

Adverse childhood experiences and personality functioning interact substantially in predicting depression, anxiety, and somatization

André Kerber¹  | Elsa Gewehr^{2,3} | Johannes Zimmermann²  |
Cedric Sachser⁴ | Jörg M. Fegert⁴ | Christine Knaevelsrud¹  | Carsten Spitzer⁵ 

¹Division of Clinical Psychological Intervention, Freie Universität Berlin, Berlin, Germany

²Department of Psychology, University of Kassel, Kassel, Germany

³Psychologische Hochschule Berlin, Berlin, Germany

⁴Department of Child and Adolescent Psychiatry/Psychotherapy, Ulm University, Ulm, Germany

⁵Department of Psychosomatic Medicine and Psychotherapy, University Medical Center Rostock, Rostock, Germany

Correspondence

André Kerber, Department of Education and Psychology, Workgroup Clinical-Psychological Intervention, Freie Universität Berlin, Schwendener Str. 27, 14195 Berlin, Germany.
Email: andre.kerber@fu-berlin.de

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Abstract

Etiological theories on the development of psychopathology often incorporate adverse childhood experiences (ACE) as an important contributing factor. Recent studies suggest personality functioning (PF; i.e., stability of the self and interpersonal relationships) as an important transdiagnostic construct that could be useful in better understanding when persons with ACE do (not) develop psychopathological symptoms. A representative sample of $N = 2363$ was assessed by questionnaires on ACE, PF (Level of Personality Functioning Scale—Brief Form 2.0), and current symptoms of depression, anxiety, and somatization (Brief Symptom Inventory 18). The interaction between ACE and PF on symptoms was investigated using multiple group models and Bayesian structural equation modeling. ACE were positively associated with psychopathology and PF impairments. The interaction effect between ACE and PF explained incremental variance in current symptoms, ranging from 26% for somatization to 49% for depression with the complete model explaining up to 91% of the latent variance in psychopathology. Our findings indicate a diathesis–stress model with PF as a resource or resilience that may buffer against the development of symptoms in the face of adversity. Treatments of depression and anxiety targeting self and interpersonal functioning therefore may lead to improvements in resilience and relapse prevention. [Correction added on 15 March 2023, after first online publication: Level of Personality Functioning Scale—Brief Form has been replaced to Level of Personality Functioning Scale—Brief Form 2.0]

INTRODUCTION

Etiological theories on the development of psychopathology such as the diathesis–stress or the differential susceptibility model often incorporate (adverse) childhood experiences as an important contributing factor

(Kawamoto, 2020). Adverse childhood experiences (ACE, i.e., childhood abuse, neglect, and household dysfunction) have a prevalence of about 30% in the general population (Moody et al., 2018) and are associated with increased odds for various health problems such as cardiovascular or respiratory disease, sexual transmitted

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infections, problematic alcohol and drug use, violence against self or others (Hughes et al., 2017; Petruccioli et al., 2019), and inflammation, reduced telomere length, and altered mitochondrial activity (Baumeister et al., 2016; Li et al., 2017; Ridout et al., 2018). Links between childhood adversity and mental health problems in particular have been reported in a plethora of studies across decades. According to pooled data across 69 meta-analyses (Sahle et al., 2021), adults' self-reports of having experienced adversity during childhood were consistently associated with twofold increased odds for depression, anxiety, and suicidality. This association could also be ascertained for somatic symptoms (Creed et al., 2012; Kuhar & Zager Kocjan, 2022) and chronic somatic pain (Petruccioli et al., 2019; Sachs-Ericsson et al., 2017). In addition, many studies report evidence for a dose-response relation, where the accumulation of ACE goes along with stronger mental health impairments (Hughes et al., 2017; Norman et al., 2012). Compared with other ACE, psychological abuse (i.e., emotional abuse and neglect) seems to show the strongest association with depression (Nelson et al., 2017), anxiety (Witt et al., 2019), and somatization (Creed et al., 2012), the three most prevalent mental health problems in primary care (Roca et al., 2009).

A key question regarding how ACE and mental health problems are related is which conditions attenuate or exacerbate this association. According to a predominant explanatory model for the association of ACE with adult psychopathology, childhood adversities during sensitive windows of early brain development may, besides inducing inflammatory and biological aging processes, damage brain development and function (Danese, 2020), with most impact on the brain functions of social information and emotional processing (McLaughlin et al., 2020). In the present study, we argue that such functional deficits can be represented by the construct of personality functioning (PF) and that individual differences in PF may act as a diathesis (i.e., vulnerability or resilience) for psychopathology, modulating the effects of ACE on current mental health. The construct of PF builds on theories of personality organization (Kernberg, 2004), object relations theory (Huprich et al., 2016; Peters et al., 2006), and the concept of mentalizing (Luyten et al., 2020), which share the assumption that social and emotional information processing ability is central for mental health. Inspired by these concepts, the Level of Personality Functioning Scale (Bender et al., 2011) was introduced in DSM-5, Section III (American Psychiatric Association [APA], 2013) as a dimensional indicator of personality disorders (PDs) capturing disturbances of the self and interpersonal relationships, and in the meantime, this construct was also adopted as a dimensional assessment of PD severity in the ICD-11 (Mulder & Tyrer, 2018). ICD-11 now defines individual

differences in PF by the amount of difficulties in functioning of the self (e.g., identity, self-worth, accuracy of self-view, and self-direction) and interpersonal relationships (e.g., ability to develop and maintain close and mutually satisfying relationships and ability to understand others' perspectives and to manage conflict in relationships).

There is ample evidence for the empirical relevance of PF, including associations with ACE and common psychopathological symptoms. Indirect evidence derives from earlier studies on PDs, because PF can be considered one of the general features of PD and, in particular, features of borderline personality disorder (BPD) such as interpersonal problems, identity diffusion, and emotional instability were suggested as indicators for general PD severity (Clark, 2018; Sharp et al., 2015). Those studies demonstrated substantial relations between ACE and PD (Afifi & MacMillan, 2011; Waxman et al., 2014) and, in particular, between ACE and BPD. In a meta-analysis of 97 case-control studies (Porter et al., 2020), patients with a BPD diagnosis were over 13 times more likely to report ACE than nonclinical controls. Prospective studies on how abuse and neglect measured in childhood predict BPD in adults mainly point towards the same direction but show smaller effects (Porter et al., 2020; Stepp et al., 2016). While BPD appears to be consistently associated with all kinds of ACE, physical abuse seems to be differentially associated with antisocial PD, sexual abuse with paranoid, schizoid, and avoidant PD (Lobbstaël et al., 2010). At the same time, there is meta-analytic evidence that has accumulated on the comorbidity of PD with other mental illness such as mood and anxiety disorders (Tyrer & Mulder, 2022). In particular, a recent analysis of data of the US National Comorbidity Survey ($N = 9282$) using structural equation modeling revealed that BPD symptoms such as identity diffusion, emotion regulation, and interpersonal problems explain a large amount of variance of a general factor of psychopathology (Gluschkoff et al., 2021).

More recent research in which PF has been directly measured supports the central role of PF for understanding ACE and psychopathological symptoms. Generally, PF seems to be associated with well-studied transdiagnostic constructs such as interpersonal problems, insecure attachment styles, emotion regulation difficulties, pathological beliefs, and maladaptive schemas (Sharp & Wall, 2021; Zimmermann et al., 2019). In particular, there are numerous research findings indicating associations between PF and ACE on the one hand (Back et al., 2021) and psychopathological symptoms such as depression (Vittengl et al., 2023), anxiety disorders (Gruber et al., 2020), and somatization (Macina et al., 2021) on the other hand. Ringwald et al. (2021) therefore come to the conclusion that psychopathology cannot be studied separately from PF.

One consideration is that PF is not only correlated with ACE and current psychopathological symptoms but also moderates their association. According to contemporary developmental approaches to personality and psychopathology, PF may, in interaction with environmental factors, influence “the strength and direction of the association between biological factors and underlying (Research Domain Criteria [RDoc; Mittal & Wakschlag, 2017]) functional domains” (Altschuler & Krueger, 2021, p. 8). Further, self-concept, emotion regulation, and social interaction/attachment (central aspects of PF) were consistently found to be resilience factors that moderate the relationship between childhood adversity and mental health (Fritz et al., 2018). Against the background of a differential susceptibility model of personality–environment interaction in the developmental context (Kawamoto, 2020), PF may therefore be seen as a diathesis (i.e., vulnerability or resilience) for psychopathology, modulating the individual environmental influences on current mental health. Individuals with ACE can then be expected to have current psychopathological symptoms primarily when they also have impairments in PF. In the present study, we hypothesized a substantial moderating effect of PF between adverse childhood experiences and the three most prevalent mental disorders (depression, anxiety, and somatization). More specifically, based on the findings reviewed above, we hypothesized psychological abuse (emotional neglect and abuse) to show the strongest interaction effect between PF and depression, anxiety, and somatization. To this aim, we investigated manifest and latent interaction models based on assessments of PF according to DSM-5, Section III, ACE, and a well-established measure of depression, anxiety, and somatization in a large representative German sample.

METHODS

Study design and participants

Data from a representative sample of the German general population were collected in from February to April 2020 by a professional demographics research institute (USUMA, Berlin). The study was approved by the Ethics Committee of the University of Leipzig (reference number 002/20-ek). After providing informed consent, a total of 2522 interviews were conducted, accompanied by self-report questionnaire assessments, of which 2363 lead to complete data on the measures described below. Omission of cases without complete data was necessary because categorical indicators are not compatible with

TABLE 1 Sample characteristics.

Variable	<i>n</i>	%
Age (<i>M</i> ± <i>SD</i> ; in years)	49.3 ± 17.5	
Sex		
Female	1189	50.3
Male	1174	47.7
Partnership	1148	48.5
Education		
No school grad	81	3.4
Lower secondary school	655	27.8
Higher secondary school	1049	44.4
High school	333	14.1
College degree	243	10.3
Job status		
In training/education	153	6.5
Employed	1750	74.1
Self-employed	160	6.8
Unemployed	160	6.8
Retiree	582	24.6

full information maximum likelihood estimation and because analyses on the effects of specific ACE involved multiple group models that do not allow for missingness in the grouping variable. Sociodemographic characteristics of the study sample are provided in Table 1; prevalence and distribution of ACE in a previous survey of this sample are investigated in Witt et al. (2019).

Measures

Brief Symptom Inventory-18 (BSI-18)

The BSI-18 is a short self-report measure assessing depression, anxiety, and somatization in the past week, with each symptom scale comprising six items (Derogatis, 1993; German version: Spitzer et al., 2011). The 18 items are rated on a 5-point Likert scale ranging from 0 (*not at all*) to 4 (*extremely*) with higher scores indicating more psychopathology. The three syndromes' scores can be summarized into the Global Severity Index (GSI) reflecting the severity of general psychological distress. The BSI-18 is a widely used, reliable, and valid measure. In a representative sample from the German general population, the internal consistencies as indicated by Cronbach's α were high ranging between $\alpha = 0.82$ (somatization) and $\alpha = 0.93$ (GSI; Franke et al., 2017).

Adverse Childhood Experiences Questionnaire (ACE)

This well-established 10-item scale assesses exposure to early life adversities prior to 18 years of age using a yes/no answer format (Felitti et al., 1998; German version: Wingenfeld et al., 2011). Five questions ask about experiences with maltreatment including emotional, physical, and sexual abuse and neglect with the other five asking about household dysfunction, that is, domestic violence, parental separation or divorce, and the presence of a substance-abusing and/or mentally ill household member. Higher sum scores (0–10) indicate greater exposure to childhood adversities. The German version of the ACE was reported to be reliable and valid (Wingenfeld et al., 2011).

Level of Personality Functioning Scale—Brief Form 2.0 (LPFS-BF)

The LPFS-BF (Weekers et al., 2019; German version: Spitzer et al., 2021) is a brief self-report instrument capturing the degree of impairments in PF as defined in the DSM-5, Section III (APA, 2013), which largely corresponds to the definition of PD severity in ICD-11 (Bach & Simonsen, 2021). The 12 items correspond to the 12 subdomains of the LPFS. Respondents are asked to rate these items on a 4-point Likert scale from 1 (*completely untrue*) to 4 (*completely true*). The LPFS-BF items assess both self-functioning (i.e., sense of identity, regulation of impulses and affects, and self-reflection) and interpersonal functioning (i.e., ability to understand others' experiences and motivations, anticipate the effects of one's own behavior on others, and maintain relationships) to an equal extent. Its psychometric properties are satisfactory to good. For example, the internal consistency of the total (sum) score was high in both clinical and general population samples (Cronbach's $\alpha \geq 0.82$; Spitzer et al., 2021).

Statistical analysis

To investigate the interaction of PF and ACE in predicting depression, anxiety, somatization, and general severity (GSI), we estimated structural equation models (SEM) including latent variable interactions using Bayesian estimation. Modeling latent variable interactions in SEM constitutes a mathematically complex problem, for which multiple approaches evolved in the last 20 years (see, e.g., Brandt et al., 2020). These approaches differ with respect to their computational demands, are mostly not applicable to categorical data, and mostly do not provide

standardized estimates. Recently, Asparouhov and Muthén (2021) developed a latent interaction modeling algorithm using a Bayesian structural equation modeling (BSEM) approach which can handle categorical data and can generate standardized estimates. As the ACE were assessed with dichotomous items in our study, we applied this approach to model the latent interaction between PF and ACE on current symptoms with Mplus 8.6. Bayesian estimation uses Markov chain Monte Carlo (MCMC) algorithms to iteratively obtain an approximation to the posterior distributions of the parameters from which the averaged estimates are obtained. Such iterations are referred to as a chain. Convergence was ensured by inspecting the Potential Scale Reduction (PSR) values of model parameters. The PSR is the quotient of between- and within-chain variation with values close to 1 indicating convergence. We used the Mplus default of two chains, with the first half of the iterations considered as a “burn-in” phase (i.e., not being used to represent the posterior distribution). In order to prevent misinterpretations of our results, we investigated the validity of the model and by checking the posterior predictive distributions for every outcome using the model generated outcome values from the BSEM models.

In addition, we conducted sensitivity analyses by investigating the manifest interactions between ACE on psychopathology using interaction plots with 95% confidence bands and simple slope analysis (Bauer & Curran, 2005) for lower, middle, and upper tercile LPFS-BF sum scores. We also investigated if certain ACE have a stronger interaction effect with PF than others using multiple group models for each of the 10 ACE as group indicators (reported vs. not reported). Here, we first calculated differences on average LPFS-BF and BSI scores between participants that reported a specific ACE and participants that did not. Then, we investigated the differences between unrestricted multiple group models and models that had regression weights between PF and mental health symptoms restricted to be equal between the groups with and without reported ACE using χ^2 and Wald tests. The Wald test assesses constraints on statistical parameters based on the distance between the unrestricted and restricted estimates measured in standard errors. The larger the distance, the less likely the constraint is true (i.e., the less likely are the regression weights equal between the groups with and without reported ACE). We investigated separate multiple group models for depression, anxiety, somatization, and GSI, yielding bivariate regression models with one outcome (psychopathology) and one predictor (PF) and the standardized regression coefficient therefore equaling the correlation coefficient.

RESULTS

With $M = 17.6$ ($SD = 6.13$) and McDonalds $\omega = 0.91$ for LPFS-BF, $M = 1.7$ ($SD = 3.2$) and McDonalds $\omega = 0.88$ for the BSI depression subscale, $M = 1.4$ ($SD = 2.5$) and McDonalds $\omega = 0.85$ for the BSI anxiety subscale, $M = 1.4$ ($SD = 2.6$) and McDonalds $\omega = 0.83$ for the BSI somatization subscale, and $M = 1.1$ ($SD = 1.8$) and McDonalds $\omega = 0.80$ for the ACE sum score, measures showed descriptive statistics and reliabilities comparable with previously published studies.

With regard to the focal BSEM, the PSR factor decreased to <1.05 after 47,600 iterations, trace plots indicated convergence, posterior distribution histograms showed no abnormalities, and the autocorrelation of the MCMC chains were small, indicating satisfactory convergence and model fit (Depaoli & van de Schoot, 2017). The final model including standardized regression coefficients is presented in Figure 1. Both PF and ACE predicted current psychopathological symptoms, with the exception of the regression weight of PF on somatization being insignificant. The latent interaction effects between PF and ACE were highly significant for all outcomes, including depression (std. coefficient 0.66), anxiety (std. coefficient 0.71), somatization (std. coefficient 0.48), and global

severity (std. coefficient 0.60, calculated in a separate model, not depicted). The regression weight of PF on somatization was insignificant. Standardized estimates in structural equation modeling are obtained by setting the variances of dependent and independent variables to 1. To further assess the size of the interaction effect, we compared R^2 for all outcomes between BSEM models (see the Supporting Information for a full description of model parameters and output) with and without interaction between PF and ACE yielding the strongest effect for depression ($R^2 = 0.91$ vs. $R^2 = 0.42$, $\Delta R^2 = 0.49$), followed by anxiety ($R^2 = 0.89$ vs. $R^2 = 0.35$, $\Delta R^2 = 0.44$) and general psychopathology ($R^2 = 0.72$ vs. $R^2 = 0.40$, $\Delta R^2 = 0.32$), while somatization showed smaller interaction effects ($R^2 = 0.49$ vs. $R^2 = 0.23$, $\Delta R^2 = 0.26$). Investigating the posterior predictive distributions for all four outcomes indicated a good fit to the data.

This pattern of result was confirmed in our sensitivity analyses focusing on manifest interactions. Figure 2 depicts the expected regression lines between the number of reported adverse childhood experiences and current symptoms for varying degrees of PF impairment. Simple slope analysis revealed that the regression slopes between reported ACE and depression, anxiety, somatization, and general symptom severity differed significantly from zero

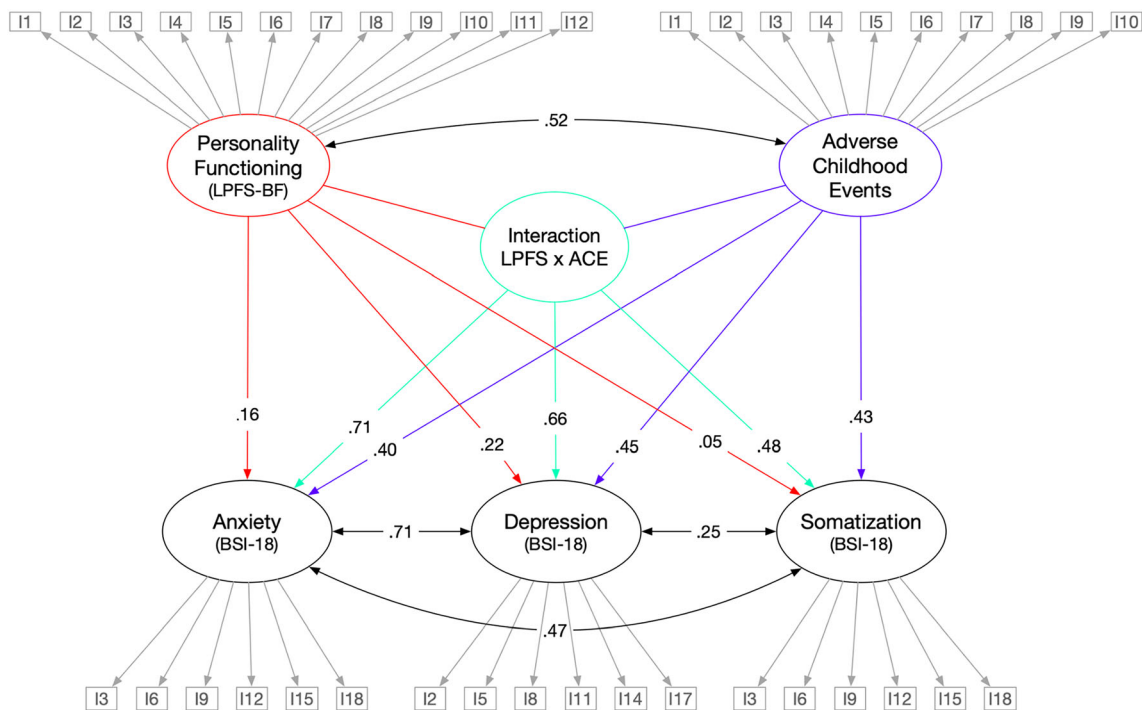


FIGURE 1 Effect of adverse childhood events, personality functioning and their interaction on depression, anxiety, and somatization symptoms using a Bayesian structural equation modeling (BSEM) approach on data of a population representative German sample. Double-sided arrows represent standardized covariances (correlations), one-sided arrows represent standardized estimates of the latent BSEM model according to Asparouhov and Muthén (2021). LPFS-BF, Level of Personality Functioning Scale—Brief Form; BSI, Brief Symptom Inventory. $N = 2363$.

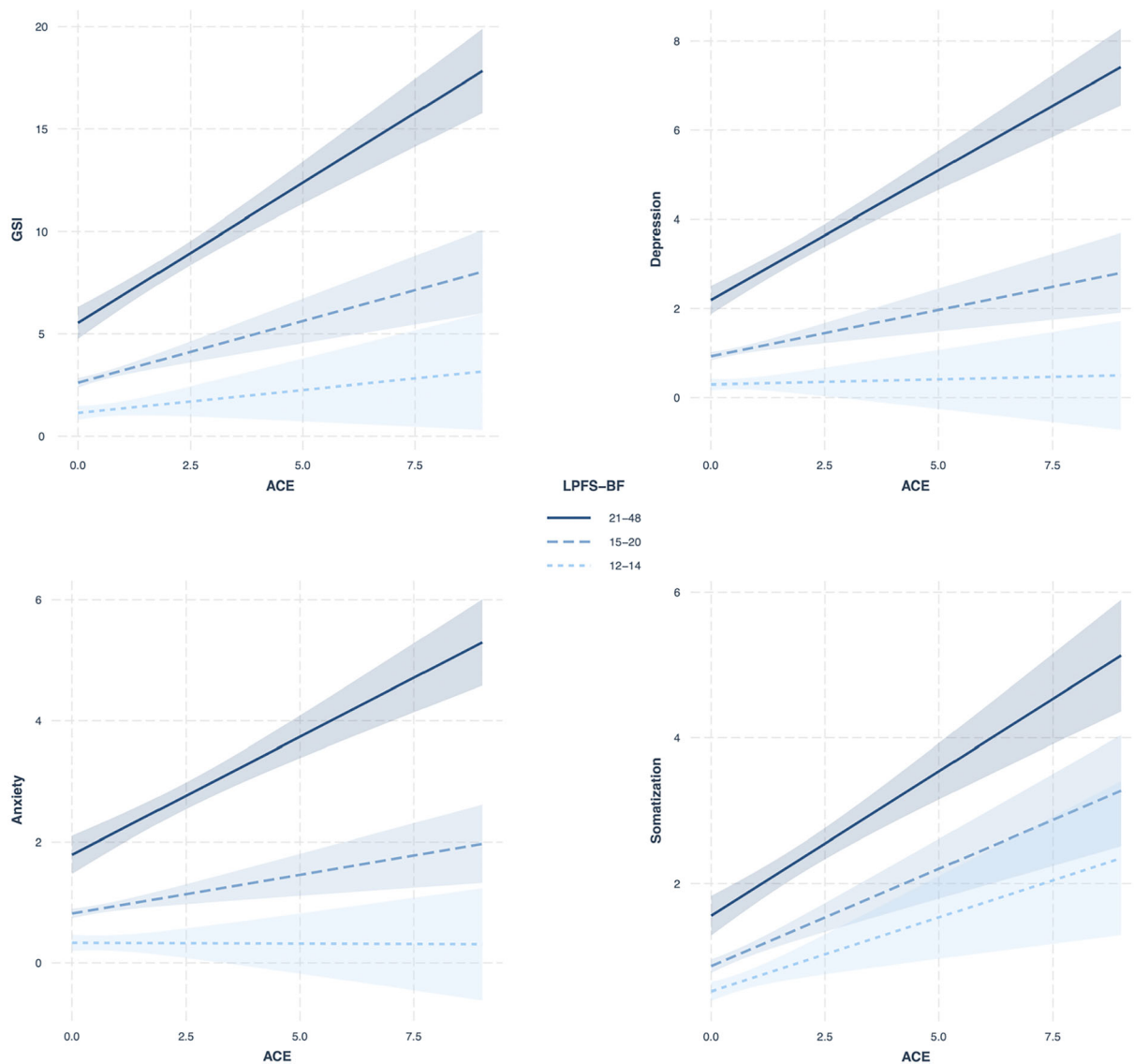


FIGURE 2 Associations between adverse childhood experiences and depression, anxiety, somatization, and global severity for lower, middle, and upper terciles of personality functioning impairment. LPFS-BF, Level of Personality Functioning Scale—Brief Form; ACE, Adverse Childhood Experiences Questionnaire; BSI, Brief Symptom Inventory; GSI, Global Severity Index. $N = 2363$.

in the middle (LPFS-BF score 15–20) and upper (LPFS-BF score 21–48) terciles of PF impairment, while slopes for depression, anxiety, and general severity were nonsignificant for participants with LPFS-BF sum scores in the lower tercile (between 12 and 14). The slope differences between the lower and the higher tercile of PF impairment were higher for global severity (Δ slope standardized [std.] = 0.28), depression (Δ slope std. = 0.31), and anxiety (Δ slope std. = 0.28) than for somatization (Δ slope std. = 0.13).

Table 2 depicts both differences in average PF, depression, anxiety, somatization, and GSI scores as well as differences in the correlation strength of PF and psychopathology between groups with and without reported specific ACE. The strongest group differences in

average PF levels were found for sexual abuse and physical neglect followed by emotional abuse and neglect, with average PF scores for the first two groups being in the clinical range (Spitzer et al., 2021). Interaction effects between PF and ACE, that is, differences in the regression weights between PF and psychopathology between groups defined by presence or absence of a specific ACE, seem to be strongest for emotional and physical abuse, followed by emotional neglect and domestic violence, sexual abuse, alcohol, and/or drug abuse and mental illness of caregivers, in that order. Divorce or separation as well as an incarcerated family member(s) showed no significant interaction effects with PF on symptoms, while the group differences in PF were still significant, albeit smaller. Compared with depression and anxiety, strength

TABLE 2 Results of multiple group regression models and group comparisons of PF impairment and psychopathology.

ACE Group Type	Group differences and separate multiple group regressions with PF as IV														
	Personality functioning			Depression			Anxiety			Somatization			BSI Total		
	Reported (N)	LPFS average	Group diff. [CI]	Group diff. [CI]	b std.	Wald	Group diff. [CI]	b std.	Wald	Group diff. [CI]	b std.	Wald	Group diff. [CI]	b std.	Wald
Emotional abuse	Yes (362)	22.4	$d = 0.89^{***}$ [0.77 1.01]	$d = 0.79^{***}$ [0.65 0.93]	0.61	47.3 ^{***}	$d = 0.69^{***}$ [0.55 0.83]	0.41	31.9 ^{***}	$d = 0.67^{***}$ [0.54 0.81]	0.41	11.8 [°]	$d = 0.81^{***}$ [0.67 0.95]	0.63	37 ^{***}
	No (2001)	16.8			0.45			0.27			0.27			0.44	
Physical abuse	Yes (250)	22.1	$d = 0.75^{***}$ [0.6 0.89]	$d = 0.77^{***}$ [0.6 0.94]	0.60	33.1 ^{***}	$d = 0.69^{***}$ [0.52 0.86]	0.44	18.1 ^{**}	$d = 0.71^{***}$ [0.55 0.88]	0.44	9.5 [°]	$d = 0.81^{***}$ [0.64 0.98]	0.63	24.5 ^{***}
	No (2113)	17.1			0.48			0.29			0.29			0.48	
Sexual abuse	Yes (94)	24.1	$d = 0.98^{***}$ [0.74 1.21]	$d = 1.02^{***}$ [0.74 1.3]	0.64	13.7 [*]	$d = 1.01^{***}$ [0.72 1.3]	0.44	9.2 [°]	$d = 0.82^{***}$ [0.54 1.1]	0.44	4.4 [°]	$d = 1.06^{***}$ [0.78 1.35]	0.62	11.2 [°]
	No (2269)	17.4			0.52			0.33			0.33			0.51	
Emotional neglect	Yes (349)	22.4	$d = 0.86^{***}$ [0.73 0.99]	$d = 0.81^{***}$ [0.67 0.96]	0.63	34.3 ^{***}	$d = 0.67^{***}$ [0.53 0.81]	0.58	17.3 ^{**}	$d = 0.64^{***}$ [0.5 0.77]	0.40	7.6 [°]	$d = 0.81^{***}$ [0.66 0.95]	0.61	23.8 ^{***}
	No (2014)	16.8			0.45			0.43			0.28			0.45	
Physical neglect	Yes (118)	24.0	$d = 1^{***}$ [0.79 1.21]	$d = 1.17^{***}$ [0.93 1.42]	0.54	5.7 [°]	$d = 0.88^{***}$ [0.64 1.12]	0.59	8.2 [°]	$d = 0.92^{***}$ [0.68 1.16]	0.35	1.6	$d = 1.12^{***}$ [0.87 1.37]	0.54	5.6 [°]
	No (2245)	17.3			0.52			0.48			0.33			0.51	
Divorce/separation	Yes (547)	19.8	$d = 0.44^{***}$ [0.34 0.54]	$d = 0.4^{***}$ [0.29 0.51]	0.54	2.9	$d = 0.32^{***}$ [0.22 0.42]	0.48	2.3	$d = 0.25^{***}$ [0.15 0.35]	0.37	0.7	$d = 0.37^{***}$ [0.27 0.47]	0.53	1
	No (1816)	17.0			0.54			0.56			0.32			0.54	
Domestic violence	Yes (168)	21.9	$d = 0.68^{***}$ [0.51 0.86]	$d = 0.7^{***}$ [0.5 0.9]	0.64	13 [*]	$d = 0.72^{***}$ [0.52 0.92]	0.63	15 ^{**}	$d = 0.69^{***}$ [0.49 0.88]	0.43	5.9 [°]	$d = 0.78^{***}$ [0.58 0.98]	0.63	14 [*]
	No (2195)	17.3			0.52			0.48			0.33			0.51	
Alcohol and/or drug abuse	Yes (363)	21.8	$d = 0.76^{***}$ [0.64 0.88]	$d = 0.65^{***}$ [0.51 0.78]	0.49	13.8 [*]	$d = 0.58^{***}$ [0.45 0.71]	0.47	6.6 [°]	$d = 0.55^{***}$ [0.42 0.67]	0.31	1.3	$d = 0.67^{***}$ [0.54 0.81]	0.48	8.4 [°]
	No (2000)	16.9			0.61			0.54			0.37			0.59	
Mental illness of caregiver(s)	Yes (216)	22.5	$d = 0.79^{***}$ [0.64 0.95]	$d = 0.67^{***}$ [0.5 0.85]	0.64	12.4 [*]	$d = 0.69^{***}$ [0.52 0.86]	0.62	8.2 [°]	$d = 0.54^{***}$ [0.37 0.7]	0.33	0	$d = 0.71^{***}$ [0.54 0.88]	0.61	6.3 [°]
	No (2147)	17.2			0.50			0.46			0.34			0.50	
Incarcerated family member	Yes (71)	22.2	$d = 0.64^{***}$ [0.36 0.92]	$d = 0.63^{***}$ [0.34 0.93]	0.57	0.5	$d = 0.75^{***}$ [0.47 1.04]	0.57	0.3	$d = 0.63^{***}$ [0.35 0.9]	0.24	1.4	$d = 0.75^{***}$ [0.46 1.04]	0.53	0
	No (2292)	17.5			0.55			0.51			0.36			0.54	

Note: Separate multiple group regression models for depression, anxiety, somatization, and BSI total scores predicted by level of personality functioning using manifest sum scores and robust standard errors. Wald test for significance of difference between the model with restricted and unrestricted regression weights between the groups.

Abbreviations: b std., standardized bivariate regression weight; CI, confidence interval; IV, independent variable; LPPFS, Level of Personality Functioning Scale—Brief Form.

*Bonferroni corrected $p < 0.05$.

**Bonferroni corrected $p < 0.01$.

***Bonferroni corrected $p < 0.001$.

[°]Uncorrected $p < 0.05$.

of correlation and interaction effects were generally smaller for somatization.

DISCUSSION

In this paper, we investigated the interaction between ACE, PF, and current psychopathological symptoms using BSEM, simple slope analyses, and multiple group regression models. BSEM models yielded substantial interaction effects of PF and ACE in predicting current symptom distress, with stronger interaction effects for depression and anxiety than for somatization, which could also be ascertained in the simple slope analysis. Further analyses revealed that physical abuse, domestic violence, emotional abuse, and neglect showed the strongest interaction effects with PF on psychopathology whereas physical neglect and sexual abuse seem to be more consistently associated with higher PF impairments and psychopathology while exhibiting less strong interaction effects.

This study comes with a number of limitations. In our focal BSEM, we conceptualized ACE as a unidimensional construct, which may mask the heterogeneity of effects of different ACE. To address this limitation, we estimated separate models to determine interaction effects of specific ACE with PF on current symptoms. However, a caveat here is that this approach does not examine whether these interaction effects are unique (when statistically controlling for the effects of other ACE), even if this may be difficult concerning the retrospective measurement in our study. Moreover, considering self-reported ACE, it is important to keep in mind that adults' retrospective self-reports of maltreatment and more objective measures of maltreatment during childhood (e.g., court records) of the same individuals often deviate substantially (Baldwin et al., 2019). This may be due to overreporting and underreporting on both ends. For example, regarding the present study, participants with more severe mental health problems and/or deficits in PF may have recalled more negative childhood memories or may have interpreted ambiguous childhood experiences as more negative, which in turn may have inflated the interaction effect between PF and ACE. As has been frequently claimed (Danese & Widom, 2020; Sahle et al., 2021), prospective data is needed to avoid bias and to better support causal inferences. However, adult psychopathology seems to be stronger related to retrospective self-reports of maltreatment than to more objective measures during childhood (Baldwin et al., 2019; Danese & Widom, 2020). Further limitations resulting from the cross-sectional and self-reported data concern issues of validity in assessing PF via self-report

(Zimmermann et al., 2019) and the problem of inflated correlations due to mono-method and mono-occasion data acquisition. However, previous studies could show that the measures used in our study show acceptable to good agreement to interview based assessments of PF (e.g., Zettl et al., 2019).

Despite these limitations, our study substantiates previous research on the etiological association of self, interpersonal, and emotion regulation capacities with childhood adversities and adult mental health (Dagnino et al., 2020; Freier et al., 2022; Krakau et al., 2021; McLaughlin & Lambert, 2017; Weissman et al., 2019) and extends it to the PF construct as defined in DSM-5, Section III and adopted in ICD-11. Further, previous studies often relied on mediation models, which may lead to biased estimates in cross-sectional data (Maxwell & Cole, 2007). Here, we used latent moderated SEM, which does not presuppose a specific causal order between the two predictors (i.e., between PF and ACE) and seems to yield more accurate estimates than moderation models based on manifest regression (Cheung & Lau, 2017). Further, our study uses a large and representative data-base and the detected interaction effects can be considered as substantial. Furthermore, the strong interaction effects between ACE and PF corroborate the hypothesis that PF may act as a diathesis such that individuals with PF impairments are more prone to mental health problems due to ACE, while individuals not exhibiting impairments in PF may be more resilient.

Our findings that reports of certain childhood adversities such as sexual abuse or physical neglect exhibit less interaction effects and are more consistently associated with PF impairments and psychopathology also suggest that there may be a limit to predispositional resilience. Viewed from this angle, our finding that certain reported ACE such as physical abuse, emotional abuse, and emotional neglect exhibit stronger interaction effects with PF may be due to that in these cases, factors such as a supportive caregiver in the wider family environment may have a higher buffering effect (McLaughlin & Lambert, 2017) on the development of psychopathology than for individuals reporting physical neglect or sexual abuse. This would also be in line with a recent study that found physical neglect and sexual abuse to be related most consistently to adult psychopathology among other ACE using a latent modeling approach (Dobson et al., 2021). A similar explanation may hold for the less strong interaction effects found for somatization disorder. The link between ACE and somatization may be less influenced by factors associated with resilience such as PF. Childhood adversity seems to set off a cascade of altered biological processes (e.g., dysregulation of the hypothalamic-pituitary axis, autonomic nervous system,

and immune system) which seem to constitute a driving part of psychosomatic disease patterns such as chronic pain or irritable bowel syndrome (Meade & Garvey, 2022). This biological cascade may be less influenceable by protective factors than the etiological processes that underlie the development of mood or anxiety disorders.

Another question concerns to which extent PF itself develops as a function of the interaction between biological and environmental influences. Recent findings on the strong interaction of genetic predispositions with early life complications (Ursini et al., 2018) leading to vulnerability for psychopathology in adulthood may therefore also hold for the development of stable self and interpersonal functioning abilities. This view would also be in line with theories on personality organization (Kernberg, 2004), object relations (Huprich et al., 2016; Peters et al., 2006), and mentalizing (Luyten et al., 2020), which inspired the development of the LPFS (Bender et al., 2011). A central assumption of these models is that an individual needs recurring positive and fostering interactional experiences with caregivers and/or the environment in early childhood in order to learn to handle the biologically predisposed temperament. These healthy interactional experiences then result, according to these theories, in the development of stable regulatory abilities of affects and impulses, a coherent self-perception, and the ability to maintain stable and healthy relationships. Importantly, “adverse (childhood) experiences, biological predisposition, or a combination of both may disrupt these virtuous cycles,” which in turn may lead to low resilience and vulnerability for psychopathology (Luyten et al., 2020). Research investigating this pathway to psychopathology is accumulating (Bach et al., 2021), and since recently, there is first longitudinal evidence for the interaction of temperamental features in early childhood and parental caring skills as a predictor of PF 14 years later (Fleck et al., 2021). Viewed from this angle, differences in PF impairment in individuals reporting ACE found in our study may be an indicator for predispositional vulnerability that only comes into effect in the interaction with unfavorable environmental influences such as ACE.

Our study has therefore both implications for prevention and intervention: If vulnerability for psychopathology evolves from an interaction between predisposition for PF impairments and (adverse) childhood experiences, individuals at risk should therefore be identified early and the corresponding family systems should be offered appropriate interventions. Taking into account recent findings on the low specificity when relying solely on

(questionnaire) assessments of ACE for identification of individuals at risk (Baldwin et al., 2021) together with the high predictive power of ACE assessed together with PF found in this study, (early) identification of individuals at risk should therefore rely on both assessments of ACE and PF. Reliable assessments for age-adjusted PF in youth and adolescents are already available (Goth et al., 2018). Clinicians treating patients with depression and/or anxiety should routinely assess impairments in PF along with ACE as our study results imply that individuals with both PF impairments and reported ACE are more prone to severe and enduring symptomatology. Applied this way, pretreatment PF scores may inform the necessity and centrality of process-based interactional experiences in the treatment of depression or anxiety disorders (Kerber et al., 2021) and could be used as a decision tool for “personalized medicine” (Bach & Simonsen, 2021).

CONCLUSION

Self-reported ACE seem to be more strongly associated with psychopathology when they are accompanied by impaired PF. Thus, our findings are in line with a diathesis–stress model suggesting that a low level of PF may represent a vulnerability for mental health problems while a high level of PF can be seen as a psychological resource or resilience that may buffer against the development of symptoms in the face of adversity. Consistent with the increasing evidence for the etiological centrality of PF for adult mental health, to which our study contributes, contemporary transdiagnostic psychological interventions increasingly target PF or PF-related constructs (Bach & Bernstein, 2018; Barlow et al., 2014; Sloan et al., 2017). Though changes in PF take time, they may lead to improvements in resilience and relapse prevention (e.g., Huber et al., 2017) by alleviating the association between ACE and adult mental health.

AUTHOR CONTRIBUTIONS

André Kerber, Elsa Gewehr, Johannes Zimmermann, Cedric Sachser, and Carsten Spitzer conceptualized the paper. André Kerber conducted the statistical analyses under supervision of Johannes Zimmermann and wrote the first draft of the manuscript with contributions of Elsa Gewehr, Cedric Sachser, and Carsten Spitzer. Elsa Gewehr, Johannes Zimmermann, Cedric Sachser, Carsten Spitzer, Jörg Fegert, and Christine Knaevelsrud then reviewed the manuscript; André Kerber revised it based on these reviews and created the final version for submission.

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CONFLICT OF INTEREST

No author of this study has competing interests to declare.

DATA AVAILABILITY STATEMENT

Researchers who provide a methodologically sound proposal can obtain deidentified individual participant data and analysis code that underlie the results reported in this article to achieve aims in the approved proposal beginning 3 months and ending 5 years following article publication. Proposals should be directed to andre.kerber@fu-berlin.de. To gain access, data requestors will need to sign a data access agreement.

ETHICS STATEMENT

The study was approved by the Ethics Committee of the University of Leipzig (reference number 002/20-ek).

ORCID

André Kerber  <https://orcid.org/0000-0002-8588-7784>

Johannes Zimmermann  <https://orcid.org/0000-0001-6975-2356>

Christine Knaevelsrud  <https://orcid.org/0000-0003-1342-7006>

Carsten Spitzer  <https://orcid.org/0000-0002-2711-285X>

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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