

## Research Article

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# On the complex and dimensional relationship of maternal posttraumatic stress disorder during early childhood and child outcomes at school-age

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**Abstract**

**Background.** Several studies have shown associations between maternal interpersonal violence-related posttraumatic stress disorder (PTSD), child mental health problems, and impaired socioemotional development. However, the existing literature lacks evidence linking constellations of risk factors such as maternal interpersonal-violence-related PTSD, psychopathology, and interactive behavior with toddlers and outcome measures at school-age.

**Methods.** This study involved a prospective, longitudinal investigation of 62 mothers and examined the relationship between maternal variables measured when children were in early childhood (mean age 27 months), and child outcomes when children were school-age (age mean = 83.2 months) while retaining a focus on the context of maternal PTSD. To identify and weigh associated dimensions comparatively, we employed sparse canonical correlation analysis (sCCA) aimed at associating dimensions of a dataset of 20 maternal variables in early childhood with that of more than 20 child outcome variables (i.e., child psychopathology, life-events, and socioemotional skills) at school-age.

**Results.** Phase 1 variables with the highest weights were those of maternal psychopathology: PTSD, depressive and dissociative symptoms, and self-report of parental stress. The highest weighted Phase 2 child outcome measures were those of child psychopathology: PTSD, anxiety, and depressive symptoms as well as peer bullying and victimization.

**Conclusions.** sCCA revealed that trauma-related concepts in mothers were significantly and reliably associated with child psychopathology and other indicators of risk for intergenerational transmission of violence and victimization. The results highlight the dimensional and multifaceted nature—both for mothers as well as children—of the intergenerational transmission of violence and associated psychopathology.

**Introduction**

Parenting is a complex task, with many challenges along the way that necessitate self-regulation of emotion and arousal to assist the child with his development of self-regulation, social communication, and to limit and redirect normative hostile aggression during this sensitive developmental period in early childhood (i.e., mutual regulation, [1]). This parental function relies in part on the ability to infer mental states in self and in one's child (i.e., mentalization, [2]). A multitude of factors, such as parents' psychopathology, a history of exposure to interpersonal violence (IPV), including child physical and/or sexual abuse, not to mention daily life stresses may interfere with a parent's capacity to participate in the mutual regulation of emotion and arousal. Outcomes for children of parents, whose psychological impairment and/or distress preclude(s) their effective participation in mutual regulation during this early period, can include various forms of behavioral difficulties and psychopathology, which in turn may interfere with learning and socialization, impaired development of social cognition, as well as altered mental representations of human relationships, both for themselves and their caregivers [3–5].

The link between posttraumatic stress disorder (PTSD) and commonly comorbid conditions has been thoroughly studied in recent decades. Approximately 80% of women and 90% of men

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with PTSD have at least one other psychiatric diagnosis, approximately half of them (44% of women and 59% of men) having three or more [6]. The most common forms of other psychopathology associated with PTSD are substance abuse and affective disorders (e.g., depression, dysthymia, [6, 7]). Parental PTSD has been shown to increase parenting stress and reduce maternal sensitivity (i.e., the capacity to understand and respond appropriately to the child's attachment signals, [8]). Additionally, PTSD in the context of increased childhood adversity (i.e., early abuse and violence exposure) is also associated with lower parental reflective functioning (PRF), i.e., as a measure of mentalization that is the parent's ability to infer the child's thoughts, feelings, and mental states [8]. PTSD resulting from childhood adversity associates also with symptoms of alexithymia (i.e., the difficulty in identifying and naming one's own and others' emotions, [9, 10]).

These relationships are complicated by the fact that many of these factors are associated with one another, such as the various forms of trauma-related psychopathology, as well as measures of alexithymia, socioeconomic status (SES), PRF, and maternal sensitivity [6, 11–14] which have multiple interrelations. The same is true for child outcomes: different factors show a complex pattern of univariate associations with each other. Different forms of child psychopathology are associated with each other [15], and can be linked to child mental representations of relationships [16, 17], social behaviors and aggression [18], and child temperament [19]. While examining each of these factors individually is undoubtedly useful, this complex pattern of relationships suggests that a multivariate dimensional approach may be necessary to capture and then interpret the overall data and to quantify the individual impact of different measures.

The aim of this study was therefore to investigate the prospective longitudinal associations of maternal measures when children were toddlers, with child outcomes when children were 5–9 years old. The sample consisted of approximately 2/3 mothers with a history of PTSD in the context of a history of childhood physical abuse, domestic violence exposure, and adult domestic and other violent victimization. Apart from violence-related measures, maternal measures also focused on mothers' capacity to interact with and understand their child. For children, we wanted to examine potentially less debilitating but generally applicable outcomes, such as emotional comprehension, children's representations of their parent(s) and relationship with their parent(s), as well as maternal report of child temperament, and bullying and victimization by bullies. Finally, we were also particularly interested in continuous measures of child psychopathology as marked by number of symptoms in a structured clinical interview of the child and parent. In order to incorporate such diverse outcomes, we used a multivariate analysis approach called sparse canonical correlation analysis (sCCA, see methods). sCCA investigates associations of entire datasets (as opposed to—for example—multiple regression analysis which investigates associations of multiple variables with only one outcome variable). In this case, we used it to associate maternal and demographic measures when children were 1–3.5 years old with a dataset of child outcomes when children were school-age (5–9 years old). Importantly sCCA allows for quantification of the importance of different variables in concert (i.e., variables of the same dataset are not necessarily weighed down because they explain overlapping variance as is the case in multiple regression). This was partially because while negative outcomes for children of mothers with pathology seem likely, how their weights affect different developmental stages (such as school-

age here) is largely unknown. A central reason for using sCCA was to allow a theory-agnostic statistical approach, which does not force a focus on a single relationship between the datasets but rather allows the algorithm to drive how the datasets are best associated.

We hypothesized that maternal psychopathology and the quality of maternal interactive behavior would be related to child psychopathological symptoms and maladaptive behaviors.

More specifically among these behaviors, we hypothesized that maternal IPV-PTSD affecting the mother–child relationship as manifested by decreased maternal sensitivity during formative development of emotion regulation at ages 1–3.5 years would predict child peer-directed bullying and being bullied at school-ages 5–9 years as possibly a further predictor of intergenerational risk for perpetration of IVP vs IVP victimization.

## Methods

### Study procedure and sample

We obtained approval from the Geneva University Hospitals' institutional ethics committee (14-271). The study was conducted in accordance with the Helsinki Declaration. Mothers gave informed consent for themselves and their children. The project is longitudinal in nature, wherefore this study refers to Phase 1, at which children (56% boys) were 1–3.5 years of age (mean = 27 months, standard deviation [SD] = 8.6), and Phase 2, at which children were 5–9 years old (mean = 84 months, SD = 12.9). This period is associated with the formation of self-regulation of emotion and the acquisition of rudimentary mentalization (i.e., reflective functioning) [20–22].

Mother–child dyads were excluded: (1) If mothers self-reported actively abusing substances, (2) suffered from a psychotic disorder, or (3) if mother or child were otherwise physically and/or mentally unable to participate in the tasks.

At Phase 2, participants were included when children were ages 5–9 years-old. After collecting informed consent, 64 mother–child dyads participated in Phase 2 of the Geneva Early Childhood Stress Study (76% retention). Two dyads were excluded due to more than 20% of data being missing. Among the remaining 62 dyads, 40 mothers had experienced significant PTSD symptoms during their lifetime (CAPS score  $> 40$ ; age mean = 39.3, SD = 5.8; 55% boys; children's age mean = 83.2 months, SD = 13.7). Twenty-two mothers had not (age mean = 40.5, SD = 5.3; 59% boys; children's age mean = 85.4 months, SD = 11.5, see Table 1). For more on recruitment, exclusion criteria and additional sample information, see [Supplementary Material](#).

### Data collection and measures

#### Phase 1

Twenty-one measures from Phase 1 were included in the analysis (see Table 2 for description of measures). Nineteen of them included data on maternal psychopathology (5 measures), experienced abuse during childhood (3 measures) as well as parental behaviors, skills and tendencies (11 measures).

Additionally, SES and child sex were included, using the Geneva Sociodemographic Questionnaire [23]. While these were not predictors of interest, this approach allowed us to quantify their impact on results compared to other measures rather than having to regress out their effect and thereby altering the data set. We wanted to avoid the latter, as these factors are known to be related to some of the other input or outcome measures.

**Table 1.** Sample characteristics and selected measures compared by group.

	Overall ( <i>n</i> = 62) Mean (SD)/ Percentage	PTSD ( <i>n</i> = 40) Mean (SD)/ Percentage	Non-PTSD ( <i>n</i> = 22) Mean (SD)/ Percentage	<i>p</i> -value for significance of difference (t-test or Mann-Whitney test)
<i>Phase 1 demographics</i>				
Maternal age (years)	35.1 (5.7)	34.5 (5.9)	35.6 (5.5)	0.51
Child age (months)	27.0 (8.6)	29.4 (8.4)	27.7 (8.4)	0.45
Socioeconomic status (high status = low value)	5.0 (1.9)	5.3 (1.8)	4.4 (1.9)	0.07
Child sex (% boys)	56%	55%	59%	0.76
<i>Phase 1 maternal measures</i>				
Lifetime PTSD score (CAPS)	60.0 (35.5)	82.6 (21.6)	18.8 (5.9)	<b>&lt;0.001</b>
Current PTSD score (PCL-S)	32.4 (14.8)	40.9 (11.3)	16.9 (2.0)	<b>&lt;0.001</b>
Depression symptoms	9.2 (7.7)	12.3 (10.5)	3.6 (3)	<b>&lt;0.001</b>
Psychological dissociation	14.8 (11.1)	19.1 (11.3)	6.8 (6.5)	<b>&lt;0.001</b>
Maternal sensitivity	5.2 (1.3)	4.7 (1.1)	6.0 (1.2)	<b>&lt;0.001</b>
Experience trauma during adulthood	31%	41%	13%	<b>0.03</b>
Physical abuse during childhood	53%	55%	50%	0.71
Sexual abuse during childhood	21%	27%	9%	0.09
<i>Phase 2 child measures</i>				
Maternal age (years)	39.7 (5.6)	39.3 (5.8)	40.5 (5.3)	0.41
Child age (months)	84.0 (12.9)	83.2 (13.7)	85.4 (11.5)	0.52
Bullying (perpetrator)	0.8 (1.0)	1.0 (1.0)	0.4 (0.9)	0.06
Bullying (victim)	4.3 (8.0)	5.1 (9.4)	2.8 (3.9)	0.32
PTSD symptoms	2.2 (3.1)	3.0 (3.7)	0.9 (1.3)	<b>0.01</b>
Anxiety disorder symptoms	3.5 (3.3)	4.1 (3.6)	2.6 (2.6)	0.10
Depression symptoms	1.5 (1.5)	1.6 (1.5)	1.4 (1.6)	0.50
Behavioral disorder symptoms	1.4 (1.9)	1.4 (1.8)	1.4 (2.0)	0.90
ADHD symptoms	1.1 (1.4)	1.3 (1.5)	0.7 (1.2)	0.09

Abbreviations: ADHD, attention-deficit/hyperactivity disorder; CAPS, clinician-administered PTSD scale; PCL-S, posttraumatic stress disorder checklist scale; PTSD, posttraumatic stress disorder; SD, standard deviation.

## Phase 2

Twenty-five measures were included (19 in Analysis 1), as shown in Table 3. These included number of child psychopathology symptoms (five measures), as well as measures of child exposure to criminal and traumatic events, bullying (two measures), emotion comprehension (three measures) and MacArthur Story Stem Battery (MSSB, [24]) assessed children's representations of their parents and their emotions (eight measures).

Furthermore, for Analysis 2, maternal report on internalizing and externalizing symptoms in children and four measures concerned with child temperament were added. All measures were validated and possess good to very good psychometrics (Tables 2 and 3).

## Data analysis

To incorporate the diverse outcomes and measures described above, we used (sparse) canonical correlation analysis (sCCA, [25, 26]), which allows for data-driven quantification of the importance of included variables and a better understanding of the inter-association of complex datasets in a dimensional way beyond what is possible with usual univariate approaches.

We then performed sCCAs to investigate the association of Phase 1 data on mothers (and potential confounders) with child-relevant data from Phase 2. Briefly, the sCCA algorithm assigns weights to each variable such that when multiplied with participant scores on those variables, a variate for each dataset is created, which represents this dataset. These variates are then correlated. Using an L1-norm penalty sCCA also allows to reduce the weights of variables to 0 with the goal to reduce the impact of potentially spurious associations. Within the given parameters, sCCA is designed to assign weights in such a way that the correlation of such variates is maximized. The weights of the variables could be interpreted as representing their importance to the model and usually indicate that the variable is associated with the variate of the other dataset. More specifically, a high weight for a variable of Phase 1 dataset indicates that the model assigns it high importance for predicting the selected outcomes of Phase 2 dataset (as represented in the variate of that data set). The P-value represents the fraction of the 10'000 permutations of the data that showed a higher correlation than the original data. For further information on how sCCA was applied here—including L1-norm—penalties, see the [Supplementary Material](#).

**Table 2.** Measures of maternal dataset including maternal variables during Phase 1 as well as selected potential confounders.

Measure	Description
Socioeconomic status	Socioeconomic status as measured by the Geneva Sociodemographic Questionnaire (GSQ) [23]
Sex of the child	Question part of the GSQ
Dissociation (Hopkins)	Dissociate Symptoms as measured by the Hopkins dissociative symptoms checklist [49], Cronbach's alpha: between 0.85 and 0.90 [49]
BPSAQ	Yes or no, did the participant experience traumatic events during adulthood. This was used along with the TLEQ [50]
BPSAQ PA	Yes or no, did the participant experience physical abuse during childhood. This was used along with the TLEQ [50]
BPSAQ SA	Yes or no, did the participant experience sexual abuse during childhood. This was used along with the TLEQ [50]
CAPS	Lifetime symptoms of interpersonal violence-related PTSD symptoms using the clinician-administered PTSD Scale [57, 58], Cronbach's alpha: 0.97 [58]
PCL-S	Symptoms of interpersonal violence-related PTSD symptoms in the last 6 months using the PTSD check-list short form [60], Cronbach's alpha: 0.94 [61]
Alexithymia: difficulty identifying feelings	Symptoms of alexithymia, subscale trouble with identification of feelings, as measured with the Toronto Alexithymia Scale (TAS-20; [62]). Cronbach's alpha: 0.81, test-retest reliability: 0.77 [63]
Alexithymia: difficulty describing feelings	Symptoms of alexithymia, subscale trouble with description of feelings, as measured with the TAS-20. Cronbach's alpha: 0.81, test-retest reliability: 0.77 [63]
Alexithymia: externally-oriented thinking	Symptoms of alexithymia, subscale externally oriented thinking, as measured with the TAS-20. Cronbach's alpha: 0.81, test-retest reliability: 0.77 [63]
PSI subscale Parent-Child Dysfunctional interaction	Subscale of the Parenting stress index short form [47]. Measures degree to which parent perceives child as not meeting expectations / rendering role of parent difficult. Subscale Cronbach's alpha: 0.79 [48]
PSI subscale Difficult Child	Subscale of the Parenting stress index short form [47]. Measures degree parent perceives child as difficult to manage. Subscale Cronbach's alpha: 0.79 [48]
PSI subscale Parental Distress	Subscale of the Parenting stress index short form [47]. Measures stress as a function directly related to parenting. Subscale Cronbach's alpha: 0.81 [48]
Child exposure to violence at Phase 1	Maternally reported questionnaire [51] on violence experienced or witnessed by the child, scored with importance of relationship with perpetrator and frequency included
Depression	Current symptoms of depression as measured with the Becks Depression Inventory [52]. Cronbach's alpha: 0.94 [53]
Narrative coding: Parental Reflective Functioning	Coding of the Working Model of the Child Interview, [54–56] Measures parents' capacity to recognize mental states in oneself and one's child and to appropriately relate them to each other's behavior
CARE-Index video coding: Maternal Sensitive behavior	Coding of mother-child interaction following Crittenden [59]. Measures maternal tendency to sense and react appropriately to child's needs. Intra-class correlation (ICC) for the CARE-Index general: $r = 0.925, p < 0.001$ . Coder agreement regarding the attachment-related classifications: $c2 = 24.167, p = 0.004$ ; $kappa = 0.841$
CARE-Index video coding: Maternal Controlling Behavior	Coding of mother-child interaction following Crittenden [59]. Measures maternal tendency to behave intrusively with the child. Intra-class correlation (ICC) for the CARE-Index general: $r = 0.925, p < 0.001$ . Coder agreement regarding the attachment-related classifications: $c2 = 24.167, p = 0.004$ ; $kappa = 0.841$
CARE-Index video coding: Maternal unresponsive behavior	Coding of mother-child interaction following Crittenden [59]. Measures maternal tendency to be avoidant or withdrawn in interactions with the child. Intra-class correlation (ICC) for the CARE-Index in general: $r = 0.925, p < 0.001$ . Coder agreement regarding the attachment-related classifications: $c2 = 24.167, p = 0.004$ ; $kappa = 0.841$
Parental drug/alcohol use disorder	Yes / No Has a parent of the child had a substance use disorder during the life of the child

Abbreviations: BPSAQ, brief physical and sexual abuse questionnaire; CAPS, clinician-administered PTSD scale; GSQ, Geneva sociodemographic questionnaire; PA, physical abuse; PCL-S, posttraumatic stress disorder checklist scale; PSI, parenting stress index; PTSD, posttraumatic stress disorder; SA, sexual abuse; TAS-20, Toronto Alexithymia scale.

Because maternal report of their children's psychopathology could potentially be affected by mothers' own biases linked to her psychopathology, personality, and interpersonal skills, we first performed an analysis in which maternal factors at Phase 1 were associated exclusively with child outcome measures that were self-reported by children or administered by clinicians. However, because parents often provide insights into their children's symptoms and behaviors that their children may not otherwise report

[27], we decided in a second step to include maternal reports of child symptoms, behaviors, and temperament.

Both sCCA analyses included Phase 1 dataset with 19 maternal psychopathology and behavior variables and 2 variables that were included to quantify potential confounders (see Table 2).

The first sCCA analysis (Analysis 1) included Phase 2 dataset with 19 child behavior and pathology measures, all of which were measured during experiments or reported by the child himself or a clinician (see

**Table 3.** Measures of child outcome dataset at Phase 2.

Measure	Description
ADHD symptoms	Number of ADHD symptoms Child symptoms originally reported by child and judged by clinician in accordance with DSM-V [64]
Behavioral disorders symptoms	Combined number of child symptoms originally reported by child and judged by clinician of oppositional defiant disorder and conduct disorders symptoms in accordance with DSM-V [64]
Depression symptoms	Number of depression symptoms Child symptoms originally reported by child and judged by clinician in accordance with DSM-V [64].
Anxiety disorders symptoms	Combined number of child symptoms originally reported by child and judged by clinician for generalized anxiety disorder and separation anxiety disorder in accordance with DSM-V [64].
PTSD symptoms	Number of child PTSD symptoms originally reported by child and judged by clinician in accordance with DSM-5 [64].
Bullying (perpetration)	Experiences of bullying, measured with the school life survey [66]
Bullying: victimization	Experiences of being the victim of bullying, measured with the school life survey [66]
Emotion comprehension: external emotions understanding	Test of emotion comprehension [69], subscale to measure understanding of facial emotions and external causes of emotion
Emotion comprehension: mental understanding	Test of emotion comprehension [69], subscale to measure understanding of belief-based emotions, and possibility of hidden emotions
Emotion comprehension: reflective capacities	Test of emotion comprehension [69], subscale to measure understanding of mixed emotions, emotion regulation, and self-reflection
VEX Total physical and nonphysical	Reported exposure to violence and criminal activity according to the clinician-administered Violent Experiences Scale (VEX-R) [72]. Cronbach's alpha (English version): between 0.72 and 0.86 [72]
MacArthur: avoidant strategies	Number of behaviors and strategies by child that keep a story from moving forward [65]
MacArthur: dissociative strategies	Number of dissociative behaviors by child during stories [73]
MacArthur: Negative Parent: ineffectual	Child represents parents as ineffectual to address story stem challenges [65]
MacArthur: Negative Parent: harsh	Child represents parents as harsh as they address story challenges [65]
MacArthur: Negative story endings	Number of stories that have emotionally negative endings [65]
MacArthur: Aggression overall sum	Overall sum of aggressions incorporated in stories [65]
MacArthur: Atypical negative	Percent stories with atypical, often bizarre, representation with negative connotation [65]
MacArthur: Danger	Sum of diverse danger situations child includes in stories [65]
CBCL internalizing <sup>a</sup>	Internalizing symptoms according to the child Behavior Checklist [67, 68]
CBCL: Externalizing symptoms <sup>a</sup>	Externalizing symptoms according to the Child Behavior Checklist.
School Life: temperament: negative reactivity <sup>a</sup>	Negative reactivity, i.e., strong reactions emotional/behavioral reactions to experiencing negative events as measured in the SATI [70]. Cronbach's alpha (English version) >0.89 [71]
School Life: Temperament: Task Persistence <sup>a</sup>	Task persistence, i.e., Failure to persist or self-direct with tasks and chores, as measured by the SATI. Cronbach's alpha (English version) >0.89 [71]
School Life: Temperament: approach/withdrawal <sup>a</sup>	Tendency to be shy, withdraw or not approach others as measured by SATI. Cronbach's alpha (English version) >0.84 [71]
School Life: Temperament: Activity <sup>a</sup>	High and potentially hyper or impulsive activity as measured by the SATI. Cronbach's alpha (English version) >0.80 [71]

Abbreviations: ADHD, attention deficit hyperactivity disorder; CBCL, Child Behavior Checklist; K-SADS, Schedule for Affective Disorders and Schizophrenia for School-aged Children; MSSB, MacArthur Story Stem Battery; PTSD, posttraumatic stress disorder; SATI, School-Age Temperament Inventory; VEX-R, Violence Exposure Scale—Revised.

<sup>a</sup>As reported by the mother, only part of Analysis 2, but not of Analysis 1 analysis.

Table 3). The second sCCA (Analysis 2) included six additional measures in Phase 2 dataset, which were maternally reported observations concerning the child (see Table 3). The reason we did not include these six variables in the first analysis was to be sure that results would not depend on potential maternal reporting biases in our analysis of the associations between Phase 1 and Phase 2 data.

### Reliability and power analysis

To assess whether our results were robust and reliable, we proceeded in five steps of reliability analyses: (1) leave-one-out

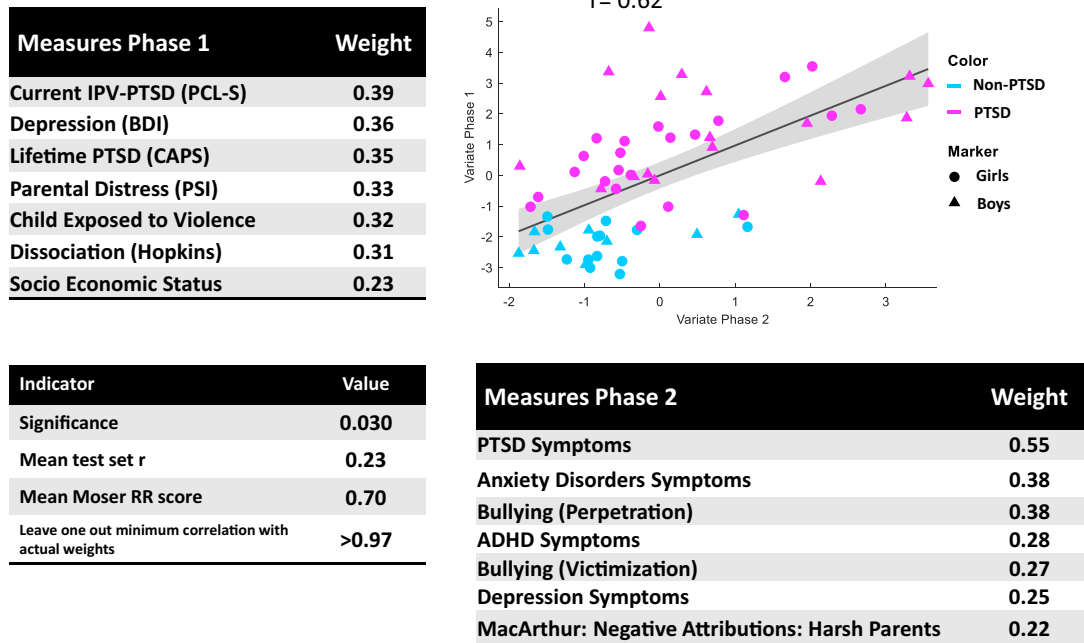
analysis, (2) Moser's RR-score [28], (3) a cross-validation, (4) repeating sCCA with regressing out age, and (5) repeating sCCA transforming each variable into ranks. In order to assess statistical power, we performed Monte Carlo-style power analysis (see Supplementary Material for details).

### Results

Groups did not differ on maternal or child-age at either time point; however, as expected, they did differ on PTSD symptom severity



## Results of sparse Canonical Correlation, Phase 2 using Child and Clinician reported Measures only



**Figure 1.** Results of the first sCCA analysis. Top left assigned weights (>0.2) of Mode 1 for Phase 1 variate, Top right scatter plot of mode 1, stratified by maternal PTSD status and child sex for illustrative purposes. Bottom left: significance and reliability measures, bottom right weights (>0.2) for Phase 2 variate. BDI, beck depression inventory; CBCL, child behavior checklist, IPV, interpersonal violence; PCL-S, posttraumatic stress disorder checklist scale, PSI, parenting stress index ; PTSD, posttraumatic stress disorder; TAS20, Toronto Alexithymia scale.

( $p < 0.001$  for both lifetime and current PTSD). See [Table 1](#) for characteristics and group differences of demographic and other selected measures.

The initial sCCA (Analysis 1, using Phase 1 maternal variables and Phase 2 child and clinician-reported variables) showed a significant first mode ( $r = 0.63$ ,  $p = 0.030$ ). For Analysis 1, the biggest contributions to the variate of Phase 1 came from current and lifetime PTSD symptoms (weight = 0.39 and 0.35, respectively), depression (weight = 0.35), report of parental distress on the PSI (weight = 0.33), as well as dissociation symptoms (weight = 0.31). Additionally, maternal report of the child being exposed to violence already at Phase 1 (weight = 0.33) also contributed with a weight above 0.2 to the variate of Phase 1. Additionally, SES also contributed with a weight of 0.23 (see [Figure 1](#) and [Table 4](#)). The number of child symptoms for PTSD (weight = 0.55), anxiety disorders (weight = 0.38), ADHD (weight = 0.28) and depression (weight = 0.25), as well as bullying perpetration (weight = 0.38) and victimization (weight = 0.27) contributed to the variate representing Phase 2. Child attributions of parents being harsh as rated via the MSSB also had a positive weight (0.22, see [Figure 1](#) and [Table 4](#)).

The sCCA of Analysis 2 (additionally using maternally reported child variables for Phase 2) was more significant ( $r = 0.69$ ,  $p = 0.003$ ) than Analysis 1. The weights defining the variate of Phase 1 were again led by psychopathology measures, with PTSD (lifetime weight = 0.36, current PTSD weight = 0.35), dissociation (weight = 0.34), and depression symptoms (weight = 0.32) contributing the most. Other variables contributing with a weight above 0.2 included all PSI subscales (weights = 0.30, 0.26, and 0.25, respectively), and the alexithymia subscale for identification

of feelings (weight = 0.22). Additionally, potential confounder variables of child sex (weight for girls = 0.24) and maternal report of child exposure to violence at Phase 1 (weight = 0.23) also contributed (see [Figure 2](#) and [Table 4](#)). The variate representing Phase 2 was contributed with weights >0.20 by the number of child symptoms for PTSD (weight = 0.41) and anxiety disorders (weight = 0.27), as well as bullying perpetration (weight = 0.27) and victimization (weight = 0.20). Several of the maternally reported variables added for Analysis 2 also had weights >0.20, including internalizing (weight = 0.35) and externalizing symptoms (weight = 0.22), as well as school life temperament measures for negative reactivity (weight = 0.39) and task persistence (weight = 0.32, see [Figure 2](#) and [Table 4](#)).

Reliability analysis indicated that mode 1 (but no other modes) of Analyses 1 and 2 was reliable (see [Supplementary Material](#)). We calculated that power was more than adequate to find an existing significant effect (see [Supplementary Material](#)).

## Discussion

We found a dimensional relationship between (1) a maternal dataset from when children were toddlers that reflects maternal lifetime experience of IPV and related psychopathology (i.e., PTSD, depression, and dissociation), parenting stress, and the quality of maternal interactive behavior (i.e., maternal sensitivity) and (2) a follow-up dataset with a focus on child outcome measures from when the same children were school-aged that reflects child symptoms, behaviors including peer-aggression (i.e., bullying) and victimization. This relationship between

**Table 4.** Weight contributions of the first modes of sparse canonical Analyses 1 and 2. (A) For Phase 1 maternal dataset; (B) for Phase 2 Child dataset.

Measure Phase 1	Weight Analysis 1	Weight Analysis 2
Current PTSD (PCLS)	0.39	0.35
Lifetime PTSD (CAPS)	0.35	0.36
Depression (BDI)	0.36	0.32
Dissociation (Hopkins)	0.31	0.34
Parenting stress index: parental distress	0.33	0.30
Child witness of violence	0.32	0.23
Alexithymia: difficulty identifying feeling	0.23	0.22
Parenting stress index: parent-child dysfunctional interaction	0.17	0.25
Socioeconomic status	0.18	0.13
Parenting stress index: difficult child	0.16	0.26
Controlling maternal behavior (Crittenden)	0.16	0.18
Childhood sexual abuse (BPSAQ)	0.14	0.17
Adult partner violence (BPSAQ)	0.11	0.16
Alexithymia: difficulty describing feelings	0.10	0.13
Parental reflective functioning	0.11	0.05
Parent is drug/alcohol abuser	0.08	0.06
Alexithymia: externally-oriented thinking	0.03	0.08
Unresponsive maternal behavior (Crittenden)	-0.04	-0.06
Childhood physical abuse (BPSAQ)	-0.12	0.00
Sensitive maternal behavior (Crittenden)	-0.13	-0.09
Sex child (higher = more boys)	-0.14	-0.24
Measure Phase 2	Weight Analysis 1	Weight Analysis 2
PTSD symptoms	0.55	0.41
School life: temperament: negative reactivity		0.39
Internalizing symptoms (CBCL)		0.35
Anxiety disorders symptoms	0.38	0.27
Bullying: perpetration	0.38	0.27
School life: temperament: task persistence		0.32
ADHD symptoms	0.28	0.19
Bullying: victimization	0.27	0.20
Externalizing symptoms (CBCL)		0.22
Depression symptoms	0.25	0.19
MacArthur: negative parent representation—harsh	0.22	0.16
Emotion comprehension: mental understanding	0.11	0.09
School life: temperament: approach/withdrawal		0.08
School life: temperament: activity		0.05
MacArthur: dissociative strategies	0.01	0.00
Behavioral disorders symptoms	0.02	-0.02
MacArthur: aggression	0.00	-0.01
MacArthur: atypical negative behaviors	0.00	-0.02
Report of physical and nonphysical exposure to violence and crime (VEX)	-0.04	-0.05
Emotion comprehension: reflective capacities	-0.11	-0.05
Emotion comprehension: external emotions understanding	-0.12	-0.10
MacArthur: avoidance	-0.15	-0.12

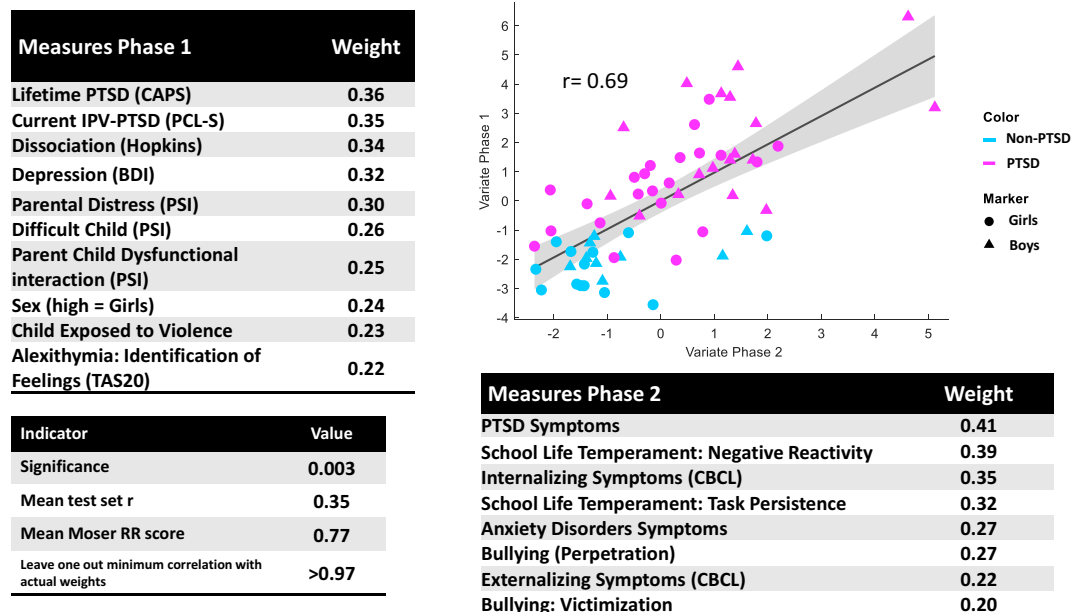
Table 4. Continued

Measure Phase 2	Weight Analysis 1	Weight Analysis 2
MacArthur: negative endings	-0.15	-0.15
MacArthur: danger	-0.16	-0.15
MacArthur: negative: parents ineffectual	-0.19	-0.16

Note: Table 4 weights of sCCA analyses. Analysis 1 includes only child measures given by clinician, experiment, or children themselves, while Analysis 2 also includes maternally reported child measures as outcomes.

Abbreviations: ADHD, attention-deficit hyperactivity disorder; CBCL, child behavior checklist; MSSB, MacArthur story stem battery; PTSD, posttraumatic stress disorder; VEX, violence exposure scale—revised.

### Results of sparse Canonical Correlation, Phase 2 using Child, Clinician and Maternal reported Measures



**Figure 2.** Results of the second sCCA analysis. Top left assigned weights (>0.2) of Mode 1 for Phase 1 variate, Top right scatter plot of mode 1 stratified by maternal PTSD status and child sex for illustrative purposes. Bottom left: significance and reliability measures, bottom right weights (>0.2) for Phase 2 variate. BDI, beck depression inventory; CBCL, child behavior checklist; PCL-S, posttraumatic stress disorder checklist scale; PSI, parenting stress index; PTSD, posttraumatic stress disorder; IPV, interpersonal violence; TAS20, Toronto Alexithymia scale.

maternal data and subsequent child outcomes was multivariate and dimensional in nature concerning both maternal predictors and child outcomes.

PTSD and comorbid psychopathology most strongly influenced the model among both maternal and child measures. However, among maternal predictors of child outcome, maternal psychopathology was accompanied by other measures related to stress, alexithymia, and atypical behavior, some of which reached almost the same weight. For the subsequent child dataset, it is important to note that the child's PTSD-like symptoms were most influential again, accompanied by other psychopathology symptoms (i.e., ADHD, depression, and anxiety). However, other variables were also important. The fact that bullying and being bullied, carried notable weight, underscores the long-term effects of the family environment on children's social interaction and how their behavior can in turn affect their peer-interactions and therefore affect society from a broader perspective.

These latter results support our hypothesis that, during early childhood, maternal PTSD symptom severity along with decreased maternal sensitivity with which PTSD severity is also associated [8, 10], and predict increased peer-aggression and -victimization at

school-age. This finding to our knowledge is a novel finding that contributes to our understanding of the influence of maternal IVP-PTSD as it can affect caregiving during the early sensitive period for the development of emotion regulation, on child school-age outcomes and subsequent risk. Further research is needed to explore this potential marker of intergenerational transmission of IVP and related psychopathology and to determine which individual child characteristics would render a child more likely at risk to perpetrate IVP vs be victimized.

An additional, novel, and surprising finding was that maternal PTSD severity during early childhood predicted school-age child attributions of parents as being harsh on the story-stem completion task (MSSB). To the best of our knowledge, no previously published study has studied this aspect of child mental representation or perception of parents during childhood. One published study of adults using retrospective measures had reported the association of offspring representations of parents as harsh and dysfunctional during childhood with family violence and maltreatment and subsequent disturbance in emotion regulation [29]. This finding indicates that during clinical examination of children via observation of play narrative, harsh representations of parental figures might lead



the clinician to inquire as to intergenerational IPV and associated psychopathology (i.e., IVP-PTSD).

Initial analyses were performed without including maternally reported measures of child psychopathology and temperament to ensure that associations transcended maternal response biases or an otherwise distorted vision of her child (for further discussion on differences between Models 1 and 2, see [Supplementary Material](#)). Our findings echo and extend those of several prior studies on parental psychopathology and child outcomes [8, 30–33]. Our findings are also in line with another study on maternal intimate partner violence and child experience [34]. That study was more focused on PTSD symptoms, considering direct physical abuse alone. This latter study did not examine comorbidities and other explicative factors; yet, similar to this study, it reported that both mothers' experience of domestic violence, together with mothers' related PTSD, and those mothers' children's history of physical abuse and/or exposure to domestic violence were important predictors of all subscales of the children's PTSD, when they were between 8 and 17 years of age.

The dimensional nature and breadth of measures studied here—both those pertaining to maternal factors and child outcomes—underscore the complexity of factors to be considered when mothers have a history of violence and abuse. Early intervention targeting mother–child interactive behavior as well as maternal psychopathology, and thus several factors simultaneously, may therefore have long-term benefits for many at-risk individuals, given the prevalence of IPV and related psychopathology [35, 36]. Moreover, the large number of child outcomes reflects the complexity and multidimensional (as opposed to a univariate categorical yes or no) nature, of the consequences of growing up during a sensitive period for the development of emotion regulation, in an environment with maternal IPV-related PTSD.

The complexity identified in this study supports and extends preexisting literature on parental PTSD and its potential effects on caregiving. PTSD is indeed associated with several comorbid psychiatric disorders, such as major depressive disorder, which can also affect parenting skills [3]. PTSD and comorbid depressive and dissociative symptoms, and their combined consequences on parenting skills can have an influence on a variety of child outcome measures and put children at greater risk for psychopathology, deficient socioemotional skills, and propensity for aggressive behavior, such as bullying as well as victimization [4, 5].

Given the complexity and number of involved factors, this study highlights important challenges that clinicians face when attempting to prevent the intergenerational transmission of IPV and related psychopathology. It is not only maternal psychopathology, such as PTSD that affects child outcomes, but also the co-occurring problems that often accompany PTSD, generally increased parenting stress [37] and decreased parental sensitive responsiveness in parent–child interactions [8, 10]. Simply treating maternal PTSD symptoms can be an important start, yet such individual treatment is unlikely to be sufficient to address all accompanying problems in the parent–child relationship, such as low PRF as a marker of the quality of the parent's attachment (i.e., attachment security and organization, 2, [38–40]), as well as proneness to additional traumatization in the context of low SES [41–44] and a tendency to misappraise interpersonal cues that would alert a mother to a risk for violence in a new romantic relationship according to a nested study of a subset of the same mothers that participated in this larger study [45, 46]. The consequences of the combination of co-occurring risk factors for young children encompass a range of factors themselves. These include different kinds of

psychopathology and behavioral difficulties, among which are increased likelihood of the perpetration of aggression and victimization. It is thus important to keep an open mind in family situations with histories of IPV and to monitor different kinds of symptoms and potentially ensuing difficulties for the children of parents with IPV-PTSD.

Limitations of this study are, however, those of the sample and the chosen measures. The focus of the sample on dyads in which the majority of mothers had experienced PTSD symptoms and childhood exposure to IPV permitted a good understanding of the intergenerational consequences of IPV. However, this focus on an important but very specific clinical population may make generalization to the larger population more difficult. While the extensive reliability and power analysis conducted for this study indicate the findings as reliable (see [Supplementary Material](#)), it is possible that with more statistical power, a secondary sCCA mode focusing more on externalizing and aggression symptoms could have become significant and reliable. Further, while we believe that the chosen measures make sense within these datasets, they are by no means the only ones that might relate to the intergenerational cycle of violence, and future studies may want to widen the scope even further.

In conclusion, this is the first study to our knowledge to report prospective, longitudinal findings of a sample of children of mothers who suffered from IVP-PTSD during early childhood and who were later studied using a range of different measures—both observed, child-reported, and maternal reported at school-age. Our study shows the complex dimensionality with which a multitude of factors around IPV-related PTSD affect mother–child dyads prospectively and longitudinally. We argue that this points to the importance of understanding the transgenerational transmission of violence-related psychopathology as a multifactor phenomenon, both in origin and outcome, that is best described dimensionally rather than categorically (such as the presence of disorder yes/no). Children's social–emotional skills, not just symptoms, are reflected in the outcome measures selected, thereby providing an opportunity to observe distortions in children's understanding of relational meanings emerging in middle childhood. A particularly novel finding of this study involves the demonstration that maternal severity of PTSD and the quality (i.e., sensitivity) of related mother–child interactive behavior during early childhood, predicts peer-aggression (i.e. bullying) and -victimization at school-age. The results, in sum, imply the importance of focusing on traumatized parents' behavioral response to their young children's distress during the clinical intervention. This plus attention to the inner worlds of parents and children—the latter, which the study characterized via the MacArthur Story Stem Battery as an observed behavioral and narrative measure, are propitious targets for restoring a healthier social–emotional developmental trajectory by school-age.

## Abbreviations

ADHD	attention-deficit/hyperactivity disorder
BDI	beck depression inventory
CBCL	child behavior checklist
CAPS	clinician-administered PTSD
IPV	interpersonal violence
MSSB	MacArthur story stem battery
PCL-S	posttraumatic stress disorder checklist scale
PRF	parental reflective functioning

PSI	parenting stress index
PTSD	posttraumatic stress disorder
sCCA	sparse canonical correlation analysis
SES	socioeconomic status
TAS20	Toronto Alexithymia scale

**Supplementary Materials.** To view supplementary material for this article, please visit <http://doi.org/10.1192/j.eurpsy.2023.8>.

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**Conflicts of Interest.** The authors declare none.

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