Supplementary Online Content

Wade M, Fox NA, Zeanah CH, Nelson CA. Effect of foster care intervention on trajectories of general and specific psychopathology among children with histories of institutional rearing: a randomized clinical trial. *JAMA Psychiatry*. Published online September 26, 2018. doi:10.1001/jamapsychiatry.2018.2556

This supplementary material has been provided by the authors to give readers additional information about their work.

Online Supplement

eResults

eTable 1. Baseline characteristics of institutionally-reared children

	CAUG (n = 68)	FCG (n = 68)	*p*-value
Female, No. (%)	35 (51.5)	33 (49.3)	.80
Birth weight (grams), *M* (*SD*)	2847 (570.2)	2733 (576.2)	.31
Gestational age (weeks), *M* (*SD*)	37.6 (1.5)	37.0 (2.4)	.12
Height for age percentile (cm), *M* (*SD*)	26.9 (23.1)	25.7 (22.5)	.78
Weight for age percentile (kg), *M* (*SD*)	22.7 (24.6)	18.2 (19.4)	.26
Duration of Institutionalization (weeks), *M* (*SD*)	87.9 (17.9)	85.2 (23.0)	.47

eTable 2. Demographic characteristics of children in the current study

Child Characteristics	CAUG (*n* = 58)	FCG (*n* = 61)	NIG (*n* = 101)
Gender (%)			
Male	51.7	52.5	47.5
Female	48.3	47.5	52.5
Ethnicity (%)			
Romanian	48.3	59.0	91.9
Roma (gypsy)	36.2	27.9	7.1
Unknown	13.8	11.5	0.0
Other	1.7	1.6	1.0
Birth weight (grams)	2898.0[a]	2727.4[a]	3208.0[a]

[a]NIG > CAUG and FCG on birth weight at $p < .01$.

eTable 3. Fit information for one-, two-, and bifactor models at age 8, 12, and 16

	χ^2	df	RMSEA	CFI	SRMR	BIC
Age 8						
One-Factor	182.81***	20	.20	.81	.12	682.00
Two-Factor	83.37***	19	.13	.93	.07	544.67
Bifactor	20.19	13	.05	.99	.03	469.24
Age 12						
One-Factor	180.60***	20	.22	.80	.14	-187.28
Two-Factor	70.61***	20	.13	.94	.08	-355.24
Bifactor	8.80	10	<.001	1.00	.03	-427.44
Age 16						
One-Factor	135.48***	20	.20	.81	.11	182.88
Two-Factor	66.72***	19	.13	.92	.07	82.15
Bifactor	11.07	10	.03	.99	.03	27.05

***$p < .001$.

Note. At age 8, ADHD had a negative residual variance that was non-significant in the bifactor model, so this was set to zero. At age 12, modification indices suggested that the bifactor model would be improved by adding residual correlations between relational aggression and overanxious, ADHD and overt aggression, and ADHD and relational aggression. At age 16, modification indices suggested that the bifactor model would be improved by adding residual correlations between relational aggression and conduct problems, ADHD and ODD, and ADHD and relational aggression. Fit indices in this Table include these residual correlations.

Comparison of One-, Two-, and Bifactor Models Across Ages

eTable 3 presents model fit for the one-, two-, and bifactor models at each age. Hu and Bentler[1] recommend goodness-of-fit cut-offs as follows: Root Mean Square Error of Approximation (RMSEA) < .06, Comparative Fit Index (CFI) > .95, and Standardized Root-Mean-Square Residual (SRMR) < .80, in addition to a non-significant χ^2 and the lowest possible BIC. As can be seen in eTable3, the bifactor model offered the best fit to the data at all three ages, exceeding these recommended fit indices for RMSEA, CFI, and SRMR, while also being the only models with a non-significant χ^2 and the lowest BIC at each age. For this reason, the bifactor model with P, INT, and EXT factors were determined to offer the best fit to the data and were thus used in the primary analysis examining latent growth in psychopathology over time.

Bifactor Models at Age 8, 12, and 16

Loadings on each latent factor at each age are presented in eTable 4. The factor structure was largely similar across ages, with all domains of psychopathology significantly loading onto the P factor and its specific INT or EXT factor. The exception was ADHD, which did not significantly load onto the EXT factor at age 8, but did load onto this factor at age 12 and 16. All other loadings on P, INT, and EXT were significant and in the expected direction at all ages.

eTable 4. Factor loadings for the bifactor models at age 8, 12, and 16

	P	INT	EXT
Age 8			
Depression	.62***	.58*	
Overanxious	.40***	.54**	
Social withdrawal/anxiety	.20**	.89***	
Opposition defiant	.80***		.52***
Conduct problems	.74***		.50***
Overt aggression	.80***		.44***
Relational aggression	.61***		.53**
ADHD	1.00***		.01
Age 12			
Depression	.96***	.27*	
Overanxious	.65***	.51**	
Social withdrawal/anxiety	.41**	.68**	
Opposition defiant	.66***		.70***
Conduct problems	.57***		.71***
Overt aggression	.52***		.81***
Relational aggression	.63***		.54**
ADHD	.67***		.60***
Age 16			
Depression	.81***	.41***	
Overanxious	.62***	.62***	
Social withdrawal/anxiety	.34**	.65***	
Opposition defiant	.74***		.43***
Conduct problems	.80***		.39***
Overt aggression	.68***		.73***
Relational aggression	.77***		.25*
ADHD	.84***		.22*

***$p < .001$. **$p < .01$. *$p < .05$.

Measurement Invariance Over Time

We assessed factorial invariance for the bifactor model over time (age 8, 12, and 16). The bifactor model was specified to have a general factor (P factor) that captured common variance across all psychopathology domains, a specific INT factor capturing shared variance between depression, overanxious, and social withdrawal/anxiety symptoms that were not accounted for by the P factor, and a specific EXT factor capturing shared variance between overt aggression, relational aggression, ODD, conduct problems, and ADHD symptoms that were not accounted for by the P factor. Factors were forced to orthogonality (i.e., uncorrelated) within time to ensure that they captured variance that did not overlap with each other.

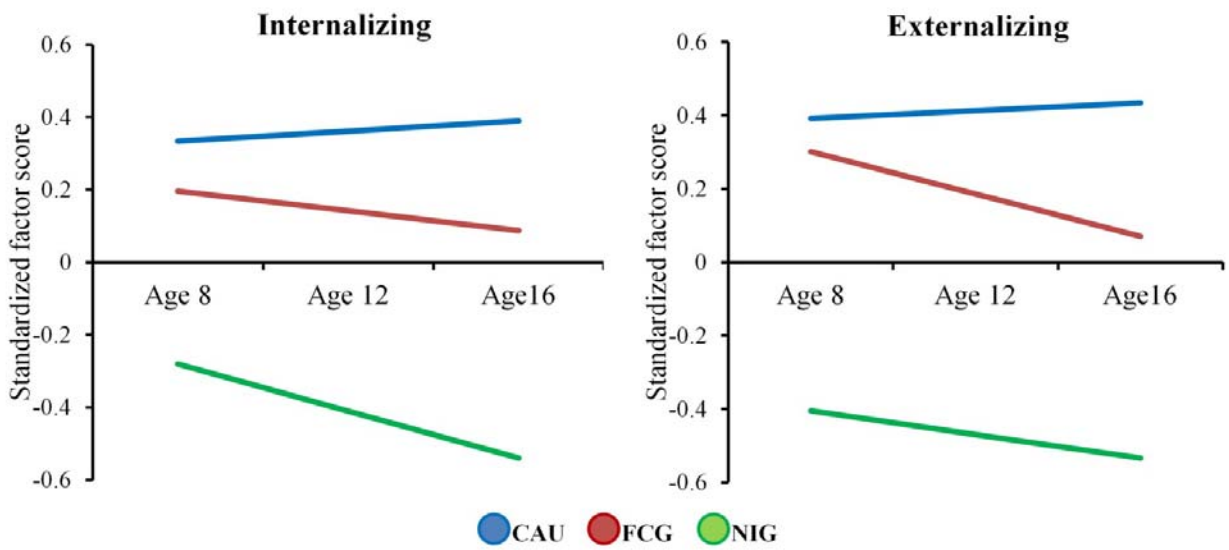
In the *configural model*, we tested whether the same factor structure is present at each age by estimating the latent bifactors simultaneously, allowing for cross-time factors to freely vary. This model fit the data well: RMSEA = .054, CFI = .96, and SRMR = .05, confirming equivalence of model form. In the *metric model*, we tested whether the factor loadings were equal across time. The model with all factor loadings constrained to equality fit the data well: RMSEA = .057, CFI = .95, and SRMR = .07. This model did not fit worse than the model with all loadings free across time, ΔRMSEA = .003, ΔCFI = .01, and ΔSRMR = .02[2]. Thus, metric invariance was established. We then tested whether the intercepts of the scales were similar over time (scalar invariance). Model fit was modest for most fit indices, RMSEA = .071, CFI = .91, and SRMR = .08, and was slightly worse than in the metric model, ΔRMSEA = .014, ΔCFI = .04, and ΔSRMR = .01. Modification indices suggested freeing the intercept for oppositional defiant disorder, and the resultant model did not fit worse than the metric model, ΔRMSEA = .004, ΔCFI = .01, and ΔSRMR = .00, suggesting partial scalar invariance. Comparisons of mean differences under these conditions are common in developmental research[3].

Alternate Model with Separate ADHD Factor

The final model suggested that, while ADHD loaded strongly onto the P factor at all ages, it did not load significantly onto the EXT factor. Residual variance in ADHD was also non-significant, suggesting that variance in ADHD was entirely accounted for by P in this sample. We re-fit a model with a separate ADHD latent factor indicated by inattention and hyperactivity/impulsivity at each age, but this model did not offer a good fit to the data at any age. Thus, the best model for the latent structure of psychopathology included ADHD as an indicator of P and EXT, and P accounted for the majority of its variance. In other words, in this sample of children with histories of institutional rearing, symptoms of ADHD appear to be underpinned by whatever P is capturing, such as problems with emotion dysregulation that manifest as inattention, hyperactivity, and/or impulsivity.

Correlated Factors Model

Finally, we examined trajectories of Internalizing and Externalizing psychopathology in a correlated-factors model that did not include the P factor, consistent with more traditional conceptualizations of psychopathology as falling along these two dimensions[4]. The pattern of the trajectories for this correlated-factors model is presented in eFigure 1, and the growth parameters are presented in eTable 5. Briefly, the shape of these trajectories was similar for the Internalizing and Externalizing factors, and both resembled the pattern of trajectories for the general P factor in the primary analysis. Only for the Externalizing factor was there the modest decline from age 8 to 16 that was observed for the P factor in the primary analysis. However, for both the Internalizing and Externalizing factors, NIG had significantly lower levels of difficulties than CAUG and FCG at age 8, 12, and 16. While no differences between CAUG and FCG were observed at age 8, these began to emerge by age 12 and were fully manifest by age 16. Thus, it does not appear that either the Internalizing or Externalizing factor were driving the pattern of results reported for the P factor. Instead, these results support the notion that the trajectory of the P factor adequately and parsimoniously captures the overlapping trajectories of the internalizing and externalizing factors. Once this variance in P is accounted for, the shape and significance of the residual INT and EXT trajectories differs from those of the correlated-factor model with only Internalizing and Externalizing factors.



eFigure. Latent growth model for correlated factors model

Trajectories of Internalizing (left) and Externalizing (right) psychopathology factors from a correlated factors model without the general factor (P). Lines represent model-estimated trajectories, and growth parameters are adjusted for gender and birth weight. Blue = care as usual group (CAUG); Red = foster care group (FCG); Green = never-institutionalized group (NIG).

eTable 5. Growth parameters for the correlated-factors model with Internalizing and Externalizing dimensions only

	CAUG Intercept [95% CI]	FCG Intercept [95% CI]	NIG Intercept [95% CI]	Group difference
Internalizing				
Age 8	.34* [.03, .67]	.21 [-.12, .49]	-.29** [-.49, -.07]	NIG < CAUG***, FCG*
Age 12	.34* [.15, .56]	.13 [-.08, .32]	-.40*** [-.57, -.22]	NIG < CAUG***, FCG*** CAUG > FCG†
Age 16	.39** [.12, .66]	.06 [-.21, .31]	-.51*** [-.79, -.25]	NIG < CAUG***, FCG** CAUG > FCG*
Slope (Age 8 to 16)	.02 [-.22, .23]	-.08 [-.28, .14]	-.11 [-.29, .05]	No diffs
Externalizing				
Age 8	.39*** [.15, .65]	.29* [.03, .51]	-.39*** [-.57, -.20]	NIG < CAUG***, FCG***
Age 12	.40*** [.22, .60]	.16* [-.03, .35]	-.45*** [-.60, -.28]	NIG < CAUG***, FCG*** CAUG > FCG*
Age 16	.42*** [.18, .67]	.04 [-.21, .27]	-.50*** [-.75, -.25]	NIG < CAUG***, FCG** CAUG > FCG*
Slope (Age 8 to 16)	.02 [-.16, .17]	-.12† [-.26, .03]	-.06 [-.20, .08]	FCG > CAUG†

$^{***}p < .001$. $^{**}p < .01$. $^{*}p < .05$. $^{\dagger}p < .10$.

Supplementary References

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3. Putnick DL, Bornstein MH. Measurement invariance conventions and reporting: the state of the art and future directions for psychological research. *Developmental Review*. 2016;41:71-90.

4. Schaefer JD, Moffitt TE, Arseneault L, Danese A, Fisher HL, Houts R, Sheridan MA, Wertz J, Caspi A. Adolescent victimization and early-adult psychopathology: approaching causal inference using a longitudinal twin study to rule out noncausal explanations. *Clinical Psychological Science*. 2018;6(3):352-71.