = 1.17, EI = 0.22, p = .42).

For the networks corrected for the general distress variable, the network invariance test (M = .17, p = .13; see Figure 15) was not significant, at age 14, but the global network expected influence differed between the CA+ and the CA- networks (EI_{CA+} = 2.15, EI_{CA-} = 2.69, EI = 0.54, p = .005). Those findings were only partially similar in the networks for age 17, as neither of the two tests revealed significant differences between the CA+ and the CA- group (M = .11, p = .86; EI_{CA+} = 2.40, EI_{CA-} = 2.49, EI = 0.09, p = .68). When we compared the networks for age 14 and age 17, we did not find any significant global network structure

differences; neither for adolescents with (M = .10, p = .78; EI_{14} = 2.15, EI_{17} = 2.40, EI = 0.26, p = .21) nor for adolescents without a history of adversity (M = .12, p = .81; EI_{14} = 2.69, EI_{17} = 2.49, EI = 0.20, p = .30).

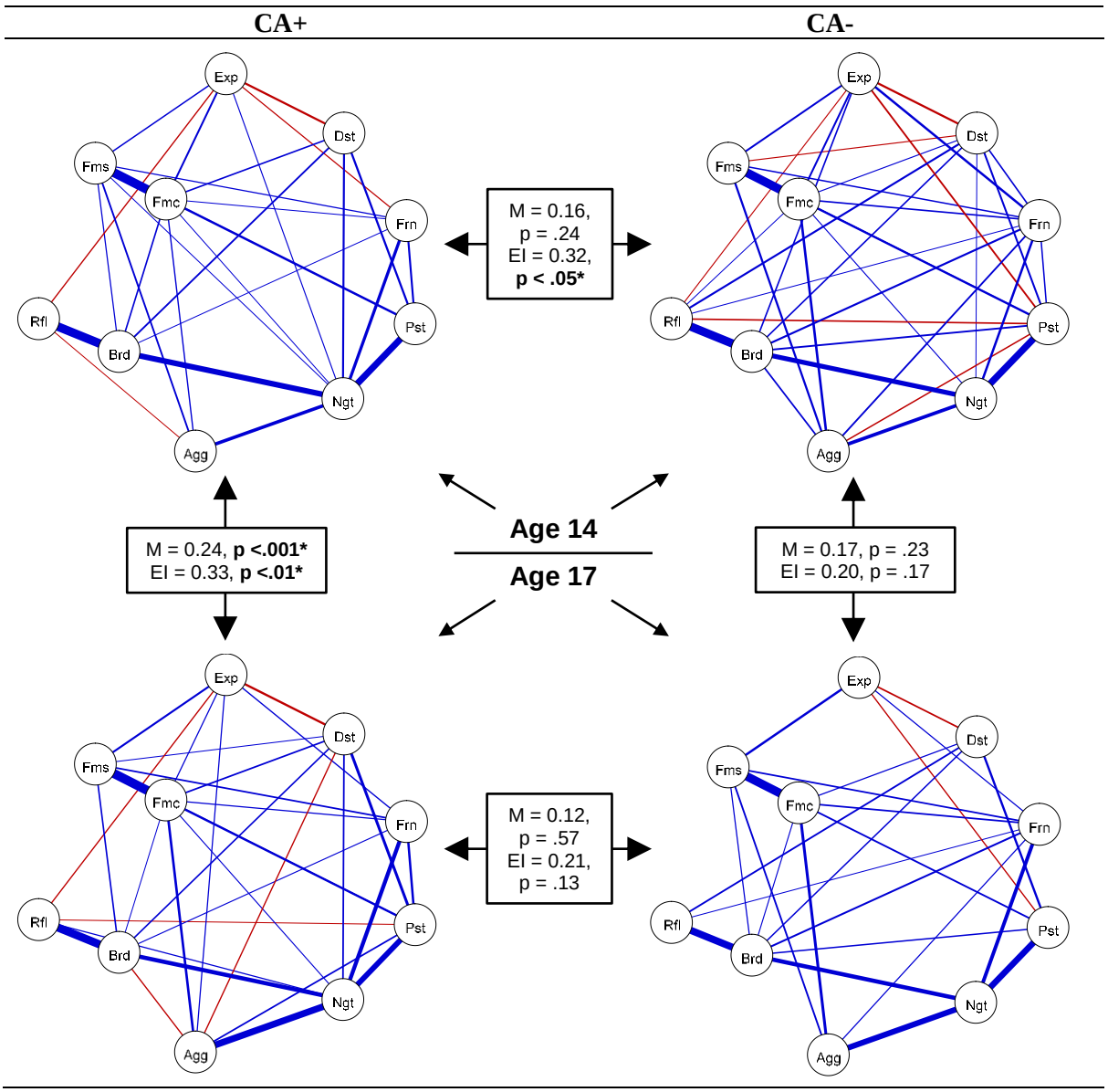


Figure 13. CA+ (*n* = 631) and CA- (*n* = 499) resilience factor networks with configural factor scores for age 14 (upper panel) and age 17 (lower panel) without the general distress variable. Width of the lines = association strength. Positive interrelations = blue, negative interrelations = red. **Legend:** Frn = friend support, fms = family support, fmc = family cohesion, ngt = negative self-esteem, pst = positive self-esteem, rfl = reflection, brd = brooding, dst = distress tolerance, agg = aggression, exp = expressive suppression. The boxes depict the maximal interrelation difference between the respective two networks (M), the difference in global network expected influence (EI) between the respective two networks (EI), and the corresponding p-values (5000 comparison samples).

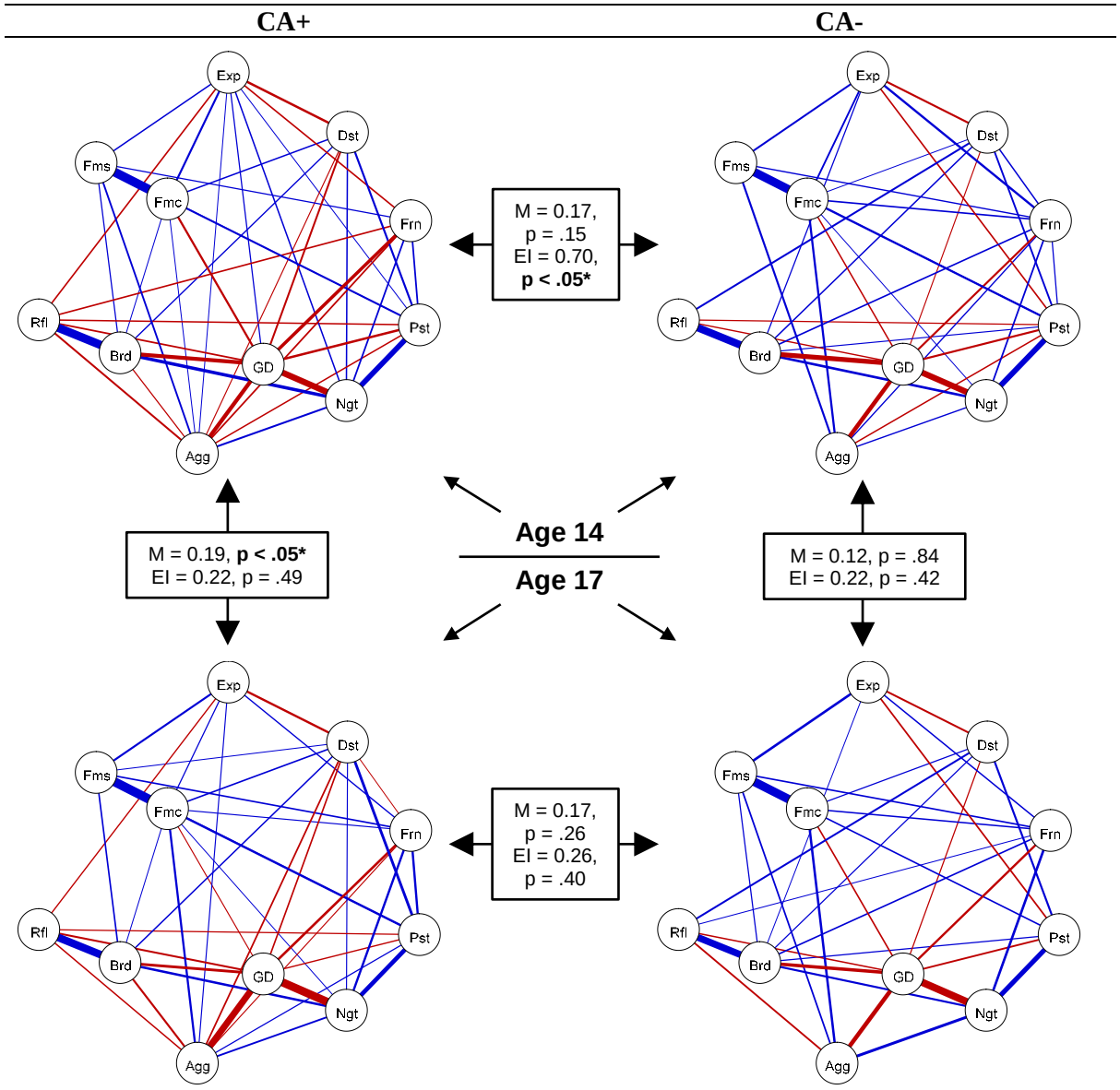


Figure 14. CA+ (n = 631) and CA- (n = 499) resilience factor networks with configural factor scores for age 14 (upper panel) and age 17 (lower panel) with the general distress variable. Width of the lines = association strength. Positive interrelations = blue, negative interrelations = red. **Legend:** Frn = friend support, fms = family support, fmc = family cohesion, ngt = negative self-esteem, pst = positive self-esteem, rfl = reflection, brd = brooding, dst = distress tolerance, agg = aggression, exp = expressive suppression, GD = general distress. The boxes depict the maximal interrelation difference between the respective two networks (M), the difference in global network expected influence (EI) between the respective two networks (EI), and the corresponding p-values (5000 comparison samples).

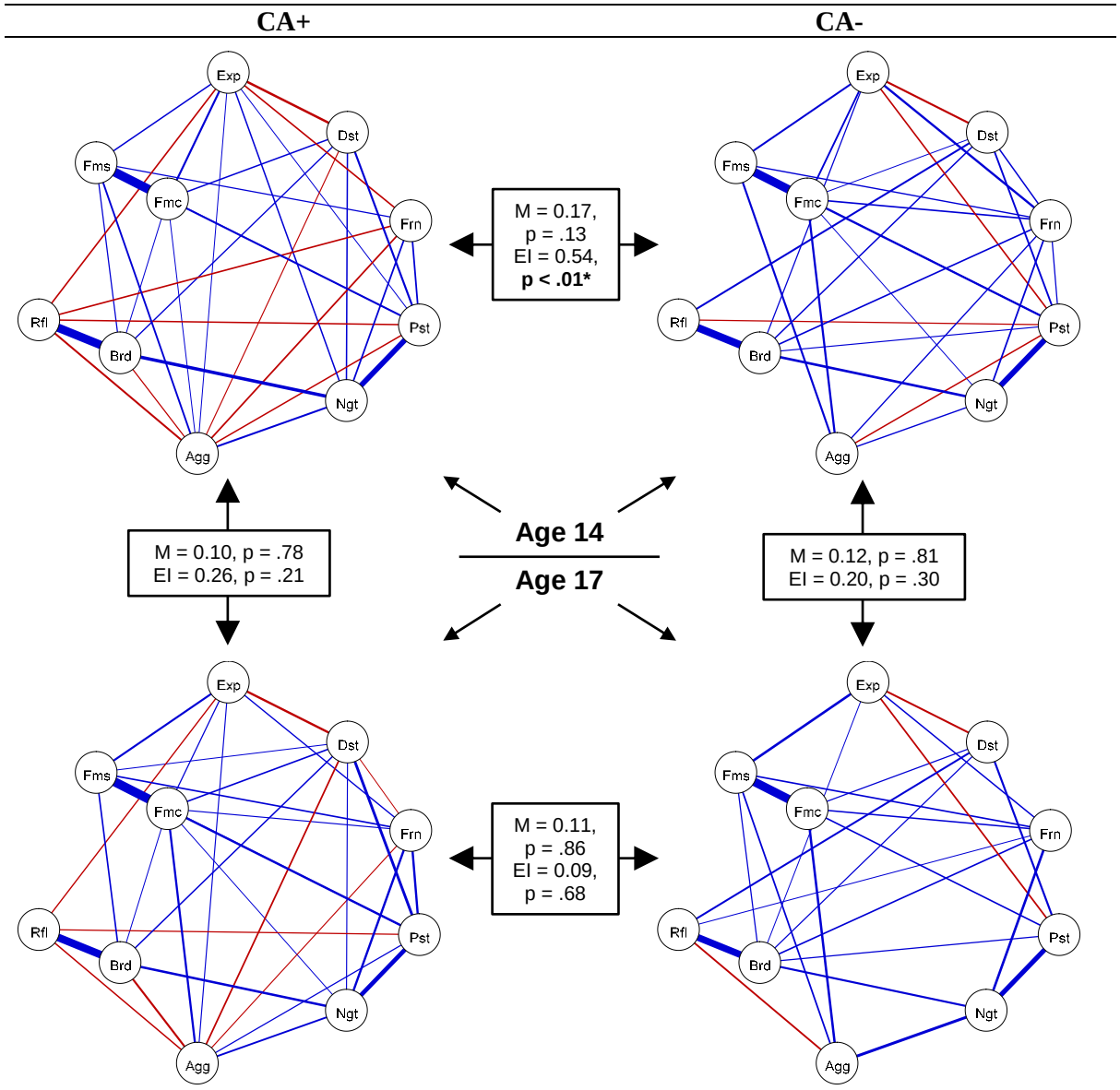


Figure 15. CA+ (*n* = 631) and CA- (*n* = 499) resilience factor networks for configural factor scores for age 14 (upper panel) and age 17 (lower panel) corrected for the general distress variable. Width of the lines = association strength. Positive interrelations = blue, negative interrelations = red. **Legend:** Frn = friend support, fms = family support, fmc = family cohesion, ngt = negative self-esteem, pst = positive self-esteem, rfl = reflection, brd = brooding, dst = distress tolerance, agg = aggression, exp = expressive suppression. The boxes depict the maximal interrelation difference between the respective two networks (M), the difference in global network expected influence (EI) between the respective two networks (EI), and the corresponding p-values (5000 comparison samples).

Additional file XII

The following three figures depict CA+ and CA- networks with sum scores. The models were estimated separately for age 14 and 17, as well as (1) once without the general distress variable, (2) once with the general distress variable, and (3) once corrected for the general distress variable. At age 14, the network invariance test was not significant for the networks without the general distress variable (M = .12, p = .58; see Figure 16), and the global network expected influence differed marginally between the CA+ and the CA- RF networks (EI_{CA+} = 3.01, EI_{CA-} = 3.31, EI = 0.31, p = .08). More specifically, the RFs in the CA+ network were less positively interrelated. Those findings were only partially similar in the networks for age 17, as neither of the two tests revealed significant differences between the CA+ and the CA- group (M = .13, p = .48; EI_{CA+} = 3.43, EI_{CA-} = 3.33, EI = 0.10, p = .49). When we compared the RF networks for age 14 and age 17, the two CA+ network were not invariant over time, in other words, they did vary over time (M = .24, p = .001). Moreover, the RFs in the age 14 network were less positively interrelated than in the age 17 network (EI_{14} = 3.01, EI_{17} = 3.43, EI = 0.42, p < .001). The two CA- network were not invariant over time (M = .22, p = .03), but did not differ in expected influence (EI_{14} = 3.31, EI_{17} = 3.33, EI = 0.02, p = .93).

For the networks with the general distress variable, the network invariance test (M = .13, p = .35; see Figure 17) was not significant at age 14. However, the global network expected influence differed between the CA+ and the CA- networks (EI_{CA+} = 0.67, EI_{CA-} = 1.20, EI = 0.53, p = .05). Those findings were only partially similar in the networks for age 17, as neither of the two tests revealed significant differences between the CA+ and the CA- group (M = .13, p = .60; EI_{CA+} = 1.22, EI_{CA-} = 1.27, EI = 0.05, p = .84). When we compared the CA+ networks for age 14 and age 17, the network invariance test was significant (M = .19, p = .02), and the RFs in the age 14 network were less positively interrelated than in the age 17 network (EI_{14} = 0.67, EI_{17} = 1.22, EI = 0.55, p = .04). The age 14 and age 17 CA- networks were again not invariant (M = .25, p = 0.009), but did not differ with regard to the expected influence (EI_{14} = 1.20, EI_{17} = 1.27, EI = 0.07, p = .80).

For the networks corrected for the general distress variable, the network invariance test was not significant at age 14 (M = .13, p = .31; see Figure 18), but the global network expected influence differed between the CA+ and the CA- networks (EI_{CA+} = 2.09, EI_{CA-} = 2.49, EI = 0.41, p = .04). Those findings were only partially similar in the networks for age 17, as neither of the two tests revealed significant differences between the CA+ and the CA- group (M = .13, p = .59; EI_{CA+} = 2.51, EI_{CA-} = 2.53, EI = 0.02, p = .90). When we compared the CA+ networks for age 14 and age 17, the network invariance test was not significant (M = .15, p = .12), but the RFs in the age 14 network were less positively interrelated than in the age 17 network (EI_{14} = 2.09,

EI_{17} = 2.51, EI = 0.42, p = .02). The age 14 and age 17 CA- networks were invariant (M = .10, p = 0.90), and did not differ with regard to the expected influence (EI_{14} = 2.49, EI_{17} = 2.53, EI = 0.04, p = .85).

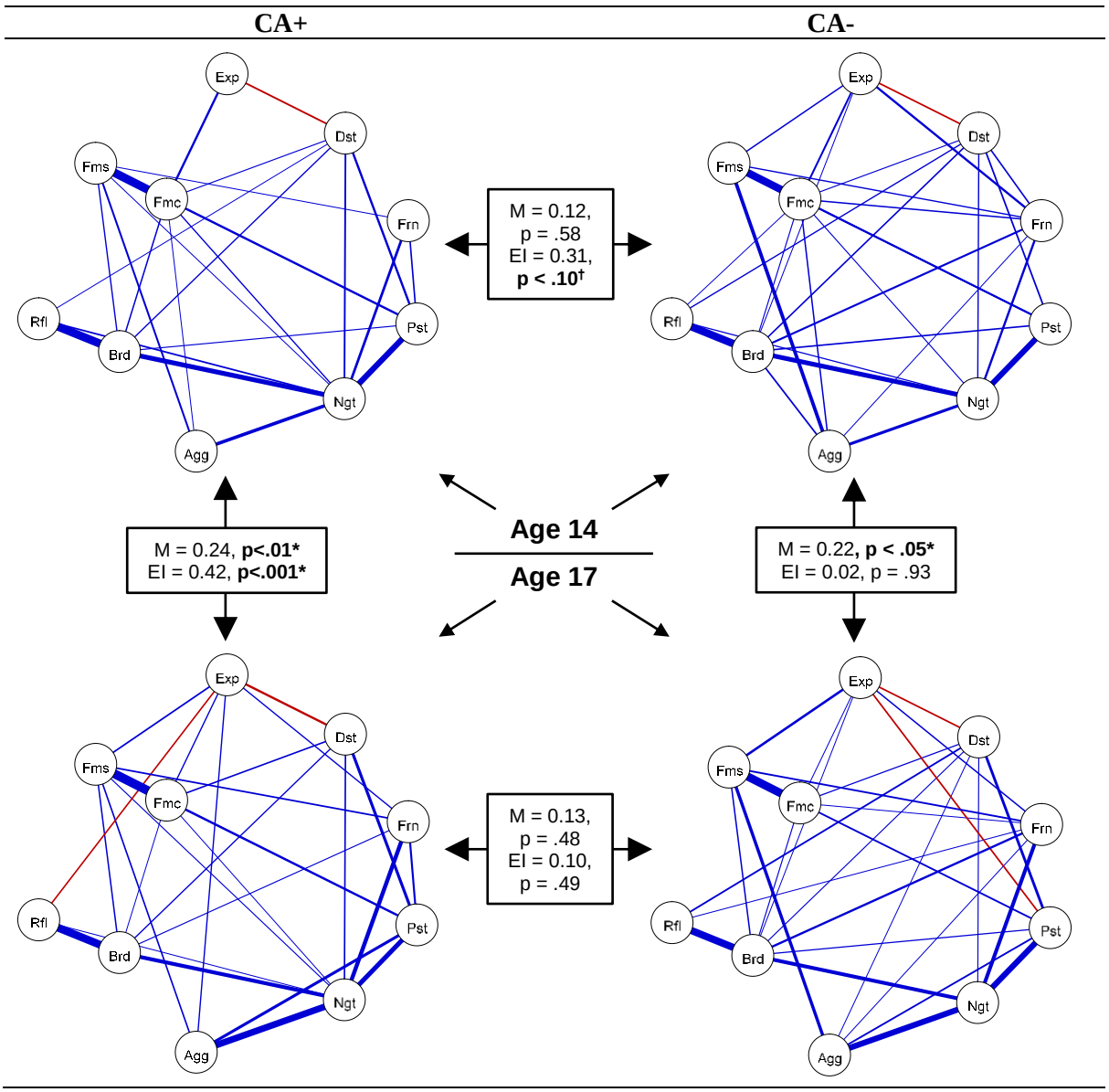


Figure 16. CA+ (*n* = 631) and CA- (*n* = 499) resilience factor networks with sum scores for age 14 (upper panel) and age 17 (lower panel) without the general distress variable. Width of the lines = association strength. Positive interrelations = blue, negative interrelations = red. **Legend:** Frn = friend support, fms = family support, fmc = family cohesion, ngt = negative self-esteem, pst = positive self-esteem, rfl = reflection, brd = brooding, dst = distress tolerance, agg = aggression, exp = expressive suppression. The boxes depict the maximal interrelation difference between the respective two networks (M), the difference in global network expected influence (EI) between the respective two networks (EI), and the corresponding p-values (5000 comparison samples).

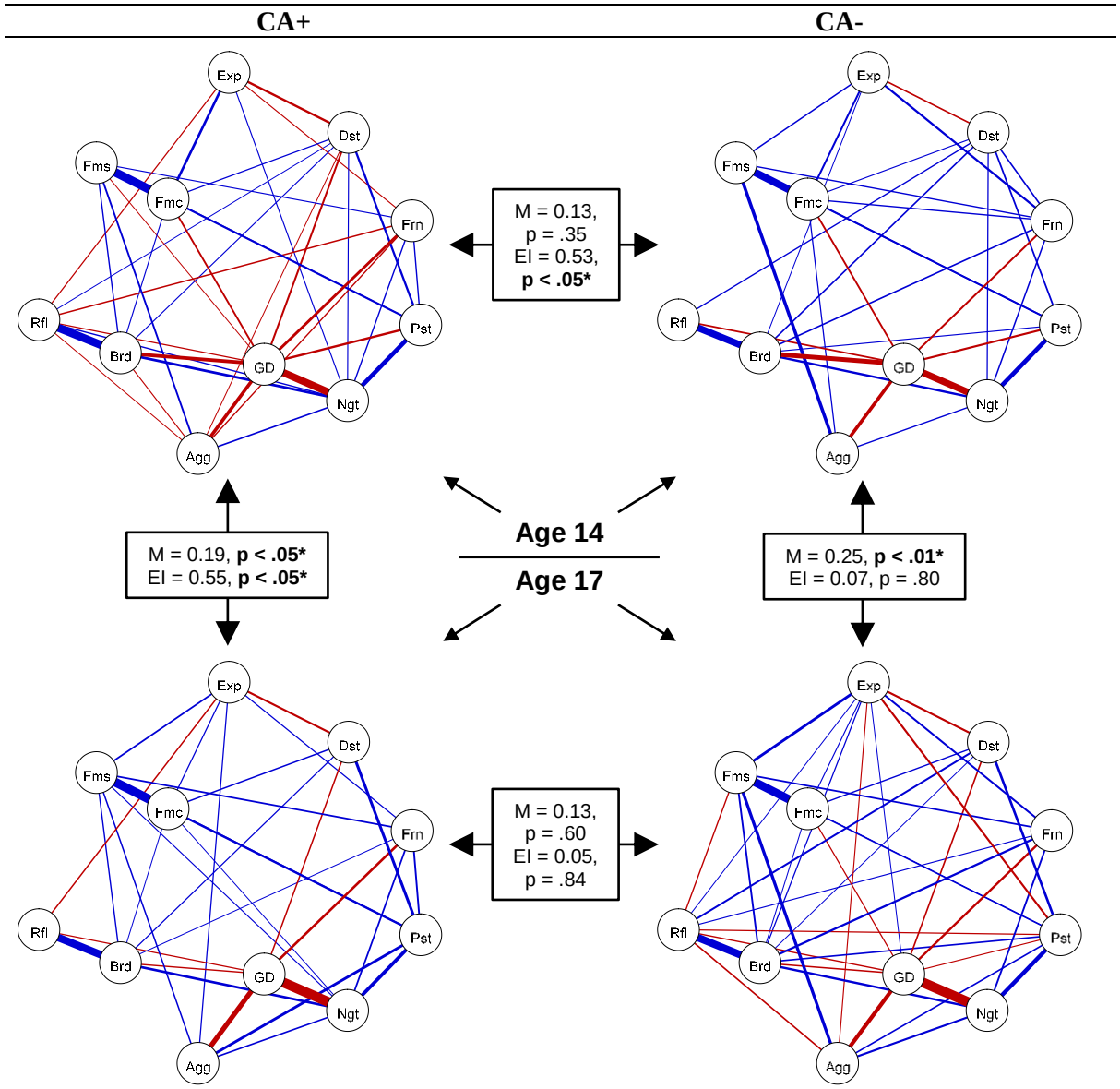


Figure 17. CA+ (*n* = 631) and CA- (*n* = 499) resilience factor networks with sum scores for age 14 (upper panel) and age 17 (lower panel) with the general distress variable. Width of the lines = association strength. Positive interrelations = blue, negative interrelations = red. **Legend:** Frn = friend support, fms = family support, fmc = family cohesion, ngt = negative self-esteem, pst = positive self-esteem, rfl = reflection, brd = brooding, dst = distress tolerance, agg = aggression, exp = expressive suppression, GD = general distress. The boxes depict the maximal interrelation difference between the respective two networks (M), the difference in global network expected influence (EI) between the respective two networks (EI), and the corresponding p-values (5000 comparison samples).

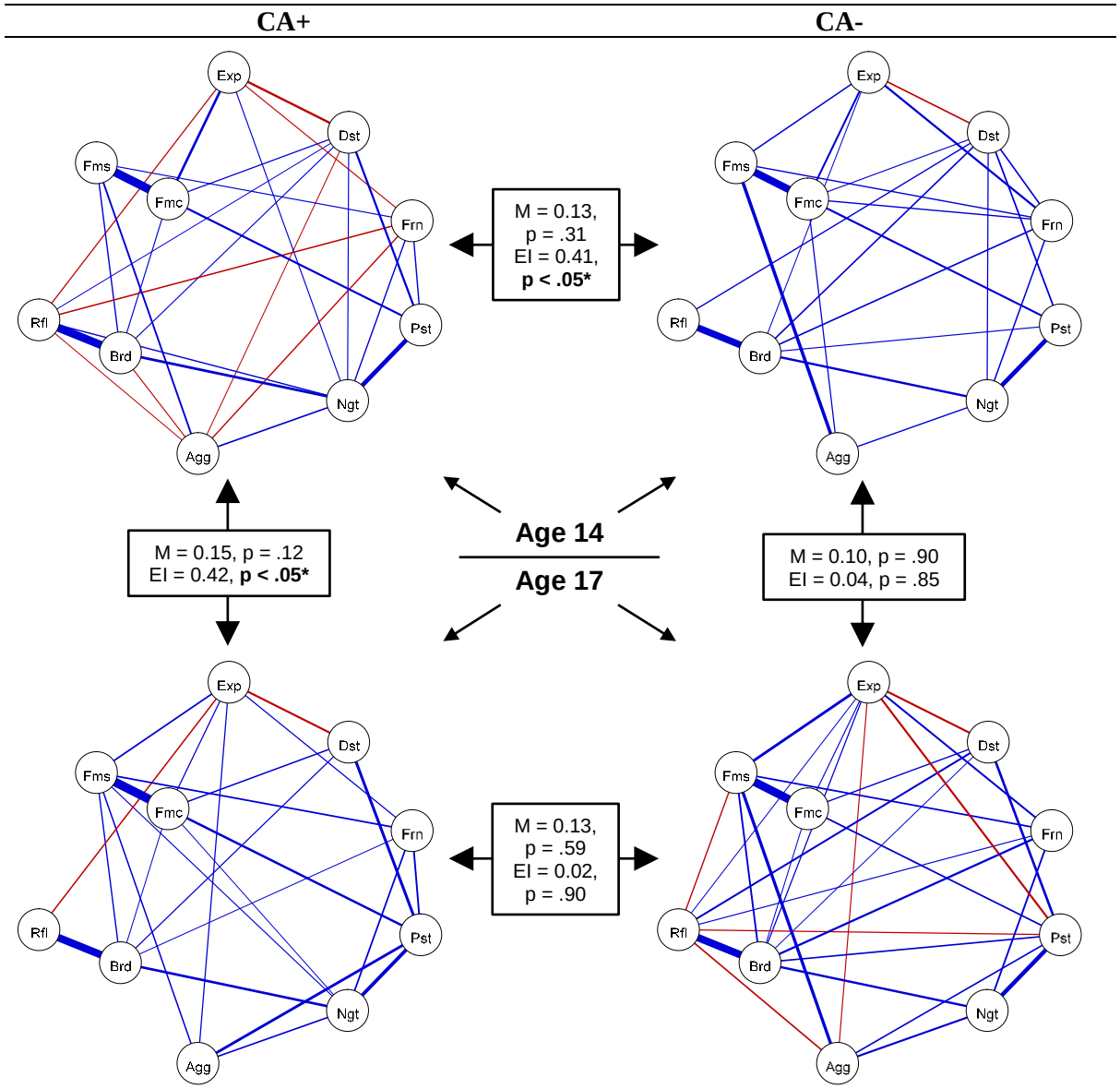


Figure 18. CA+ (n = 631) and CA- (n = 499) resilience factor networks for sum scores for age 14 (upper panel) and age 17 (lower panel) corrected for the general distress variable. Width of the lines = association strength. Positive interrelations = blue, negative interrelations = red. **Legend:** Frn = friend support, fms = family support, fmc = family cohesion, ngt = negative self-esteem, pst = positive self-esteem, rfl = reflection, brd = brooding, dst = distress tolerance, agg = aggression, exp = expressive suppression. The boxes depict the maximal interrelation difference between the respective two networks (M), the difference in global network expected influence (EI) between the respective two networks (EI), and the corresponding p-values (5000 comparison samples).

Additional file XIII

Table 9

Significant RF-RF Interrelation Differences between the CA+ (n = 631) and the CA- (n = 499) Networks

RF1	RF2	interrelation sign in the CA+ network	interrelation sign in the CA- network	E	*p*
		Age 14			
friendship support	brooding	null	positive	0.07	.014
friendship support	expressive suppression	negative	positive	0.14	.007
positive self-esteem	expressive suppression	null	negative	0.05	.046
reflection	distress tolerance	null	positive	0.09	.015
		Age 17			
friendship support	positive self-esteem	positive	null	0.11	.031

Note. RF = Resilience factor. CA = childhood adversity. E = RF-RF interrelation difference (i.e. edge difference).

Table 10

Significant RF-RF Interrelation Differences between Age 14 and Age 17 Networks

RF1	RF2	interrelation sign in the age 14 network	interrelation sign in the age 17 network	E	*p*
		CA+ Networks			
friendship support	expressive suppression	negative	positive	0.07	.031
negative self-esteem	brooding	more positive	less positive	0.08	.019
		CA- Networks			
-	-	-	-	-	-

Note. RF = Resilience factor. CA = childhood adversity. E = RF-RF interrelation difference (i.e. edge difference).

Additional file XIV

The following three figures depict CA+ and CA- networks with faded interrelations, for both age 14 and age 17, for (1) the networks without the general distress variable, (2) the networks with the general distress variable, and (3) the networks corrected for the general distress variable.

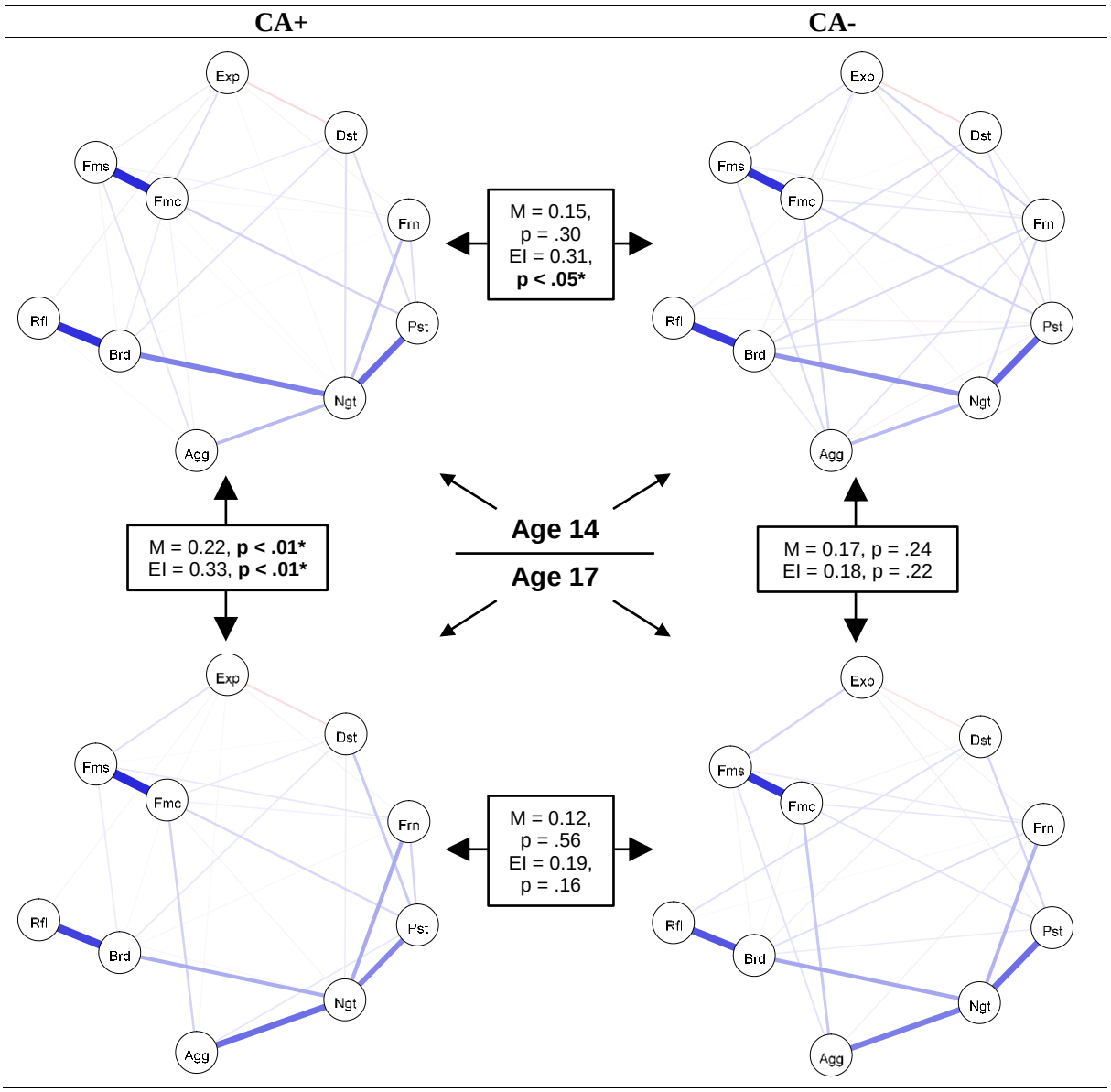


Figure 19. CA+ (n = 631) and CA- (n = 499) resilience factor networks with faded interrelations for age 14 (upper panel) and age 17 (lower panel) without the general distress variable. Width of the lines = association strength. Positive interrelations = blue, negative interrelations = red. **Legend:** Frn = friend support, fms = family support, fmc = family cohesion, ngt = negative self-esteem, pst = positive self-esteem, rfl = reflection, brd = brooding, dst = distress tolerance, agg = aggression, exp = expressive suppression. The boxes depict the maximal interrelation difference between the respective two networks (M), the difference in global network expected influence (EI) between the respective two networks (EI), and the corresponding p-values (5000 comparison samples).

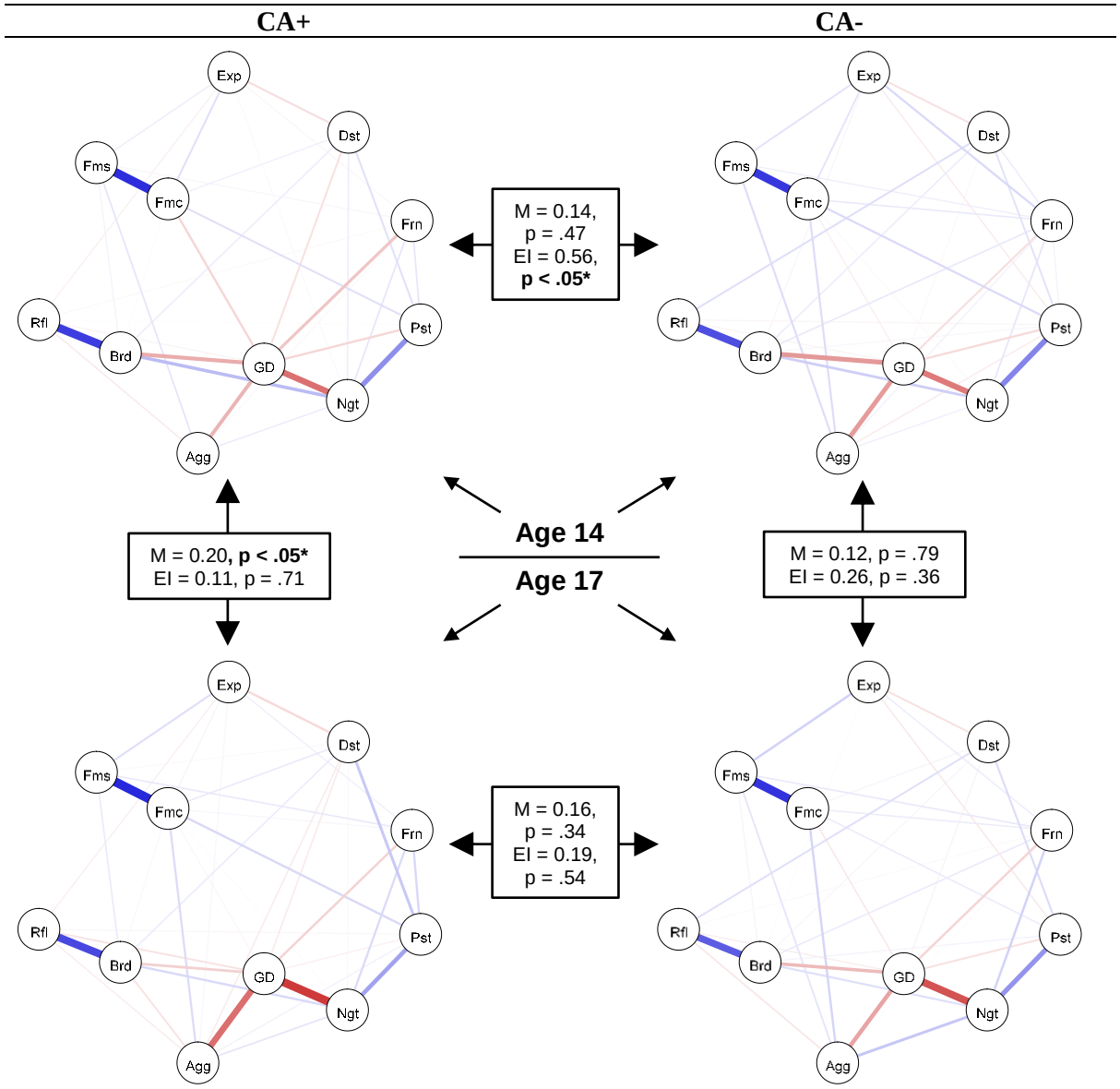


Figure 20. CA+ (*n* = 631) and CA- (*n* = 499) resilience factor networks with faded interrelations for age 14 (upper panel) and age 17 (lower panel) with the general distress variable. Width of the lines = association strength. Positive interrelations = blue, negative interrelations = red. **Legend:** Frn = friend support, fms = family support, fmc = family cohesion, ngt = negative self-esteem, pst = positive self-esteem, rfl = reflection, brd = brooding, dst = distress tolerance, agg = aggression, exp = expressive suppression, GD = general distress. The boxes depict the maximal interrelation difference between the respective two networks (M), the difference in global network expected influence (EI) between the respective two networks (EI), and the corresponding p-values (5000 comparison samples).

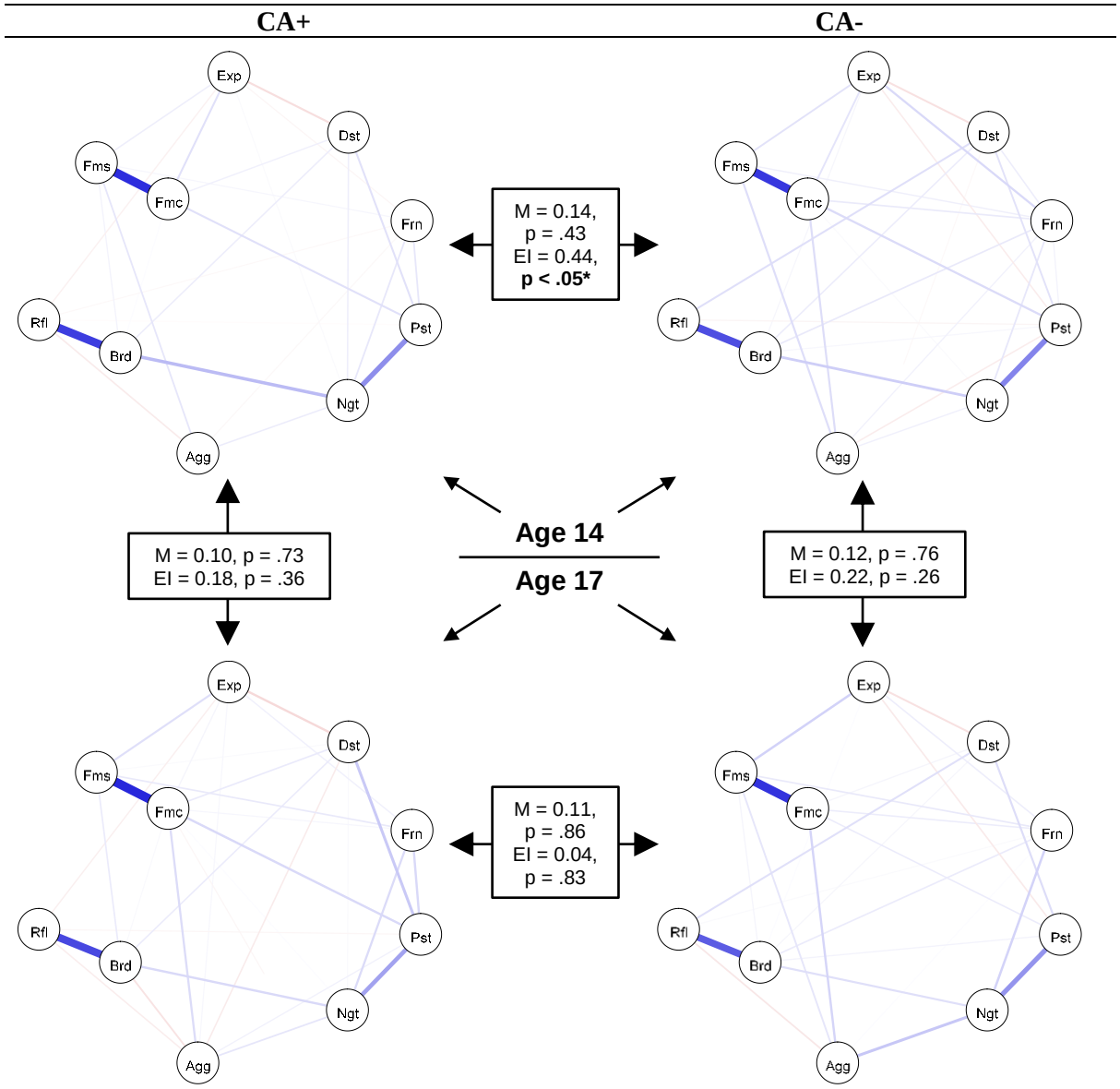


Figure 21. CA+ (*n* = 631) and CA- (*n* = 499) resilience factor networks with faded interrelations for age 14 (upper panel) and age 17 (lower panel) corrected for the general distress variable. Width of the lines = association strength. Positive interrelations = blue, negative interrelations = red. **Legend:** Frn = friend support, fms = family support, fmc = family cohesion, ngt = negative self-esteem, pst = positive self-esteem, rfl = reflection, brd = brooding, dst = distress tolerance, agg = aggression, exp = expressive suppression, GD = general distress. The boxes depict the maximal interrelation difference between the respective two networks (M), the difference in global network expected influence (EI) between the respective two networks (EI), and the corresponding p-values (5000 comparison samples).

Additional file XV

Several network figures for age 14 (i.e. Figure 2 and 3 in the main manuscript, and figures in Supplement II, V, VII, IX, XI, XII, XIV) are similar to figures in a previous report on this sample Fritz et al. (2018; Scientific Reports; can be retrieved from https://doi.org/10.1038/s41598-018-34130-2)[1]. In the original article, the figures were published under the Creative Commons Attribution 4.0 International License. Information about this license can be found in the article itself[1] or at http://creativecommons.org/licenses/by/4.0/. The figures here are however only partially similar to the figures in our previous report, for the following reasons: (1) a slightly different sample was used as we could impute the missing data, (2) the general distress variable was not the same for reasons described in Supplement I, (3) the brooding variable was not the same for reasons described in Supplement I, (4) the scores were not derived from one-factor CFAs, but from longitudinal categorical CFAs with two factors, one for each time point, and (5) due to computing different CFA models, some CFAs did not need the modification we had to apply for the CFAs in our previous report.

Additional file XVI

Are resilience and risk factors opposing sides of the same coin?

The question whether resilience and risk factors lie on one continuum, representing respectively the opposite ends, has been widely discussed in the resilience literature. Yet, the answer to this question is probably not done justice with a simple yes or no. For our study the resilience factors (RFs) were derived from our systematic review[29] and were defined as follows (p. 2): "*RFs have a promotive impact on the adjustment process following CA and thus help individuals to adapt and recover from the sequelae of CA (Rutter, 1985, 2013; Zolkoski & Bullock, 2012).*[30–32] *Statistically, RFs operate as a moderator (Fergus & Zimmerman, 2005; Rutter, 1985)*[30,33], *and/ or as a positive mediator (Masten, 2001; van Harmelen et al., 2016)*[34,35] *for the relationship between CA and psychopathology.*" We further specified as inclusion criteria that an RF "*belongs either to the individual-, family-, or community-level category, […] belongs to the cognitive, behavioural, social, and/ or emotional functioning domain, […* and should be*] amenable"* (p. 3 in [29]). We specified as exclusion criteria that the RF should not be "*defined (a) as financial advantage, (b) as no re-victimization, (c) as inverse of CA, [and] (d) as inverse of psychopathology*" (p. 3 in [29]). In other words, RFs are amenable factors that operate as ameliorating or modifying variables in the relationship between adversity and mental health problems, and should neither be equivalent to CA nor to mental health problems. CA was defined as "*traumatic and/or severely stressful events, [leading to]…a higher risk of developing mental health problems*" (p. 2 in [29]). We additionally specified in detail which events would qualify as CA, in the attempt to keep the definitions of RFs and CA as separate as possible. Yet, based on our definitions, adversity is not equivalent to risk factors, as risk factors do not need to be traumatic and/or severely stressful events but still lead to a higher risk of developing mental health problems (e.g. low maternal education). With regard to our study, the quick, but insufficient answer is probably that many (or most) of the investigated RFs are indeed the flip side of risk factors. For example, self-esteem (or a positive self-concept) is commonly defined as RF and has been discussed as such by many of the seminal resilience researchers, including Michael Rutter, Emmy Werner, Ann Masten, and Michael Ungar (for a review see e.g. [36]). Yet, at the same time a low level of self-esteem or self-worth is part of the DSM V criteria for depression ("Feelings of worthlessness"; American Psychiatric Association[37]). Hence, whereas a high level of self-esteem may protect against low mood levels, low self-esteem is assumed to contribute to or reflect low mood.

That said, some RFs have been suggested not to lie on the same continuum with their supposingly opposing risk factor. For example, Carretta and colleagues[38] showed that hope and hopelessness are highly negatively correlated, but not as high as would be expected for opposing poles of the same construct.[39] Others

have proposed that not hopelessness and hope, but hopelessness and the absence of hopelessness may be bipolar.[39,40] Hence, here the risk factor may be hopelessness and the RF hope, which may however not lie on the exact same continuum. For other factors the liaison between risk and protection is even more complicated, as it depends on external factors. For instance, a low level of expressive suppression, which means that someone can effectively expresses and communicate his/her emotions, may well be advantageous in safe environments. Yet, in hazardous environments, as for example a violent home environment, emotional expression may not always be advantageous. Similarly, Luthar[41] found in adolescents from underprivileged environments that high intelligence functions as risk factor, rather than, as commonly found, as RF. Hence some RFs may be protective in one context or environment but may be harmful in another.[36] Moreover, some RFs may be particularly protective during early development and others during adulthood. For example, some researchers argue that parental support is particularly protective during childhood, but less so during adolescence.[42]

Sometimes researchers differentiate between RFs and risk factors though defining risk factors as direct effects, and RFs as moderators or mediators (e.g. see [43]). Such attempts are limited in our opinion, as both mediating and moderating RFs statistically also require a direct effect between the RF and the mental health outcome. Hence, according to such a definition one would suggest that all factors that qualify as direct effect and as mediator and/or moderator should be clustered into the RF category, whereas all factors that only qualify as direct effect should be clustered into the risk factor category. One crucial consideration that limits this definition is the present lack of replicability of RFs and risk factors. For example, Dubow and colleagues[44] found that positive parenting moderates the relationship between CA and mental health problems, while Cui and Conger[45] did not find convincing support for a moderation effect. Thus, now one would be stuck with deciding on whether high positive parenting should be considered as RF or whether low positive parenting should be considered as risk factor. Other resilience researchers have argued that both direct effects and mediating and moderating effects qualify as RFs. For example, Garmezy and colleagues[46] refer to RFs with a direct effect on mental health as “compensatory” factors and to RFs with an interaction effect on mental health as “protective” factors.

In sum, we cautiously conclude that on the group level (particularly when a rather homogeneous group is studied) many RFs (such as those included in our study) operate on a continuum with risk factors. Yet, on an individual level, the relationship between resilience and risk factors is likely to additionally depend on biological predispositions, type of adversity experienced, the specific environmental circumstances, and the developmental stage.

While neither our RF definition nor our analyses allow us to clearly demarcate the conceptualisation of resilience vs risk factors, we believe that our work expands the RF literature on another aspect. Shaik and Kauppi (p. 162-163 in [43]) state that "*[o]ne of the major shortcomings is the tendency to view factors as mono-directional influences as opposed to bi-directional influences (Glantz & Sloboda, 1999)*[47]*. These models fail to delineate how all factors can be the influences, mediators and outcomes tied in varying degrees to the entire system of variables. Despite the large number of empirical studies […], there are not sufficient details available about how and why the protective or compensatory factors directly or indirectly influence the outcomes (Lepore & Revenson, 2006)*[48]." We believe that the strength of our manuscript lies in shedding light onto the bi-directional system of RFs that are associated with a lower risk of mental distress during early and later adolescence. Regardless of whether resilience and risk factors operate on the same continuum or are inversely correlated but not identical, understanding the nature of RFs seems to have universal appeal as it focuses on what promotes good mental health rather than on what increases mental health problems. Knowledge on the promotion of good mental health in adolescents may not only be of clinical, but also of policy interest, as good mental health in today's youth may result in less mental health problems in tomorrow's adults. Or to put it into Garmezy's words (p. 171 in [49]): "*Government, by providing protective factors, enables some who would otherwise be lost to a fruitful life to move above the threshold of competence needed to survive in an increasingly complex, technological society.*"

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