**Doctoral thesis submitted to
the Faculty of Behavioural and Cultural Studies
Heidelberg University
in partial fulfillment of the requirements of the degree of
Doctor of Philosophy (Dr. phil.)
in Psychology**

Title of the publication-based thesis:

"Transgenerational Transmission of Childhood Adversity: Examining potential pathways to break the cycle of risk across generations"

Presented by:
Dipl. Psych. Anna Fuchs

Year of submission
2016:

Dean: Prof. Dr. Birgit Spinath
Advisor: PD Dr. Michael Kaess

Abstract

Child maltreatment is a widespread global phenomenon affecting the lives of millions of children all over the world. As these children grow up to be parents, they are at a higher risk of completing the so-called "cycle of abuse" and become perpetrators themselves. Only very recently, however, the spotlight has been moved from a limited focus on the intergenerational transmission of actual maltreatment on to further maladaptive outcomes in offspring of victims of child maltreatment. Hence, the number of studies investigating the subject is small, and core questions still remain unanswered. In addition, there is a lack of top-down theories enabling researchers to integrate evidence into a broader framework.

Therefore, the aim of this work is to extend theoretical and empirical knowledge on transgenerational sequelae of maternal child abuse and neglect by 1) contributing an overarching model of transgenerational transmission of risk and 2) broaden the empirical data base by reporting results of four studies.

Study 1 investigates the impact of a maternal history of childhood abuse (HoA) on mother-child interaction in a longitudinal case-control design. Results indicate that the period of developing child locomotion represents a critical time window for mothers with a HoA as they show less optimal mother-child interactional quality compared to a healthy control group during that phase. **Study 2** examines mother-child interaction in mothers with depression in remission, mothers with a HoA, mothers with both depression in remission and a HoA, and comparison group mothers. Results reveal that depression affects maternal emotional availability even during remission. Furthermore, mothers with depression in remission and additional severe childhood abuse seem to be particularly affected. **Study 3** investigates mother-child adrenocortical attunement in a community sample of mothers with a HoA and their five-months-old infants, matched with a healthy comparison group. Results confirm an association between maternal and infant salivary cortisol levels for the complete sample. However, in the comparison group, cortisol attunement was only significant in mother-daughter dyads, whereas in the maltreatment group, cortisol levels were associated only in mother–son dyads. Lastly, **Study 4** examines whether children of the sample described in study 2 differ in inhibitory performance while taking into account their mothers reported impulsivity. There are no group differences in children's inhibitory performance, however, maternal impulsivity moderates the association between group membership and child inhibition. Children whose mothers report a history of childhood abuse and high levels of impulsivity show lower levels of inhibition than children whose mothers report a HoA and low levels of impulsivity.

Content

**Liste der wissenschaftlichen Veröffentlichungen
zur publikationsbasierten Dissertation**

I. Schrift

Fuchs, Anna; Möhler, Eva [Autor 1 & Autor 2] (2015). Impact of a maternal history of childhood abuse on the development of mother–infant interaction during the first year of life. *Child abuse & neglect, 48,* 179-189.

II. Schrift

Boedeker, Katja; Fuchs, Anna [Autor 2 & Autor 3] (2015). Emotional Availability in mother-child-interaction: The effects of maternal depression in remission and additional history of childhood abuse. *Depression and anxiety, 00,* 1-10.

III. Schrift

Fuchs, Anna; Möhler, Eva [Autor 1 & Autor 2] (2016). Sex-specific differences in adrenocortical attunement in mothers with a history of childhood abuse and their 5-month-old boys and girls. *Journal of Neural Transmission, 00*, 1-10.

IV. Schrift

Fuchs, Anna; Führer, Daniel [Geteilte Erstautorenschaft] (2016). Transgenerationale Einflussfaktoren kindlicher Inhibitionskontrolle: Mütterliche Trauma-Erfahrung, Depression und Impulsivität (2016). *Praxis der Kinderpsychologie & Kinderpsychiatrie 65*, 423 – 440.

List of figures

1. Introduction

Child maltreatment appears to be a widespread global phenomenon affecting the lives of millions of children all over the world (Stoltenborgh, Bakermans-Kranenburg, Alink, & IJzendoorn, 2015). A recent review combining results of 244 publications reported estimated global rates in studies using self-report measures and assessing maltreatment ever during childhood to be 12.7% for sexual abuse, 22.6% for physical abuse, 36.3% for emotional abuse, 16.3% for physical neglect and 18.4% for emotional neglect world-wide (Stoltenborgh et al. 2015). Consequently, addressing sequelae of this "major public health problem" (Norman et al., 2012; p.2) should be of high priority.

From an evolutionary perspective, it is commonly assumed to be adaptive for individuals to impart their acquired skills and experiences to their offspring. Consequently, it seems self-evident that humans could pass on their experiences to future generations, and that children would be molded by experiences of their parents (Kellermann, 2013). However, up until now, research has been challenged by highlighting those transgenerational transmission processes. Since the 1970s, initiated by a growing interest in the etiology of child maltreatment, transgenerational mechanisms have been the subject of developmental research. Early researchers reported "an unbroken line in the repetition of parental abuse" (Steele, 1976, p. 15; cited in Belsky, 1993), suggesting an exceedingly high rate of continuity in negative parenting across generations (Phelps, Belsky, & Crnic, 1998). Today, studies on transmission rates in this "cycle of abuse" show great variation given a range in rates between lower than 10% (e.g. Dixon, Browne, & Hamilton-Giachritsis, 2005) and approx. 70% (Berlin, Appleyard, & Dodge, 2011; Byron Egeland, Jacobvitz, & Sroufe, 1988; Kaufman & Zigler, 1987). Inconsistent findings regarding the "cycle of abuse"-hypothesis could reflect differences in definitions of abuse as well as research designs and methods used (Berlin et al., 2011; Bert, Guner, & Lanzi, 2009; Langeland & Dijkstra, 1995). In sum, existing evidence fails to identify the suggested "unbroken line" between one's own adverse childhood experiences and abusive acts towards own children (Cathy Spatz Widom, Czaja, & DuMont, 2015). An estimated transmission rate of 30% (Begle, Dumas, & Hanson, 2010; Bert et al., 2009; Kaufman & Zigler, 1987) indicates both continuity and discontinuity in intrafamilial transmission of adverse parenting (Belsky, 1993; Phelps et al., 1998).

So far, however, the majority of research efforts has? been limited to the investigation of transgenerational transmission of physical and sexual child abuse. Despite the fact that there is a vast body of literature on this area of research, many studies show methodological weaknesses making it difficult to interpret and generalize findings. In addition, only very recently the spotlight has been moved from a limited focus on the intergenerational

transmission of actual maltreatment on to further maladaptive outcomes in offspring of child abuse victims, leading to yet a very limited database. But not only is the number of studies sparse, there is also no up to date overarching model or theory to describe potential effects. Hence, there is a lack of top-down theories enabling researchers to integrate evidence into a broader framework. Despite decades of research, core questions remain unanswered: In what way do maternal childhood experiences of abuse and neglect affect their children? Which mechanisms take place, which pathways are of significance? Considering a higher risk status of mothers having experienced childhood abuse, which factors might support them and help breaking malign cycles? Research findings on pathways, outcomes, risk and buffering factors should build a foundation through which identification of children at risk is made possible and effective prevention and intervention programs can be installed.

Within the scope of this work, the aim is to overcome some of the limitations of previous research by extending theoretical and empirical knowledge on transgenerational implications of maternal child abuse and neglect. Firstly, an overview of pioneering models in the field will be given and an overarching model of transgenerational transmission will be introduced in the following, including an embedded review of the current stand of research (Chapter 2). Secondly, following an overview of limitations of current literature in the field of transmission research, contributions of this work will be outlined (Chapter 3 and 4). The last two Chapters (5 and 6) include a discussion of findings and clinical implications.

2. Proposing a model for transgenerational transmission of risk and maladaptive child functioning

"All models are wrong, but some models are useful" (Box, 1976)

Investigation of potential transgenerational repercussions of maternal childhood abuse and neglect is marked by high complexity, and could be simplified by a theoretical framework including mediating and moderating factors as well as child outcomes. However, current research in this area is rarely guided by an up-to-date overarching model or theory (Bosquet Enlow, Englund, & Egeland, 2016). So far, contributions of Belsky (1984, 1993), (A. Sameroff, 1975) and Cicchetti & Lynch (1993), who established "process" (Belsky) or "transactional" (Sameroff, Chicchetti and Lynch) models, have been giving scientific orientation by helping to understand and define transgenerational transmission mechanisms. Due to the contribution of these authors, child outcome in the context of a maternal history of childhood abuse (HoA) is now widely recognized to be multiply determined by a variety of factors influencing each other. Especially Belsky's seminal work (Belsky, 1993), initially developed to outline determinants of parental functioning, has been a source of orientation. He is drawing attention to three general sources directly influencing parenting behavior and thereby child outcome: (1) the parents' ontogenic origins and personal psychological resources, (2) the child's characteristics of individuality and (3) contextual sources of stress and support (see fig. I).
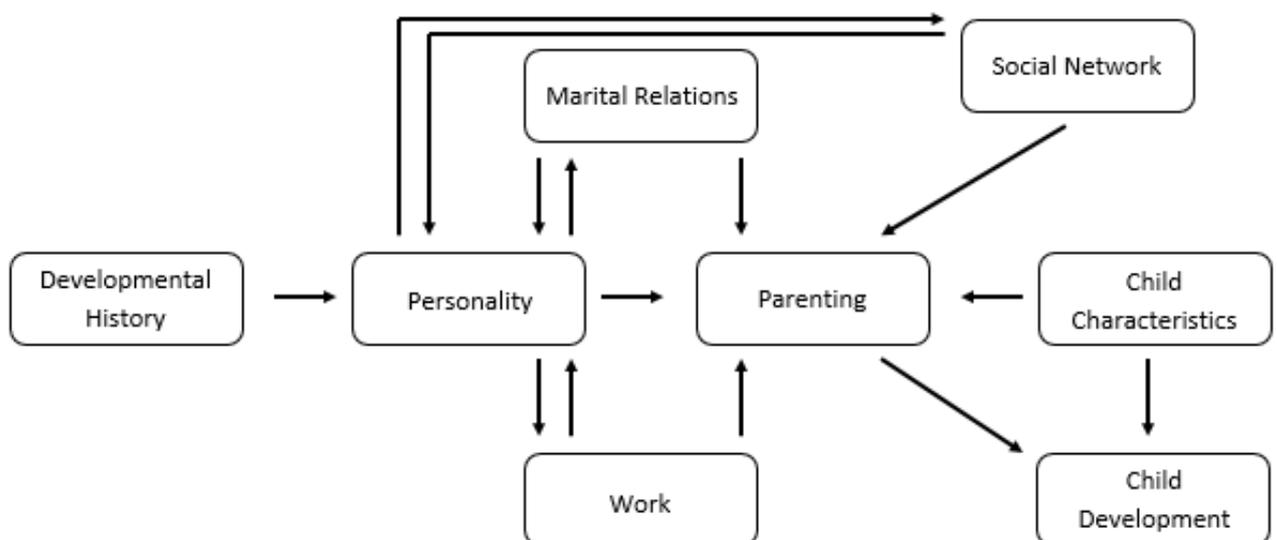

Figure I: A process model of the determinants of parenting (Belsky, 1984, p. 84)

As for maternal variables, Belsky (1984; 1993) includes maternal developmental history (e.g. history of childhood maltreatment, attachment style), mental health (e.g. maternal depression) and personality (e.g. maturity, openness, internal locus of control, active coping style). As child contributions, he considers e.g. child age, physical health, and temperament. The third factor, namely the broader social context in which the parent-child relationship is embedded, is defined by community and social support such as peer networks and involvement in communities, by the societal-cultural context such as the society's attitude towards violence and corporal punishment, and, lastly, by the evolutionary context in terms of reproductive interest and adaptiveness (Belsky, 1984; 1993). In his work, Belsky criticizes that mostly, research had been focusing on individual contributions, ignoring the interactivity of behavior of one shaping the behavior of the other (Belsky, 1993). This aspect of interaction is echoed and elaborated further by Sameroff (1975), who proposes a transactional model, emphasizing child development being a product of the continuous dynamic interactions of the child and the experience provided by his or her family and social context (Sameroff & Mackenzie, 2003). Sameroff appeals to move beyond the linear nature vs. nurture debate, and starts examining the more complex interplay between dynamic systems (Sameroff, 2009). Consequently, research on well-being in children and adolescents should not only include child inherent factors, but also the potential impact of parental factors and reciprocal influences (Sameroff & Mackenzie, 2003). His call for certain statistical approaches such as moderating analysis and longitudinal investigations continues to be highly relevant for current developmental research practice.

In addition to these models focusing on multiple determinants of parenting and child outcome, on transactional processes and connectedness, a recent approach has put the spotlight on biological underpinnings of the formation of human affiliative bonds (Feldman, 2012b). Feldman's bio-behavioral approach is based on three main assumptions: first, she emphasizes how micro-level behaviors and physiology of caregiver and child organize to form a dyadic-specific bond (Ethology). Coordination between parent and child social behavior, parent and child ongoing physiology, and physiology of one and behavior of the other "charts the four-channel matrix of parent–infant bio-behavioral synchrony" (Feldman, 2012, p.4). Secondly, she points out the centrality of time and synchrony for the organization of brain activity (Neural Darwinism), and lastly, she emphasizes the relational nature and embeddedness of the human mind in concrete time-locked sensory experiences (Phenomenological philosophy). By implication, Feldman's approach puts a focus on the centrality of behavior, physiology, time and coordination for building and maintaining of human bonds. Feldman and her colleagues report finding synchrony in the interactions of parents and children from infancy to adolescence, of friends and partners in intimate relationships, and this experience of synchrony in each relationship appears to be similarly

supported by autonomic reactivity, affiliative hormones, and brain activation, indicating that this biological basis of synchrony continues throughout life (Feldman, 2012). Adding a further elaboration on the aspect of bi-directionality by examining coordination and synchrony between caregiver and child and adding the aspect of physiological mechanisms, Feldman's bio-behavioral approach poses another meaningful viewpoint for the study of transgenerational transmission of childhood adversity.

As those models all include important aspects to be considered in the study of transgenerational transmission of risk, I am proposing an integrational model of transactional and bio-behavioral approaches. This theoretical framework provides the basis from which we can infer research questions and, subsequently, classify and interpret found results.

2.1. Integration of transactional and bio-behavioral models: dynamic bio-psychosocial model of transgenerational transmission
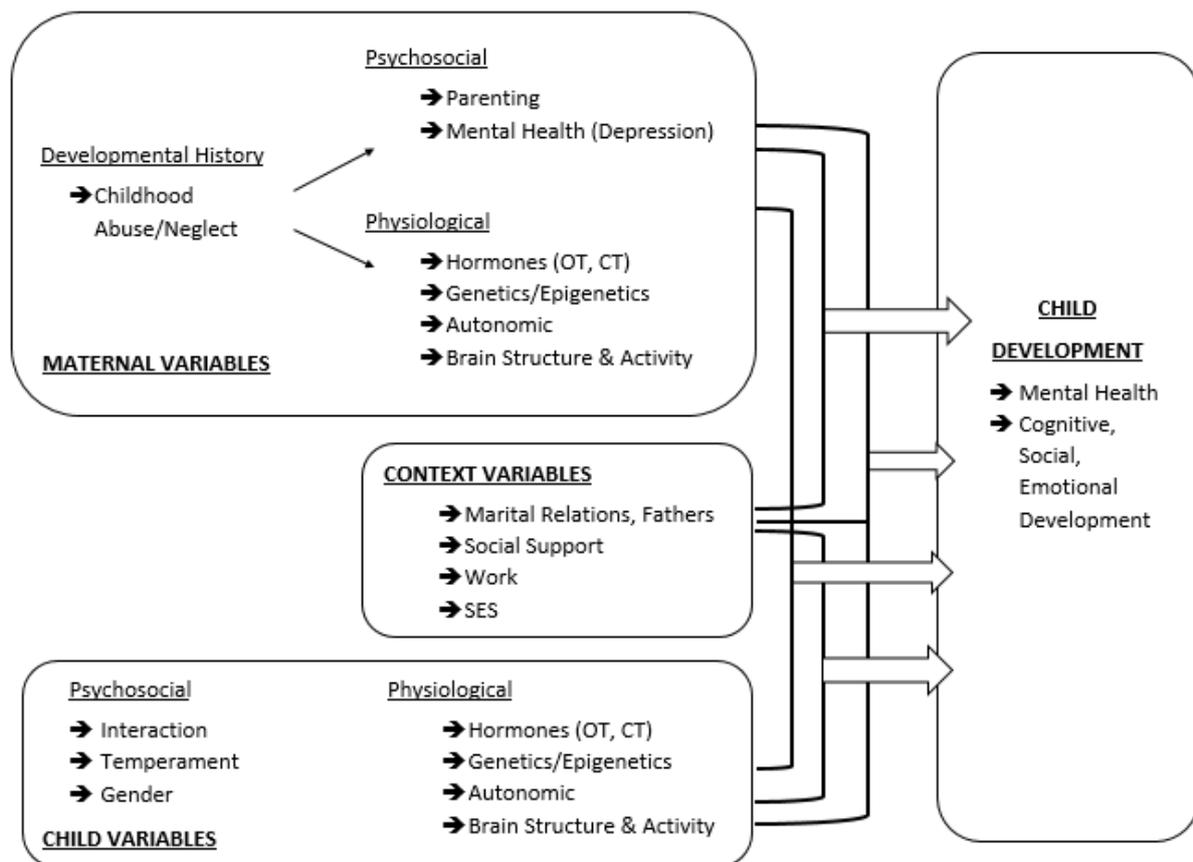

Fig. II: A dynamic bio-psychosocial model of transgenerational transmission.

As an integration of core aspects of transmission processes which are theorized to be transactional (Sameroff, 1975; 2009), determined by multiple sources (Belsky, 1984; 1993) and shaped not only by behavior, but also by physiology (Feldman, 2012), I am proposing a

dynamic biopsychosocial model of transgenerational transmission of childhood adversity. In line with Belsky's (1984) model, maternal, context and child variables are included, factors which are interrelated and, through interactional effects, shape child outcome. As earlier frameworks were mainly developed to depict potential transgenerational mechanisms of child maltreatment, the child outcome of interest would have been limited to child abuse and neglect. Here, a broader approach is considered, including not only child maltreatment, but also mental health, cognitive, social and emotional development as indicators of child developmental outcome. Accordingly, this framework is not limited to encompass and describe the notion of a "cycle of abuse", but rather describes a broader transmission process termed "cycle of childhood adversity". Consequently, transgenerational effects of maternal childhood abuse and neglect are not expected not be limited to actual maltreatment of next generation offspring, but to potentially influence others aspects of child development and health as well. In line with Feldman's (2012) work, I am postulating a biopsychosocial model, including not only psychological and social variables, but also physiological factors which might play a central role in transgenerational transmission processes.

2.1.1. The abused child as a mother: Maternal Variables

The urgency of finding ways to reduce rates of childhood abuse and neglect is becoming even more evident focusing on the long and short-term consequences on child development, which will be elaborated in the following paragraph.

2.1.1.1. Psychosocial consequences

Exposure to childhood maltreatment is associated with a broad range of detrimental psychosocial outcomes in adolescence and adulthood, particularly with manifold mental health problems (Edwards, Holden, Felitti, & Anda, 2003; Norman et al., 2012; Putnam, 2006; Spertus, Yehuda, Wong, Halligan, & Seremetis, 2003). Depression has been the center of research efforts in this context, with studies finding significant associations consistently (Brown, Cohen, Johnson, & Smailes, 1999; Edwards et al., 2003; Infurna et al., 2016; Paolucci, Genuis, & Violato, 2001; Plant, Barker, Waters, Pawlby, & Pariante, 2013; Putnam, 2003). Early adversity has been linked with earlier onset, a greater number of episodes and a more chronic course of the disorder (Lomanowska, Boivin, Hertzman, & Fleming, 2015). In addition, exposure to childhood maltreatment has been linked with borderline personality disorder (Fossati, Madeddu, & Maffei, 1999), elevated substance use and alcohol consumption (Dube et al., 2005; Norman et al., 2012; Putnam, 2003; Spertus et al., 2003), posttraumatic stress disorder (Paolucci et al., 2001), anxiety (MacMillan et al., 2001; Spertus et al., 2003) and higher rates of suicidality (Brown et al., 1999; Paolucci et al.,

2001). Moreover, child maltreatment has been shown to predict a higher risk for revictimization (Arriola, Louden, Doldren, & Fortenberry, 2005; Desai, Arias, Thompson, & Basile, 2002; Yehuda, Spertus, & Golier, 2001), unprotected intercourse, sex with multiple partners and sex trading (Arriola et al., 2005; Kellogg, Hoffman, & Taylor, 1999), school problems and higher drop-out rates (Putnam, 2006) and a higher likelihood to have serious legal problems (Zingraff, Leiter, Myers, & Johnsen, 1993). In sum, victims of childhood maltreatment are at higher risk for developing psychiatric disorders, show maladaptive psychosocial adjustment and risk behaviors, have troubled relationships and a lower economic status.

2.1.1.2. Effects on parenting

Disturbed behavioral mother-child-interaction has repeatedly been found in HoA-Mothers, and has been hypothesized to play a role in the transgenerational transmission of early life adversity (Dixon et al., 2005). Considering the abovementioned detrimental psychosocial outcomes in victims of child abuse and neglect, such as higher rates of psychopathology in adulthood, higher risk for revictimization or legal and educational problems, those mothers might not be able to sustain high quality care. Especially, symptoms of mental illness could interfere with the parent's ability to provide optimal parenting - a pathway that has been found for maternal depressive symptoms in particular (DiLillo & Damashek, 2003; Martinez-Torteya et al., 2014; Norman et al., 2012; Schuetze & Eiden, 2005). According to social learning theory, children who grew up without an acceptable role model of parenting might have difficulties in adopting this role themselves (Bert et al., 2009; Pears & Capaldi, 2001). Correspondingly, attachment theorists discuss disadvantageous effects on the development of internal working models as prototypes for all future relationships (Banyard, 1997; Bretherton, 1985; Main & Goldwyn, 1984). There is evidence pointing out an association between grandmother's and mother's knowledge of child development, with the possible results of developmentally inappropriate expectations and poor knowledge of child development influencing child rearing across generations (Nuttall, Valentino, Wang, Lefever, & Borkowski, 2015). Also, first prospective evidence supports the hypothesis of a certain intergenerational continuity of parenting style (Lomanowska et al., 2015; Scaramella, Neppl, Ontai, & Conger, 2008). Other researchers place emphasis on the possibility that experiences of childhood abuse could interfere with the perception of own parenting abilities (DiLillo & Damashek, 2003). Mothers who were victims of physical and sexual abuse in their childhood have been shown to have "black and white" or negative perceptions of themselves as a parent (Banyard, 1997; Burkett, 1991; Gara, Allen, Herzog, & Woolfolk, 2000). Only recently, research efforts have highlighted the significance of emotion regulation in parenting, which has been shown to be affected by early maltreatment experiences (Briere & Jordan,

2009; Maughan & Cicchetti, 2002; Oshri, Sutton, Clay-Warner, & Miller, 2015). Mothers who are having trouble regulating their own emotions might show maladaptive strategies in parenting situations, such as aggression or withdrawal (Ehrensaft, Knous-Westfall, Cohen, & Chen, 2015; Smith, Cross, Winkler, Jovanovic, & Bradley, 2014). Victims of unresolved childhood trauma might try to protect themselves from painful affect by failing to develop the ability of mentalization, which enables them to attribute mental states to themselves and others, making it difficult for them to modulate and regulate children's emotions (Lieberman, Chu, Van Horn, & Harris, 2011) . Especially under stress conditions, physically abused mothers may focus less on their babies ("filtering-out") (Gara et al., 2000) or might be more emotionally distant towards their children (DiLillo & Damashek, 2003). Maternal dissociation following childhood trauma has been discussed as one possible explanatory mechanism in this context (Lieberman et al., 2011; Main & Goldwyn, 1984). In summary, there seems to be a link between a mothers own childhood experiences and the ability of providing optimal care for her child, although the exact mechanisms have not yet been conclusively highlighted (Bifulco et al., 2002). Additionally, several limitations are to be considered interpreting the existing evidence. Many studies have been utilizing self-report measures to assess parenting behavior, which might be subject to bias, especially in a population of subjects having experienced traumatic events in their childhood. Coping mechanisms such as dissociation might limit the ability to reflect on their own parenting behavior (Briere & Jordan, 2009; Marysko et al., 2010). Furthermore, studies have been applying various definitions of childhood maltreatment regarding type of maltreatment (sexual, physical, or emotional), severity of maltreatment and timing of victimization. Bearing these limitations in mind, prospective longitudinal studies applying objective measures of parenting behavior and maltreatment experiences are needed to highlight the exact mechanisms of transmission processes via parenting.

2.1.1.3. Medical and physiological consequences

Wegman and Stetler (2009) report child abuse to be associated with an increased risk of negative physical health outcomes in adulthood, thereby underlining earlier findings of Felitti and colleagues (1998) Adverse-Childhood-Experiences-Study (ACE), who found adverse childhood experiences to be linked with adult diseases including ischemic heart disease, cancer, chronic lung disease, skeletal fractures, and liver disease. Additionally, victims of non-sexual child abuse show a higher risk for sexually transmitted infections (Norman et al., 2012), experiencing chronic pain (Davis, Luecken, & Zautra, 2005) or non-epileptic seizures (Sharpe & Faye, 2006). Besides affecting medical conditions, exposure to child maltreatment has been found to alter brain and neuroendocrinological functioning (Teicher et al., 2003). Evidence is showing deficits in brain volume, gray and white matter of several regions, neural

network abnormalities and atypical activation (Hart & Rubia, 2012). A recent review underlines the finding of structural alterations in the corpus callosum, cerebellum and prefrontal cortex as well as functional differences in regions implicated in emotional and behavioral regulation, including the amygdala and anterior cingulate cortex (McCrory, De Brito, & Viding, 2012). However, according to the authors, the hypothesis of childhood maltreatment causing aberrant brain development leading to an increased risk of psychiatric vulnerability, still remains a hypothesis in need for further investigation.

As the early years appear to represent a sensitive period for biosocial dysregulation, conditions of child abuse or neglect are also hypothesized to be a risk factor for normative development of hypothalamic–pituitary–adrenal axis (HPA axis) functioning. The HPA axis presents a primary mechanism in the allostatic process through which early life stress might contribute to the development of disease (Essex et al., 2011). However, studies on HPA axis functioning in victims of child abuse and neglect show mixed results in terms of effect direction, as hypo- and hyperactivity have been found in victims of childhood abuse (Laurent, Ablow, & Measelle, 2011; McCrory et al., 2012; Tarullo & Gunnar, 2006). It is not yet clear whether this dysregulation in HPA-activity might be associated with the presence of comorbid disorders (McCrory, De Brito, & Viding, 2010). However, in summary, there is strong evidence that early stress may lead to an ongoing dysregulation of the HPA axis, and more longitudinal research is needed to strengthen this line of argument (Bernard, Dozier, Bick, & Gordon, 2015; McCrory et al., 2012; Scarpa et al., 2004).

Since Caspi and colleagues' first report on a gene-environment interaction for a psychiatric outcome, an accumulating number of studies focus on the role of genetic influences in the context of transgenerational transmission of child adversity (Caspi et al., 2002). Results point to genetic influences on individual differences in psychiatric outcomes associated with maltreatment (McCrory et al., 2012). Furthermore, of special interest are candidate genes implicated in systems underlying maternal behavior, including variations in dopamine or serotonin transporter genes as well as genes implicated in the functioning of oxytocin or vasopressin (Bakermans-Kranenburg & van IJzendoorn, 2008; Feldman, 2012a; Mileva-Seitz, Bakermans-Kranenburg, & van IJzendoorn, 2016). Here, first evidence suggests gene-environment effects of maternal genetics and early experience such as maternal genetics and mothers' own early parenting experiences on maternal behavior (Lomanowska et al., 2015).

In summary, recent evidence points to longitudinal effects of child maltreatment on medical condition, brain and hormonal functioning. However, the question remains how these long-term adverse consequences impact on next generation offspring.

2.1.2. The abused child as a mother: Context variables

In the context of research on transgenerational transmission of child abuse and neglect, several context variables have been identified as risk factors, in line with Belsky's theoretical work (Belsky, 1993). According to the author, three sources of context are of significance: First, community and social support, such as small peer networks, involvement in communities, for instance church communities, and also reciprocity in social relationships. Secondly, he describes the societal-cultural context, which incorporates a society's attitude and beliefs towards parenting style and appropriate discipline. One example would be the general acceptance or sanctioning of physical punishment as a means of controlling children's behavior. The third and most broadly defined context source is evolutionary context. According to Belsky (1993), modern evolutionary theory underlines the reproductive interest of individuals rather than species. Consequently, under conditions in which the provision of sensitive care adds nothing to the reproductive fitness of parents, which might be the case if resources are scarce, neglecting or even abusing some children may enable the parent to invest more effectively in others – ones who might have more reproductive potential (Belsky, 1993). In addition to Belsky's framework, by presenting their ecological/transactional model of community violence and child maltreatment, Cichetti & Lynch (1993) also draw attention to the relevance of context systems in transmission research. In agreement with Belsky's model, the authors consider cultural values and beliefs ("macrosystem") and informal social structures that impact the child's immediate environment such as neighborhoods, formal support groups, socioeconomic status or the availability of employment ("exosystem") as highly relevant. In addition, they postulate a "microsystem" incorporating the immediate context in which the child develops, including what Belsky describes as "maternal factors", such as quality of parenting, parental developmental histories and mental health, but also work and school environments (Cichetti & Lynch, 1993). In presenting their theoretical frameworks, all three authors give an overview of current evidence on the associations between context variables and transmission processes (see Belsky, 1993; and Cichetti & Lynch, 1993). Likewise, current research supports the significance of context in transmission of childhood adversity. In general, evidence points out that families with greater risk factors such as single parenthood, adolescent pregnancy, lower educational status, poverty or less external resources of support are more likely to engage in child abuse as compared with families with fewer risk factors (Bert et al., 2009; Dixon et al., 2005; Smith et al., 2014). Especially external support from at least one significant person (therapist, spouse, or friend) either in childhood or adulthood seems to buffer adverse transgenerational effects (Phelps et al., 1998; Stith et al., 2009). In a study on effects of caregiver vulnerabilities including a maternal HoA, Wekerle, Wall, Leung and Trocme (2007) concluded that parent behavior should be considered in a tandem with partner relationships,

as the relationships between caregiver vulnerabilities and substantiation of child abuse and neglect was moderated by the existence of partner violence (Wekerle, Wall, Leung, & Trocmé, 2007). This is of special importance, as a HoA has been shown to be related to an increased likelihood to live with a violent partner (Dixon et al., 2005; Egeland, Bosquet, & Chung, 2002).

Evidence of child or context factors exerting an influence in transgenerational transmission of risk is even more sparse than evidence on maternal or child variables. In their studies on Spanish 8 to 17 year old children and their mothers, Miranda and colleagues (2013) examined the role of child gender, reporting no significant moderating effects of gender regarding the association between maternal history of violence and child behavior problems (Miranda et al., 2013). Bifulco and colleagues (2002), examining transgenerational transmission of major depressive disorder, found the effect of maternal childhood adversity on child disorder to be dependent on offspring experiences of abuse and neglect. Maternal experiences of neglect were associated with a higher risk of offspring maltreatment leading to a higher risk of offspring disorder (Bilfulco et al., 2002). Illuminating the importance of context factors, Rijlaarsdam and colleagues (2014) pointed out the significance of fathers' mental health and harsh discipline as mediating factors between a HoA and child adjustment (Rijlaarsdam et al., 2014). Other results highlight the detrimental effects of intimate partner violence (Delker et al., 2014), social isolation and lack of support (Bosquet Enlow et al., 2016; Leifer, Shapiro, & Kassem, 1993; Min, Minnes, Kim, & Singer, 2013) or stressful life events (Bosquet Enlow et al., 2016; Collishaw et al., 2007).

2.1.3. The abused child as a mother: Child Variables

In his framework, Belsky pointed out the relevance of child characteristics for parenting behavior, drawing attention to a potential role of child factors in transgenerational transmission of childhood adversity via parenting behavior (Belsky, 1993). Based on results showing a higher risk for younger children to be abused and neglected, he postulated child age as a relevant factor. In addition, evidence points to an association between child physical health, e.g. prematurity and low birth weight or other at risk conditions, and childhood adversity (Belsky, 1993). According to Feldman and Eidelman (2006) infant-related conditions such as prematurity are associated with disruptions in mother-infant-synchrony and over-stimulatory parenting as those children seem to be sending unclear social messages, making interactions even more anxiety-provoking for mothers, who turn to intrusive behavior (Feldman & Eidelman, 2006). Another potential child factor of influence might be emotional reactivity or child temperament, defined as individual differences in the way children react to experience and their regulatory abilities (Rothbart, Ellis, & Posner,

2004). Following the seminal work of Thomas and Chess (1977) in temperament research, who were the first to acknowledge the significance of a "Goodness of Fit", it is rather the fit between environmental characteristics and child temperament than the child's disposition alone that influences child outcome. Since then, other theoretical frameworks have defined parent characteristics and child characteristics to mutually shape each other over time, resulting in bidirectional or transactional models predicting child adjustment (Cicchetti & Lynch, 1993; Hinshaw, 2010; Sameroff & Mackenzie, 2003). Recent work has been focusing on the extent of responsiveness and reactivity in children, suggesting that individuals respond to environmental factors differently, a framework represented in the organismic specificity (Wachs, 1987) and differential susceptibility hypotheses (Belsky, Bakermans-Kranenburg, & Van IJzendoorn, 2007; Belsky & Pluess, 2009). Current extensions of these models include biological sensitivity, suggesting that some individuals are highly susceptible to environmental conditions on a biological level, while others are hardly affected (Kiff, Lengua, & Zalewski, 2011). In their review, Kiff and collaegues (2011) conclude that temperament and parent characteristics such as parenting behavior seem to shape each other as well as condition each other's effects. Additionally, temperamental components such as reactivity and self-regulation (Rothbart, Sheese, Rueda, & Posner, 2011) have been found to directly influence child outcome, e.g. in terms of cognitive development (Halpern, Coll, Meyer, & Bendersky, 2001; Keenan, 2002; Matheny, 1989; van de Weijer-Bergsma, Wijnroks, & Jongmans, 2008) or development of psychiatric disorders (Sayal, Heron, Maughan, Rowe, & Ramchandani, 2014). However, there is a scarcity of studies examining the role of child variables in the context of transmission of risk, a gap in literature future studies should aim to close (Scaramella et al., 2008).

3.   Problems in current transmission research

The field of transgenerational transmission research is yet in the early stages of development. Taking on the challenge of illuminating possible transgenerational effects of child abuse and neglect, researchers are confronted with a wide range of difficulties. Consequently, interpretation of results should be made with caution. First, maltreatment definition varies vastly in between studies. Classification of participants as maltreated or not maltreated has been, to some degree, a subjective process (DiLillo & Damashek, 2003). There is a broad variance in measures used to determine maternal maltreatment history, methods include self-reports, interviews, hospital records, and official records. Especially in large-scale population-based studies, maltreatment assessment has even been limited to less than five dichotomous yes- or no-questions (e.g. Myhre, Dyb, Wentzel-Larsen, Grøgaard, & Thoresen, 2014). Assessment of maltreatment experiences encompasses an enormous variety of experiences, ranging from limited incidents to prolonged experiences, including physical, emotional, and sexual abuse as well as physical or emotional neglect (Putnam, 2006). In this context, transmission research encounters the problem of comorbidity in maltreatment type: many parents would not show only one form of maltreatment, but several (Belsky, 1992). There is increasing recognition of the need to improve construct validity of measures that assess maltreatment type and severity, and implement a more systematic assessment of maltreatment type, chronicity, frequency and even perpetrator identity, if findings from different samples are to be meaningfully compared (McCrory et al., 2010). In addition to comorbidity of different types of maltreatment, many studies on offspring outcome in transgenerational transmission of risk have examined effects of childhood history and current experiences of intimate partner violence (IPV) or incidents such as stranger assault or robbery in adulthood (Dubowitz et al., 2001; Koverola et al., 2005; Miranda, de la Osa, Granero, & Ezpeleta, 2013), creating a dependent variable of "victimization" without disentangling the effect of current and childhood experiences (e.g. Collishaw, Dunn, O'Connor, Golding, AVON Longitudinal Study; 2007). The use of retrospective measures posits a further limitation in maltreatment research, which applies for almost every single study in this context. Retrospective reports could suffer from over- or underestimation of childhood abuse and neglect (Shaffer, Huston, & Egeland, 2008). However, current evidence supports their utility in research, particularly when standardized instruments are used, maltreatment is behaviorally operationalized and a range of experiences are covered (Hardt & Rutter, 2004; Tonmyr, Draca, Crain, & MacMillan, 2011). Not only valid and reliable measurement of childhood experiences poses a challenge in transgenerational research, assessment of parenting behavior or quality of mother-child relationship as well as offspring outcome has also been marked by measurement issues. Most studies rely on the economic choice of maternal self-report to gain information on

parenting and relationship quality. However, observational measures and self-report data seem to result in divergent findings, especially in populations at risk (Heidi N. Bailey, DeOliveira, Wolfe, Evans, & Hartwick, 2012). As a tendency, studies applying self-report data find significant associations between a HoA and parenting more consistently than the few studies applying observational measures (Fitzgerald, Shipman, Jackson, McMahon, & Hanley, 2005; Zuravin & Fontanella, 1999). Therefore, in future research designs, more frequent deployment of objective measures such as video-based interaction coding should be considered. Interestingly, in the context of investigation of transgenerational transmission of childhood adversity, asking mothers to report not only on their childhood histories but also on their offspring's behavior and emotional problems has been shown to result in different trajectories compared to information gathered from different sources, such as the child itself, father or teacher. Shared method variance might be one explanation, as it implicates the risk of overestimating associations. It may be that mothers who have experienced maltreatment are more attentive to their child's well-being and adjustment. Alternatively, feelings of shame or guilt might be causing these women to trivialize problems. They could also be inclined to over-report child behavior problems due to long-term consequences of their childhood experiences, such as diminished mental health, which might influence their perception of their children. Divergent results from multi-informant sources on child adjustment in transgenerational transmission of maltreatment might also capture context dependency. It is quite possible that adjustment problems in children will only emerge at home, embedded in everyday life activities, in the context of interaction between mother and child. In addition, not only results relying on maternal reports, but also on teacher reports of child behavior should be interpreted with caution. For example, teachers have been shown to under-report internalizing behavior problems (Stanger & Lewis, 1993). Future research will have to address this problem of divergent results from multiple informants. Additionally, studies should put a focus on choosing an adequately representative sample. In current research, mother-child dyads are mostly selected based on mother's victimization histories, leading to an overrepresentation of clinical or high-risk samples in this field of research (Morrel, Dubowitz, Kerr, & Black, 2003). Since child maltreatment has been recognized as a public health problem, studies should make sure to include a diverse group of participants to be able to draw conclusions about the population of child maltreatment survivors as a whole (Myhre et al., 2014; Wegman & Stetler, 2009). In addition, choosing a sample type, child age needs to be taken into account. Transmission processes might take place from birth onwards, or might even begin in pregnancy (Lang, Rodgers, & Lebeck, 2006). As children go through developmental stages, developmental upheavals and reorganizations might affect child outcomes in different ways, and children themselves might influence the process. Therefore, scientists will need to conduct longitudinal studies highlighting transmission

processes over the course of development (Belsky, 1992). At the same time, however, it is important to bear in mind that there is no necessary, inevitable link between mother's vulnerability and child risk. Bifulco and colleagues (2002), for example, found only a small minority of at risk mothers to be neglectful, abusive or show high antipathy in interaction with their own children. The authors emphasize the role of protective factors in this context: Parents' own difficult childhood experience might be counter-balanced by later protective factors such as support from partner (Bifulco et al., 2002). Other variables often not specified, such as coping strategies or social support might also play a role in determining child outcomes (Roberts, O'Connor, Dunn, & Golding, 2004). As these authors sum up, "abuse is not destiny" (Roberts et al., 2004; p.540). To avoid jumping to conclusions, researchers also need to make themselves aware of the file drawer problem. An emphasis on statistically significant literature while filtering out other results will lead to over-interpretation of transmission links (DiLillo & Damashek; 2003). Summing up, the field of transgenerational transmission research will have to face the challenge of conducting longitudinal studies including a diverse sample of mothers and their children. There should be a focus on elaborate assessment of maltreatment histories and child outcome as well as testing of potential mediators and moderators.

# 4.	Contributions of this work

As outlined in the previous chapters, evidence on pathways of transmission of risk in general is still sparse and not only marked by methodological limitations, but also by a missing overarching model as a guiding framework. The present work aims at filling this gap by firstly, contributing a model of transgenerational transmission of risk and secondly, by reporting on results obtained from carefully designed case control-studies.

This work incorporates four published manuscripts examining different aspects of transgenerational transmission processes which are embedded in the theoretical framework of a dynamic bio-psychosocial model of transgenerational transmission (for an overview see figure III, variables highlighted in the attached manuscripts illustrated in bold). Two of those manuscripts (1+3) report data from the "Cycle of Abuse" study, which took place in 2005/2006 and was funded by the German Research Association (DFG). This longitudinal case-control study examined community mothers who reported severe physical and sexual abuse in childhood together with their five to twelve months old infants (n=58) and a comparison group of healthy mothers and infants (n=61) to shed light on potential transgenerational effects of maternal experiences of childhood abuse. The other two manuscripts (2+4) are based on data from the "Understanding and Breaking the Intergenerational Cycle of Abuse"-Project ("UBICA"), a large multicenter study designed to highlight possible mechanisms underlying the intergenerational transmission of experiences of physical and sexual abuse. UBICA was funded by the German federal ministry of education and research (BMBF) and ran from 2012-2015. Participants where four groups of women (N = 194) and their five to 12-year-old children: mothers with a history of childhood abuse (n=30), mothers with remitted depression (n=38), mothers with a HoA and remitted depression (n=51) and comparison group mothers (n=75). Both projects were set at the Child and Adolescent Psychiatry of the University Hospital Heidelberg. Additionally, UBICA was conducted in close collaboration with the Charité Universitätsmedizin Berlin.
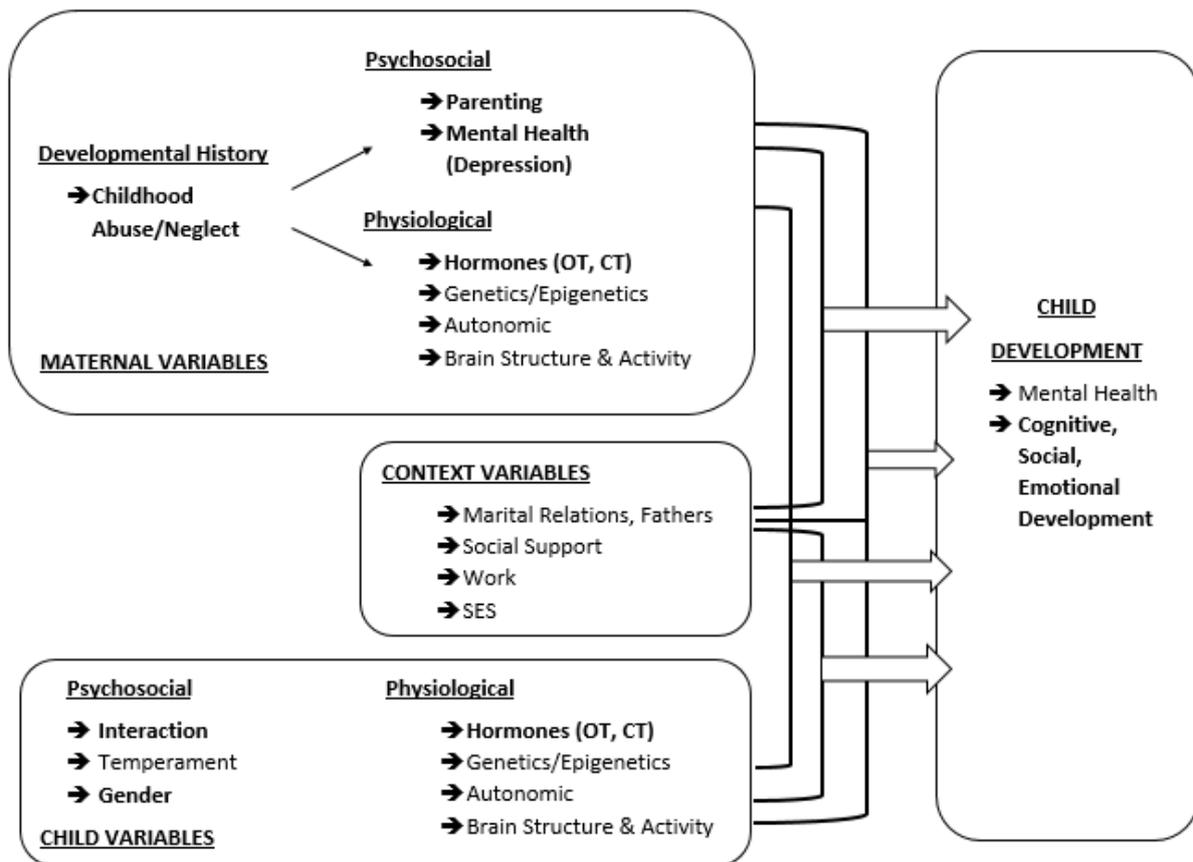
Fig. III: Contributions of this work

4.1. Manuscript 1: "Impact of a maternal history of childhood abuse on the development of mother–infant interaction during the first year of life"

Fuchs, A.; Möhler, E.; Resch, F., & Kaess, M. (2015). Impact of a maternal history of childhood abuse on the development of mother–infant interaction during the first year of life. Child abuse & neglect, 48, 179-189.

Childhood maltreatment and its adverse consequences for the individual have been identified as a major public health problem (Norman et al., 2012). In this context, researchers have also been focusing on a potential transgenerational transmission of childhood maltreatment experiences, embedding corresponding results in a "cycle of abuse" framework. Here, having experienced abuse in childhood increases the risk of perpetrating child maltreatment later as a parent (Egeland et al., 1988; Widom, 1989). Possibly attributable to social learning processes, impaired internal working models of attachment, higher levels of psychopathology or impaired emotion regulation, mothers with a history of abuse might have difficulties caring for and interacting with their own children. At the same time, evidence stemming from developmental research has consistently been linking lower levels of maternal interactional

quality with negative child outcome and maladjusted behavior such as insecure attachment (Ainsworth, 1979; Wolff & Ijzendoorn, 1997), poor socio-emotional development (Landry, Smith, Swank, Assel, & Vellet, 2001; Sroufe, 2005), cognitive development (Halpern et al., 2001; Hirsh-Pasek & Burchinal, 2006; Lemelin, Tarabulsy, & Provost, 2006) and mental health (Fearon, Bakermans-Kranenburg, Van IJzendoorn, Lapsley, & Roisman, 2010; Madigan, Atkinson, Laurin, & Benoit, 2013). It stands to reason that parenting behavior might play a central role in transmission processes influencing child outcome.

However, studies exclusively examining a potential mediating role of parenting or mother-child-interactional quality are limited in interpretability due to measurement issues such as self-report data of parenting (Delker, Noll, Kim, & Fisher, 2014; Riser, 2009). Those studies have reported full mediation of the associations between a maternal HoA and child internalizing behavior (Riser, 2009) or child regulation difficulties (Delker et al., 2014). Results obtained by the one study using observational measures failed to confirm a mediation role of interactional behavior explaining the association between a maternal HoA and child adjustment (Bosquet Enlow et al., 2016). To be able to evaluate the role of mother-child interactional quality in the context of transgenerational transmission of risk, it is therefore of high importance to investigate observed behavior through validated video-based coding measures.

A widely used observational framework assessing the emotional context in mother-child interaction which has been shown to have good psychometric properties is represented by the "Emotional Availability Scales" (EAS; Biringen, Robinson, & Emde, 1998). For both studies included in this work, we chose the EAS-framework to assess the dyad's capacity for emotional connection and the extent to which the connection is genuinely affectively positive and healthy (Biringen & Easterbrooks, 2012). Sensitivity as its maternal key dimension refers to the capability of the mother to establish a positive and genuine emotional communication. Highly sensitive mothers show authentic affect and pleasure in play with her child, flexibility, creativity and appropriate handling of conflict situations. Interactions between mother and child have a "dance-like" quality. Responsiveness, the key dimension referring to the child, assesses the degree to which the child responds to the mother's bids as well as how much the child enjoys the interaction. Further subscales include maternal structuring, non-intrusiveness, non-hostility and child involvement (Biringen, 2008). Interactional quality based on the EAS can be coded in a wide range of contexts such as structured or free play and across a wide range of child ages from birth to age 14 (Saunders, Kraus, Barone, & Biringen, 2015).

Not only maternal but also child characteristics influence the interaction between mother and child. Beginning in the latter half of the child's first year, the developmental milestone of

locomotion changes the relation between the infant and its environment dramatically (Anderson et al., 2013). Considering the potential influence of the child's development on the quality of interaction, there is a significant lack of knowledge about the trajectory of the emotional exchange between mother and child over the course of development since only a few studies so far have used longitudinal designs (Zeynep Biringen, Derscheid, Vliegen, Closson, & Easterbrooks, 2014). Additionally, most studies focused on low-risk community samples and an older age group (Biringen et al., 1999; Biringen, Matheny, Bretherton, Renouf, & Sherman, 2000; Bornstein et al., 2006, 2010; Lovas, 2005).

Therefore, the aim of this study was to examine the impact of a maternal HoA on mother-child interaction in infancy and early toddlerhood using an observational method assessing emotional availability in a longitudinal case-control design. We expected HoA-mothers and their children to score lower on emotional availability than comparison-group mothers and children.

Over an 18-month period, women giving birth to a child in the local obstetric units were screened using the Childhood Trauma Questionnaire (CTQ, Bernstein & Fink, 1999). Women who reported moderate or severe sexual and/or physical abuse were included in the maltreatment group (n=58; MG) and compared with a non-maltreated comparison group (n=61; CG). Emotional availability was investigated under experimental conditions when the children were 5 and 12 months of age using the EAS. Maternal psychopathology was assessed using the Symptom Checklist 90-Revised (SCL 90-R; Franke & Derogatis, 2002).

As both groups differed significantly in mean scores of reported symptom severity, SCL scores were controlled for in all analyses. Mean scores in both groups were within the average range of reported symptom severity in the population; in addition, the CG reached a mean score close to below average (MG: M=50.47, SD=7.83; CG: M=43.93, SD=7.45). While mother-child dyads in the MG showed only very discrete interactional alterations at an infant age of 5 months, their EA differed significantly from the CG at 12 months due to the lack of an increase in EA observed in the MG.

These data indicate that the period of developing child locomotion might represent a critical time window for mothers with a HoA. Our results constitute an advance in research on child abuse as they identify a possible time window of non-normative alteration in mother-child interaction. This period could be targeted by strategies to prevent intergenerational transmission of abusive experiences.

With reference to the dynamic bio-psychosocial model of transgenerational transmission, this manuscript highlights information regarding maternal variables of childhood history, parenting and mental health. In addition, as emotional availability is a dyadic construct taking child

responsivity and child involvement into account, child interactional quality was included, as well as the developmental context of the child.
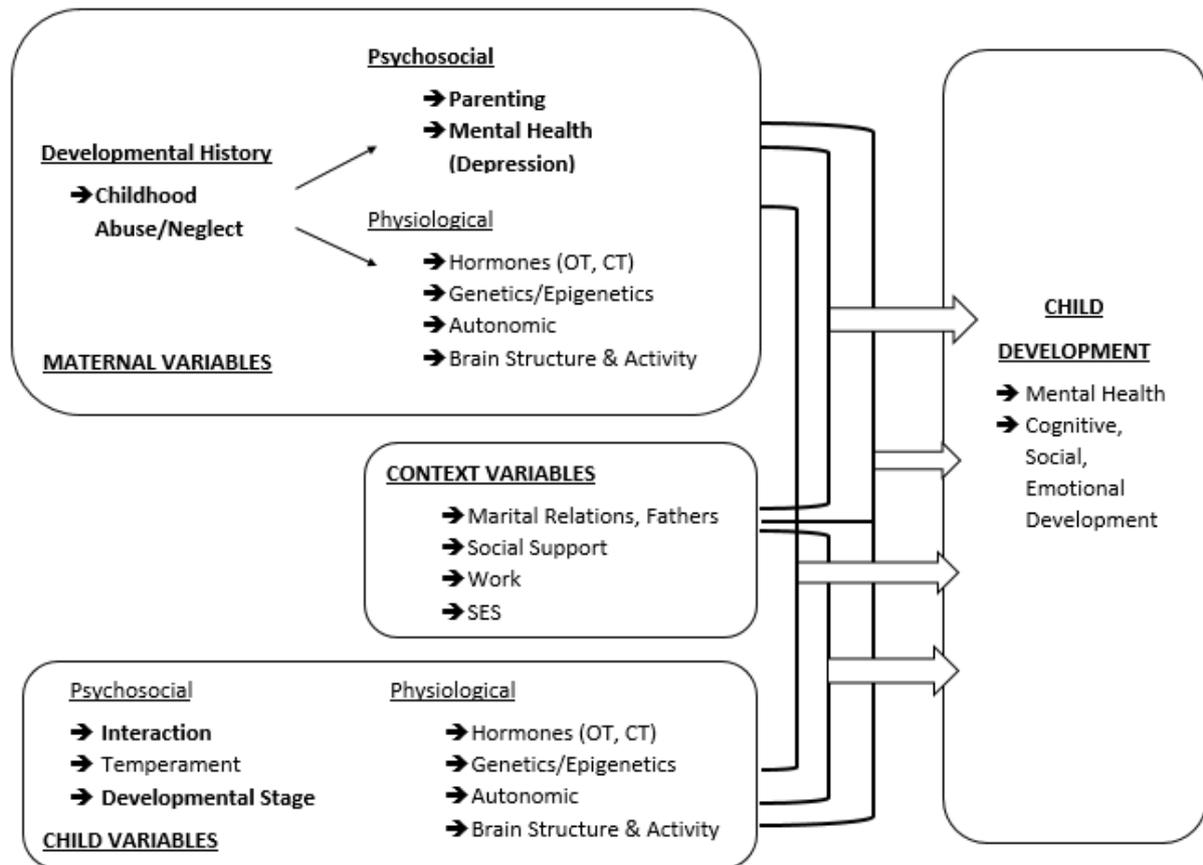
Fig. IV: A dynamic bio-psychosocial model of transgenerational transmission: Manuscript 1.

The results of Manuscript 1 suggest impaired mother-child interaction in a high functioning community sample of mothers with a history of abuse compared to a non-abused group of mothers. In this study, maternal psychopathology was assessed using the self-report questionnaire SCL 90-R.

To date, studies examining mother-child interaction in context of maternal HoA and maternal depression have solely relied on questionnaire data for parenting behavior, diagnostic status, and maltreatment history instead of conducting elaborate interviews such as the Childhood Experience of Care and Abuse Interview (CECA; Bifulco, Brown, & Harris, 1994). The following manuscript reports results from a study aiming at overcoming this methodological limitation, examining maternal depressive disorder and a maternal HoA as potential predictors of EA.

4.2. Manuscript 2: "Emotional Availability in mother-child-interaction: The effects of maternal depression in remission and additional history of childhood abuse"

The examination of potential pathways of transmission of risk is still in the early stages. The majority of the few studies conducted have been focusing on maternal HoA affecting maternal mental health or parenting behavior, which in turn would influence child outcome. The association between maternal depression and adverse outcomes in children is well established, and first evidence is suggesting a similar link between a maternal HoA and negative outcomes in children.

So far, studies examining the associations between HoA, maternal mental health, parenting and child outcome have yielded inconsistent results. Three studies using self-report instruments to assess mental health as well as parenting behavior identified the latter as the important mediating variable for child adjustment (Claridge, Lettenberger-Klein, Farineau, Wojciak, & McWey, 2014; Collishaw et al., 2007; Rijlaarsdam et al., 2014). However, applying observational measures of parenting and self-report data on mental health, most studies confirmed a mediation role of maternal depression in this context (Madigan et al., 2013; Martinez-Torteya et al., 2014; Mitchell, Lewin, Rasmussen, Horn, & Joseph, 2010; Morrel et al., 2003; Roberts et al., 2004). This underlines the importance of deployment of observational methods as well as a detailed assessment of maternal mental health, especially maternal depression. So far, however, studies focusing on mother-child interactional quality in context of a maternal HoA and maternal depression have relied on questionnaire data for parenting behavior, diagnostic status, and childhood abuse (e.g. Ammerman et al., 2012; Cohen, Hien, & Batchelder, 2008; Zalewski, Cyranowski, Cheng, & Swartz, 2013).

Consequently, our aim was to investigate sensitive parenting in mothers with depression in remission and to examine the impact of a maternal HoA applying the EAS as an observational method and clinical interviews as a thorough assessment of maternal mental health. We hypothesized mothers with depression to show impaired emotional availability during remission, and that this effect would be more pronounced in those mothers with an additional HoA. We also hypothesized an effect of trauma severity.

Mother-child interaction of 188 dyads was assessed during a play situation using the EAS measuring overall affective quality of the interaction: maternal sensitivity, structuring, non-hostility, and non-intrusiveness. Mothers with depression in remission were compared to healthy mothers. Diagnostic status was assessed by the Mini International Neuropsychiatric Interview (M.I.N.I; Lecrubier, Sheehan, Weiller et al., 1997) and the International Personality Disorder Examination (IPDE; Loranger, Janca, & Sartorius, 1997). Children were between 5 and 12 years old.

Mothers with depression in remission showed less emotional availability during mother–child interaction compared to healthy control mothers. Specifically, they were less sensitive and, at trend-level, less structuring and more hostile. Among these mothers, we found an additional effect of severe maternal childhood abuse on maternal sensitivity: Mothers with depression in remission and a history of severe childhood abuse were less sensitive than remitted mothers without childhood abuse. Our data suggest that depression affects maternal emotional availability during remission, which might represent a trait characteristic of depression. Mothers with depression in remission and additional severe childhood abuse were particularly affected. Disturbed mother-child interaction might therefore be one pathway in transgenerational transmission of risk.

With reference to the dynamic bio-psychosocial model of transgenerational transmission, this manuscript highlights information regarding maternal variables of childhood history, parenting and maternal mental health. In addition, as emotional availability is a dyadic construct taking child responsivity and child involvement into account, child interactional quality was included, as well as the developmental context of the child.
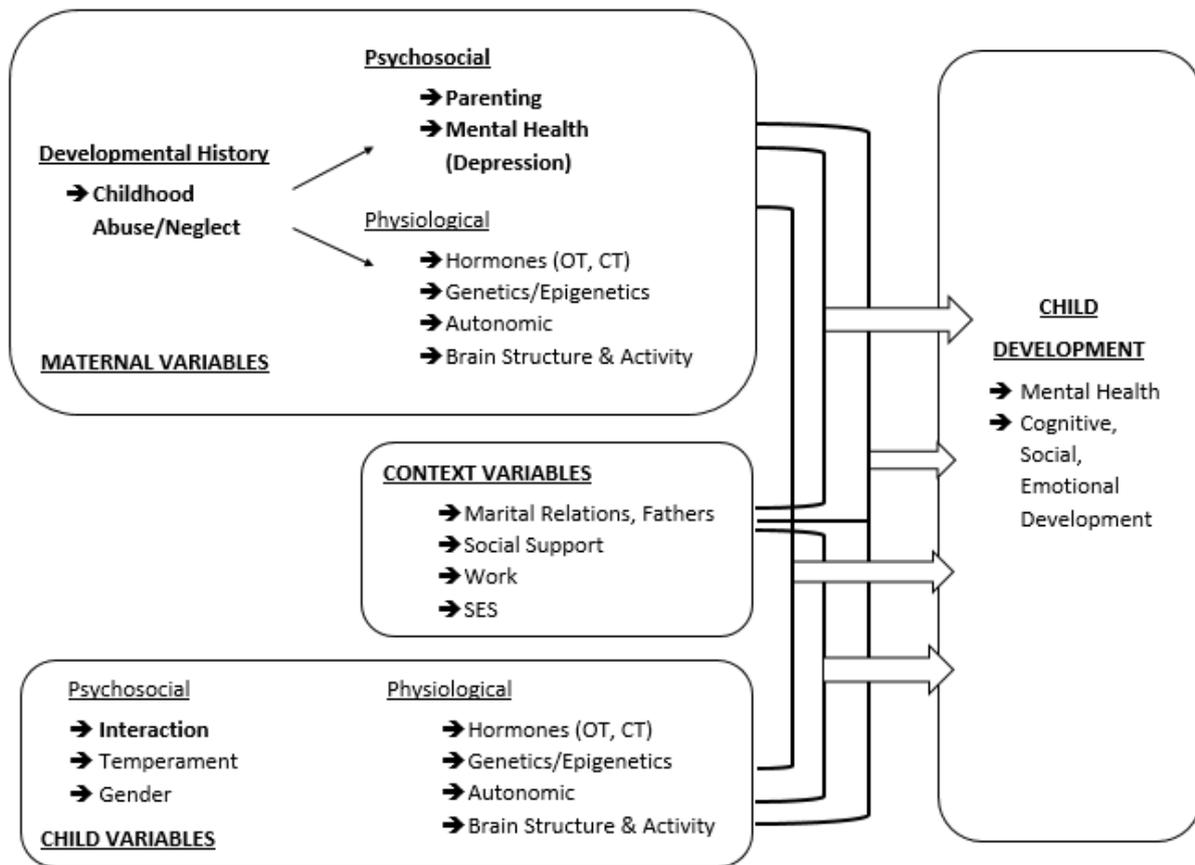
Fig. V: A dynamic bio-psychosocial model of transgenerational transmission: Manuscript 2.

Examining the relationship between mothers and their children has been a core area of developmental research for decades (Bornstein, 2013; Brazelton, Koslowski, & Main, 1974). In line with this, Manuscripts 1 and 2 put a focus on observed mother-child interaction in context of a maternal HoA and maternal depression in remission. Very recently, advancing the study of mother-child relationships with the aim of creating a more integrated, holistic framework, physiology has been included as a new aspect of mother-child interaction (Feldman, 2007; Ruttle et al., 2011). Manuscript 3 is the first study to report on results regarding mother-child attunement in HPA axis functioning in context of a maternal HoA.

4.3. Manuscript 3: Sex-specific differences in adrenocortical attunement in mothers with a history of childhood abuse and their 5-month-old boys and girls

Over the course of the last decade, a shift in parenting and attachment research has provoked a stronger focus on a more integrative model of parent-child-relationships considering not only behavioral, but also physiological dimensions of dyadic interaction (Feldman, 2012; see also chapter 2). In light of this, mother-offspring "interactional attunement" refers not only to the matching of behavior and affective states during social contact, but to the matching of physiological processes as well (Feldman 2007, 2012).

One system possibly embodying physiological mother-offspring-attunement is the HPA axis. The HPA axis releases the stress hormone cortisol, a glucocorticoid helping to restore homeostasis in case of environmental demands. Cortisol has been shown to be under strong social regulation, especially in small children, for which it is hypothesized to play a role in transgenerational transmission of early life stress (Brand et al., 2010; Hostinar & Gunnar, 2013; Tarullo & Gunnar, 2006). Over the last 15 years, several independent research groups have reported significant associations between maternal and child cortisol levels in diverse samples and study designs. Since there is evidence indicating HoA-mothers and their children might exhibit and report less optimal behavioral interactional quality (Hibel, Granger, Blair, & Finegood, 2015), there could be alterations in the physiological dimension of synchrony as well. To date, however, a possible role of altered adrenocortical attunement in the context of transgenerational transmission of risk has not been examined.

As a maternal HoA has been shown to negatively affect both behavioral mother–child interaction and HPA axis functioning, we theorized a maternal HoA to exert an influence on cortisol attunement. In addition, we examined the role of infant gender. We expected to find an association between maternal baseline salivary cortisol and infant baseline salivary cortisol as an indicator of mother–child adrenocortical attunement. Furthermore, we hypothesized maternal experiences of maltreatment to have a detrimental effect on mother-child adrenocortical attunement, and child gender to exert an influence on the association between cortisol attunement and impact of a HoA.

Shortly after birth of their first child, a community sample of women was screened using the CTQ (Bernstein & Fink, 1999). Mothers reporting moderate or severe sexual and/or physical abuse were included in the maltreatment group (n = 41; MG) and compared with a non-

maltreated comparison group (n = 47; CG). At the child's age of 5 months, mother and infant baseline salivary cortisol was collected on two consecutive days between 11 am and 1 pm. Maternal psychopathology was assessed using the SCL 90-R and was controlled for in all analyses.

Correlation analyses confirmed an association between maternal and infant salivary cortisol levels for the complete sample. However, hierarchical regression models revealed a moderating role of a maternal HoA and infant gender: in the CG, cortisol attunement was only significant in mother-daughter dyads, whereas in the MG, we found cortisol levels to be associated only in mother–son dyads. Consequently, alterations of neurobiological attunement between mother and child might compose a mechanism for the transgenerational transmission of adverse childhood experiences.

In reference to the dynamic bio-psychosocial model of transgenerational transmission, manuscript 3 puts the spotlight on the maternal variables of developmental history (HoA), physiological factors (HPA axis, stress hormone cortisol) and takes into account maternal mental health. Regarding child variables, this manuscript includes child gender and, in line with maternal physiological factors, child HPA axis functioning.
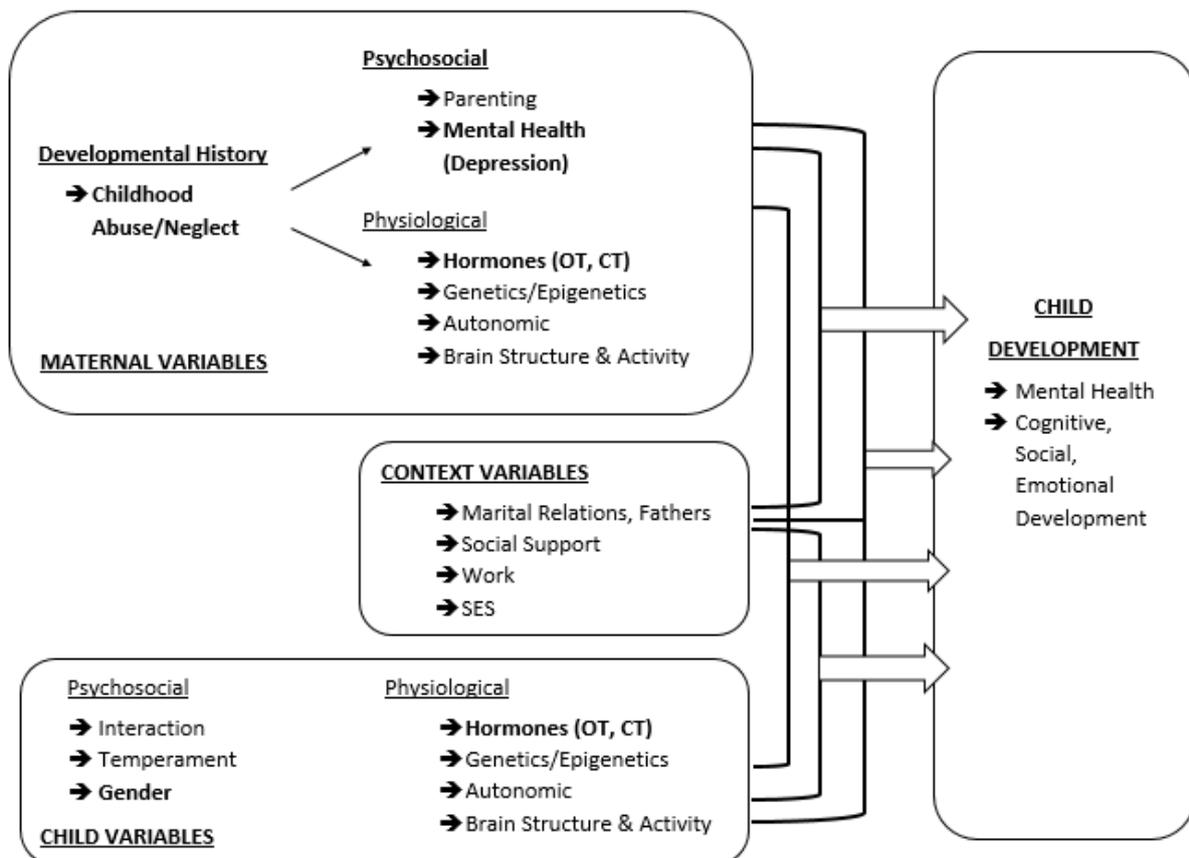

Fig. VI: A dynamic bio-psychosocial model of transgenerational transmission: Manuscript 3.

Manuscripts 1, 2 and 3 focused on mother-offspring interactional attunement, behaviorally and physically, in samples of HoA-mothers compared to non-HoA-mothers, as mother-child-interaction is theorized to be a mechanism in transgenerational transmission of risk. However, none of these manuscripts explicitly examined child outcome. As outlined in the previous chapters, studies investigating transgenerational effects of a maternal history of childhood abuse are rare. Consequently, the last manuscript examines transgenerational effects of a maternal HoA and maternal depression on child inhibitory performance.

4.4. Manuscript 4: "Transgenerational Effects on Child Inhibition: The Role of Maternal History of Abuse, Depression and Impulsivity"

Fuchs, A.; Führer, D.; Bierbaum, A.; Zietlow, A.; Hindi-Attar, C.; Neukel, C.; Kluczniok, D.; Kaess, M.; Kramschuster, A.; Reck, C.; Möhler, E.; Lehmkuhl, U.; Bermpohl, F.; Brunner, B.; Resch, F.; Bödeker, K. (2016). Transgenerational Effects on Child Inhibition: The Role of Maternal History of Abuse, Depression and Impulsivity (2016). Praxis der Kinderpsychologie & Kinderpsychiatrie 65, 423 – 440.

Children's level of inhibitory functioning has been shown to be positively associated with child adjustment over the course of development. Mothers exert an influence on their children's self-regulatory capabilities by interacting with them, representing a role model or creating a certain life environment (Blair et al., 2011; Bridgett, Burt, Edwards, & Deater-Deckard, 2015; Kraybill & Bell, 2013). Maternal variables such as childhood history of maltreatment or ill mental health have been shown to exert a detrimental effect on mother-child interaction, parenting behavior and the capability of providing an optimal environment for children to grow up in. It can therefore be hypothesized that offspring inhibitory performance would show associations with a maternal history of childhood abuse or depression. However, studies examining transgenerational outcomes are rare. In addition, only very few studies have used objective observational measures of child behavior, e.g. coding of emotion regulation abilities of infants (Martinez-Torteya et al., 2014). With regard to general self-regulatory abilities, there has only been one study so far examining child outcome in context of a maternal HoA, however, they did not take maternal depression into account (Henschel, de Bruin, & Möhler, 2014).

Examining a sample of 194 mothers and their 5 to 12-year-old children, we analyzed whether children of mothers with a HoA (n=30), mothers with remitted depression (n=38), mothers with a HoA and remitted depression (n=51) and children of comparison group mothers (n=75) differed in their inhibitory performance. In addition, we examined the role of maternal impulsivity. Children's level of inhibitory functioning was assessed using three subtests of the developmental neuropsychological assessment battery (NEPSY; Korkman, Kirk, & Kemp,

2007). Assignment to one of the four groups was based on recognized and valid clinical interviews (M.I.N.I; Lecrubier, Sheehan, Weiller et al., 1997; IPDE, Loranger, Janca, & Sartorius, 1997). Maternal impulsivity was measured using a self-report questionnaire (Barrat Impulsiveness Scale; Patton, Stanford, Barratt, 1995).

We hypothesized offspring inhibitory control to be lower in case of maternal depression in remission and maternal experiences of childhood abuse. Furthermore, we theorized maternal impulsivity to mediate the association between group membership and offspring inhibitory control. We also explored whether the association between group membership and inhibitory control would be stronger in case of high maternal impulsivity.

Data analyses did not reveal any group differences in children's inhibitory performance. However, we found a moderating effect of maternal impulsivity: Children whose mothers reported a history of childhood abuse and high levels of impulsivity were found to show lower levels of inhibition than children whose mothers reported a HoA and low levels of impulsivity.

In reference to the dynamic bio-psychosocial model of transgenerational transmission, this manuscript is the first to report transgenerational effects on offspring inhibitory performance. As maternal variables, maternal HoA and the psychosocial factors of maternal mental health and maternal impulsivity were included.
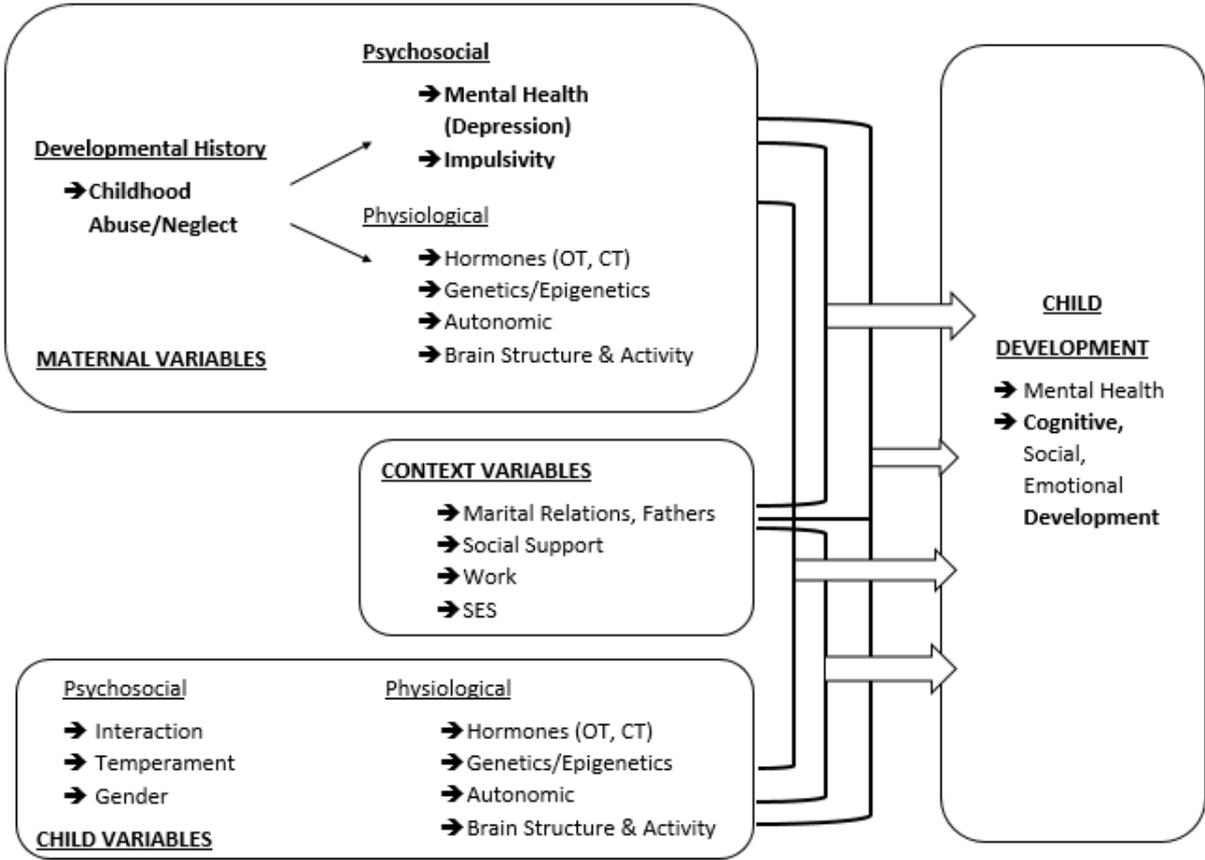

Fig. VII: A dynamic bio-psychosocial model of transgenerational transmission: Manuscript 4.

5.   Discussion

Embedded in a framework of a newly defined model of transgenerational transmission of risk, the present work aimed at overcoming some of the limitations of previous research and extending knowledge on transgenerational implications of maternal experiences of child maltreatment. It therefore focused on three main subjects:

1) Expanding knowledge regarding the role of mother-child interactional quality by applying a valid and widely used observational method, by examining longitudinal data and different offspring age groups, by highlighting child variables such as child gender and by examining not only behavioral, but also physiological levels of synchrony.

2) Investigating the interplay of a maternal HoA and maternal mental health in regard to interactional quality, thereby ensuring high quality assessment through the use of clinical interviews and observational methods.

3) Enhancing knowledge on transgenerational effects of a maternal HoA with regard to offspring inhibition.

Illuminating maternal characteristics of the dynamic bio-psycho-social model of transgenerational transmission of risk, this work shows that in a sample with on average low levels of psychopathology, a maternal HoA was associated with less emotional availability in mother-child interaction (Manuscript No.1). Results reported in the second manuscript focusing on women with a HoA and/or depression in remission show that depression exerts a detrimental effect on emotional availability in mother-child-interaction. They also show that there is an additive effect of severe maltreatment experiences. Consequently, the data support the hypothesis that a maternal HoA has adverse long-term consequences in terms of caregiving quality and mother-child interaction. In both studies, maternal psychopathology was included, firstly, by examining the general level of current psychopathology using a maternal self-report questionnaire, and secondly, using a detailed clinical assessment, an interview conducted by experienced clinicians, focusing on maternal depression.

Interestingly, in the first study, although there were differences between both groups regarding self-reported level of psychopathological symptoms, maternal mental health did not significantly influence the dyad's quality of emotional exchange over and above maternal maltreatment history. Due to the use of self-report questionnaires, it can't be ruled out that response bias or a limited ability to self-reflect might have affected the results. However, mothers from the CG reported significantly lower levels of symptoms than mothers from the MG, which was to be expected (see chapter 2.1.1.1. for further details on the association between HoA and mental health) and reduces the probability of the result being caused by

methodological errors or maternal misjudgment. It might be more likely that the findings are sample specific, as we examined a community-based sample with high levels of social support reporting mostly low or average levels of psychological distress. It is therefore possible that a limited range or a low average symptom severity may have produced weak associations between psychopathological symptoms and EA.

Focusing on the investigation of physiological variables playing a role in transgenerational transmission of risk, the study reported in manuscript No.3 is the first to examine adrenocortical attunement in a sample of mothers with a HoA and a comparison group. By highlighting alterations in physiological synchrony, this work expands the width in transmission research by adding a physiological aspect of mother-child interactional mechanisms. However, important questions still remain unanswered. It is theorized that higher levels of physiological attunement are associated with positive developmental outcome in offspring, as it has been shown to be the case for behavioral synchrony (Feldman, 2012), but empirical evidence supporting this hypothesis is lacking. Especially in mothers with a HoA, who have been shown to display dysregulated HPA-functioning, question arises whether a strong coupling between mother and child is still beneficial. Further research is needed to determine the role, valence and longitudinal pathways of physiological attunement in child development.

Referring to the model of transgenerational transmission of risk, manuscripts No.1 and No.3 in particular point out the importance of focusing not only on maternal variables but also factoring in child characteristics. Focusing on the effects of a maternal HoA on mother-child interactional quality (No.1), results show an interaction between maternal HoA and child age, thereby indicating a role of child developmental status and underlining the need for further longitudinal studies. Examining alterations in physiological synchrony in mothers with a HoA (No.3), data once again suggest child factors to play a compelling role, as there was a significant interaction between a maternal HoA and child gender. Consequently, results from this work encourage further research to focus on child variables in the context of transgenerational transmission of risk.

Lastly, highlighting transgenerational effects on child outcome, the study on child inhibitory control reported in manuscript No.4 is the first to describe transmission processes taking into account maternal HoA, maternal remitted depression, maternal impulsivity and observed child inhibitory control. There was no direct effect of a maternal HoA on child inhibitory performance, which is in line with the only study examining associations between maternal HoA and child self-regulation (Henschel et al., 2013). However, by taking into account maternal impulsivity as an additional maternal variable, transgenerational effects of a maternal HoA were revealed: Children of HoA-mothers who also reported high levels of

impulsivity were found to make more mistakes in inhibition tasks than children whose mothers reported a HoA and low levels of impulsivity. This was not the case for children of mothers with depression in remission. These data add to the few existing results on child outcome in a transgenerational framework. They portray the complex interplay of multiple factors influencing child development, and underline the need for further investigation of these complex interactions.

Summing up, in reference to the dynamic bio-psycho-social model of transgenerational transmission of risk, this work included the examination of maternal and child variables as well as child developmental outcome. On this basis, it underlines the importance of maternal childhood histories in the context of mother-child interaction. It also uncovers the significance of child characteristics. Furthermore, it adds a new perspective to the behavioral focus of mother-child interaction by describing alterations in physiological attunement in HoA-mothers and their infants. Lastly, it reports first evidence of maternal HoA and maternal impulsivity influencing child inhibitory control, thereby highlighting potential mechanisms of transgenerational transmission of adverse child outcome.

6.   Directions for future research

To overcome current methodological limitations in the field of transgenerational transmission research, future studies should ensure the use of validated instruments to assess maltreatment experiences, preferably interviews conducted by experienced clinicians, to reduce variance in measures and definitions of maternal history of maltreatment. In addition, maltreatment type, chronicity, frequency and even perpetrator identity should be assessed in detail, and following life events, e.g. victimization later in life, should be considered. Focusing on transgenerational effects, assessment of child outcome and parenting behavior will profit from multi-informant designs or video-based observational measures. Ultimately, prospective longitudinal studies will be needed to highlight transmission processes over the course of development.

Bearing in mind the bio-psychosocial model of transgenerational transmission and current state of literature, the need for a larger pool of studies examining different factors and highlighting their complex interplay becomes evident. For example, research on physiological factors regarding maternal as well as child variables is still in the early stages of development. So far, the concept of physiological synchrony has only been examined in a few studies. In addition, it might be beneficial to adapt this concept to other physiological measures known to be associated with mental health, such as autonomic activity. Genetic and epigenetic influences in the context of transgenerational transmission will be another

important question to address. Furthermore, there is a profound lack of research examining child variables such as temperament, developmental stage or gender. In line with this, context variables, especially influence of fathers, will need increased attention in future studies.

To minimize complexity, to maintain scientific orientation and to enable meaningful study designs in the future, transmission research should be guided by a theoretical framework such as the bio-psychosocial model. Increasing research efforts based on this overarching theory will help highlighting potential transmission effects and underlying pathways. Results obtained will build the foundation on which efficient prevention and intervention programs can be developed.

7. Clinical Implications

Referring to the introduction of this work, we now know that there is by no means "an unbroken line in the repetition of parental abuse" (Steele, 1976, p. 15; cited in Belsky, 1993)". However, mothers who have experienced child abuse and neglect might be struggling harder to care for their children adequately and give them the emotional support they need. In addition, they are at higher risk for poor mental health, which has been shown to exert detrimental effects on child development. Consequently, mother-child interactional quality and maternal mental health are important pathways in transgenerational transmission of risk and should be targets of prevention and intervention efforts. The early metaphor of "ghosts in the nursery" (Fraiberg, Adelson, & Shapiro, 1975) set off the development of infant-parent psychotherapy, aiming at guiding the mother to a new understanding of herself and her baby and restoring the positive developmental impact of the mother-child relationship (Lieberman et al., 2011). Video feedback and micro-analytic approaches are now in use to sensitize mothers to her child's signals and to teach them to respond adequately (Feldman, 2012). There are several validated parent-child-treatment programs that have been shown to improve interactional quality (e.g. Parent–Child Interaction Therapy, Chaffin et al., 2004 or Triple P-Positive Parenting Program, Sanders, 1999) in both healthy and clinical samples (Field, 1998). Evidence suggests intervention efforts to be most effective using only a limited number of sessions and a clear-cut behavioral focus (Bakermans-Kranenburg, Van Ijzendoorn, & Juffer, 2003). However, even though the efforts needed are manageable, those programs are rarely implemented in clinical practice. Focusing on interventions regarding maternal mental health, especially in case of maternal depression, studies show small to moderate effects of maternal treatment on well-being of their children (Cuijpers, Weitz, Karyotaki, Garber, & Andersson, 2015). However, complementary interventions addressing

psychopathology as well as mother-child-relationship might be the optimal approach (Forman et al., 2007).

Looking at the complexity of the abovementioned dynamic bio-psychosocial model of transgenerational transmission, it would be short-sighted to only focus on included variables as risk factors. They also represent a variety of targets of prevention and intervention, ranging from promoting the mother-child relationship or supporting maternal mental health to improving social conditions that make life difficult and put the children even more at risk (Belsky, 1993). Other approaches are based on findings on father's buffering role, teaching them skills for engaging in interactions with their children and conducting triadic family interactions (Feldman, 2012). Furthermore, some authors have pointed out the potential reversibility of alterations in stress response and brain functioning, implicating intervention efforts might be helpful not only by targeting behavioral, but also physiological consequences of a maternal HoA (Bernard et al., 2015; McCrory et al., 2010). In the long run, high-quality research on transgenerational transmission pathways, outcomes, risk and buffering factors should build the foundation through which effective prevention and intervention programs can be developed and usefully implemented. On this basis, the adverse cycle of transmission of risk could hopefully be broken.

References

Ainsworth, M. S. (1979). Infant–mother attachment. *American Psychologist*, *34*(10), 932.

Ammerman, R. T., Shenk, C. E., Teeters, A. R., Noll, J. G., Putnam, F. W., & Van Ginkel, J. B. (2012). Impact of depression and childhood trauma in mothers receiving home visitation. *Journal of Child and Family Studies*, *21*(4), 612–625.

Anderson, D. I., Campos, J. J., Witherington, D. C., Dahl, A., Rivera, M., He, M., … Barbu-Roth, M. (2013). The role of locomotion in psychological development. *Frontiers in Psychology*, *4*. Retrieved from http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3719016/

Arriola, K. R., Louden, T., Doldren, M. A., & Fortenberry, R. M. (2005). A meta-analysis of the relationship of child sexual abuse to HIV risk behavior among women. *Child Abuse & Neglect*, *29*(6), 725–746.

Bailey, H. N., DeOliveira, C. A., Wolfe, V. V., Evans, E. M., & Hartwick, C. (2012). The impact of childhood maltreatment history on parenting: A comparison of maltreatment types and assessment methods. *Child Abuse & Neglect*, *36*(3), 236–246.

Bakermans-Kranenburg, M. J., & van IJzendoorn, M. H. (2008). Oxytocin receptor (OXTR) and serotonin transporter (5-HTT) genes associated with observed parenting. *Social Cognitive and Affective Neuroscience*, *3*(2), 128–134.

Bakermans-Kranenburg, M. J., Van Ijzendoorn, M. H., & Juffer, F. (2003). Less is more: meta-analyses of sensitivity and attachment interventions in early childhood. *Psychological Bulletin*, *129*(2), 195.

Banyard, V. L. (1997). The impact of childhood sexual abuse and family functioning on four dimensions of women's later parenting. *Child Abuse & Neglect*, *21*(11), 1095–1107.

Begle, A. M., Dumas, J. E., & Hanson, R. F. (2010). Predicting child abuse potential: An empirical investigation of two theoretical frameworks. *Journal of Clinical Child & Adolescent Psychology*, *39*(2), 208–219.

Belsky, J. (1984). The determinants of parenting: A process model. *Child Development*, 83–96.

Belsky, J. (1993). Etiology of child maltreatment: A developmental€ cological analysis. *Psychological Bulletin*, *114*(3), 413.

Belsky, J., Bakermans-Kranenburg, M. J., & Van IJzendoorn, M. H. (2007). For better and for worse differential susceptibility to environmental influences. *Current Directions in Psychological Science*, *16*(6), 300–304.

Belsky, J., & Pluess, M. (2009). Beyond diathesis stress: differential susceptibility to environmental influences. *Psychological Bulletin*, *135*(6), 885.

Berlin, L. J., Appleyard, K., & Dodge, K. A. (2011). Intergenerational continuity in child maltreatment: Mediating mechanisms and implications for prevention. *Child Development*, *82*(1), 162–176.

Bernard, K., Dozier, M., Bick, J., & Gordon, M. K. (2015). Intervening to enhance cortisol regulation among children at risk for neglect: results of a randomized clinical trial. *Development and Psychopathology*, *27*(3), 829–841.

Bernstein, D. P., & Fink, L. F. (1999). Childhood Trauma Questionnaire (CTQ). San Antonio: Psychological Corporation.

Bert, S. C., Guner, B. M., & Lanzi, R. G. (2009). The influence of maternal history of abuse on parenting knowledge and behavior. *Family Relations*, *58*(2), 176–187.

Bifulco, A., Brown, G. W., & Harris, T. O. (1994). Childhood Experience of Care and Abuse (CECA): a retrospective interview measure. *Journal of Child Psychology and Psychiatry*, *35*(8), 1419–1435.

Bifulco, A., Moran, P. M., Ball, C., Jacobs, C., Baines, R., Bunn, A., & Cavagin, J. (2002). Childhood adversity, parental vulnerability and disorder: examining inter-generational transmission of risk. *Journal of Child Psychology and Psychiatry*, *43*(8), 1075–1086.

Biringen. (2008). *The Emotional Availability (EA) Scales, 4th edition.* PO Box, 3625, Boulder, Colorado 80307: emotionalavailability.com.

Biringen, Z., Derscheid, D., Vliegen, N., Closson, L., & Easterbrooks, M. (2014). Emotional availability (EA): Theoretical background, empirical research using the EA Scales, and clinical applications. *Developmental Review*, *34*(2), 114–167.

Biringen, Z., & Easterbrooks, M. (2012). Emotional availability: concept, research, and

window on developmental psychopathology. *Development and Psychopathology*,

24(1), 1–8.

Biringen, Z., Emde, R. N., Brown, D., Lowe, L., Myers, S., & Nelson, D. (1999). Emotional

availability and emotion communication in naturalistic mother-infant interactions:

Evidence for gender relations. *Journal of Social Behavior and Personality*, *14*(4),

463–478.

Biringen, Z., Matheny, A., Bretherton, I., Renouf, A., & Sherman, M. (2000). Maternal

representation of the self as parent: Connections with maternal sensitivity and

maternal structuring. *Attachment & Human Development*, *2*(2), 218–232.

Biringen, Z., Robinson, J. L., & Emde, R. N. (1998). Manual for scoring the emotional

availability scales. *Unpublished Manuscript*.

Blair, C., Granger, D. A., Willoughby, M., Mills-Koonce, R., Cox, M., Greenberg, M. T., …

Fortunato, C. K. (2011). Salivary cortisol mediates effects of poverty and parenting on

executive functions in early childhood. *Child Development*, *82*(6), 1970–1984.

Bornstein, M. H. (2013). Mother-infant attunement: A multilevel approach via body, brain, and

behavior. *The Infant Mind: Origins of the Social Brain*, 266–298.

Bornstein, M. H., Gini, M., Putnick, D. L., Haynes, O. M., Painter, K. M., Suwalsky, & TD, J.

(2006). Short-term reliability and continuity of emotional availability in mother–child

dyads across contexts of observation. *Infancy*, *10*(1), 1–16.

Bornstein, M. H., Suwalsky, J. T., Putnick, D. L., Gini, M., Venuti, P., de Falco, S., … de

Galperín, C. Z. (2010). Developmental continuity and stability of emotional availability

in the family: Two ages and two genders in child-mother dyads from two regions in

three countries. *International Journal of Behavioral Development*, *34*(5), 385–397.

Bosquet Enlow, M., Englund, M. M., & Egeland, B. (2016). Maternal Childhood Maltreatment

History and Child Mental Health: Mechanisms in Intergenerational Effects. *Journal of

Clinical Child & Adolescent Psychology*, 1–16.

Brand, S. R., Brennan, P. A., Newport, D. J., Smith, A. K., Weiss, T., & Stowe, Z. N. (2010). The impact of maternal childhood abuse on maternal and infant HPA axis function in the postpartum period. *Psychoneuroendocrinology*, *35*(5), 686–693.

Brazelton, T. B., Koslowski, B., & Main, M. (1974). The origins of reciprocity: The early mother-infant interaction. Retrieved from http://psycnet.apa.org/psycinfo/1974-22730-007

Bretherton, I. (1985). Attachment theory: Retrospect and prospect. *Monographs of the Society for Research in Child Development*, 3–35.

Bridgett, D. J., Burt, N. M., Edwards, E. S., & Deater-Deckard, K. (2015). Intergenerational transmission of self-regulation: A multidisciplinary review and integrative conceptual framework. *Psychological Bulletin*, *141*(3), 602.

Briere, J., & Jordan, C. E. (2009). Childhood maltreatment, intervening variables, and adult psychological difficulties in women an overview. *Trauma, Violence, & Abuse*, *10*(4), 375–388.

Brown, J., Cohen, P., Johnson, J. G., & Smailes, E. M. (1999). Childhood abuse and neglect: specificity of effects on adolescent and young adult depression and suicidality. *Journal of the American Academy of Child & Adolescent Psychiatry*, *38*(12), 1490–1496.

Burkett, L. P. (1991). Parenting behaviors of women who were sexually abused as children in their families of origin. *Family Process*, *30*(4), 421–434.

Caspi, A., McClay, J., Moffitt, T. E., Mill, J., Martin, J., Craig, I. W., … Poulton, R. (2002). Role of genotype in the cycle of violence in maltreated children. *Science*, *297*(5582), 851–854.

Chaffin, M., Silovsky, J. F., Funderburk, B., Valle, L. A., Brestan, E. V., Balachova, T., … Bonner, B. L. (2004). Parent-child interaction therapy with physically abusive parents: efficacy for reducing future abuse reports. *Journal of Consulting and Clinical Psychology*, *72*(3), 500.

Cicchetti, D., & Lynch, M. (1993). Toward an ecological/transactional model of community

violence and child maltreatment: Consequences for children's development.

Psychiatry, *56*(1), 96–118.

Claridge, A. M., Lettenberger-Klein, C. G., Farineau, H. M., Wojciak, A. S., & McWey, L. M.

(2014). Maternal history of victimization and adolescent behaviors: Protective function

of relationship quality among at-risk mother-adolescent dyads. *Journal of Family*

Violence, *29*(5), 473–482.

Cohen, L. R., Hien, D. A., & Batchelder, S. (2008). The impact of cumulative maternal trauma

and diagnosis on parenting behavior. *Child Maltreatment*, *13*(1), 27–38.

Collishaw, S., Dunn, J., O'Connor, T. G., & Golding, J. (n.d.). the Avon Longitudinal Study of

Parents and Children Study Team (2007)'Maternal childhood abuse and offspring

adjustment over time'. *Development and Psychopathology*, *19*(2), 367–383.

Cuijpers, P., Weitz, E., Karyotaki, E., Garber, J., & Andersson, G. (2015). The effects of

psychological treatment of maternal depression on children and parental functioning:

a meta-analysis. *European Child & Adolescent Psychiatry*, *24*(2), 237–245.

Davis, D. A., Luecken, L. J., & Zautra, A. J. (2005). Are reports of childhood abuse related to

the experience of chronic pain in adulthood?: a meta-analytic review of the literature.

The Clinical Journal of Pain, *21*(5), 398–405.

Delker, B. C., Noll, L. K., Kim, H. K., & Fisher, P. A. (2014). Maternal abuse history and self-

regulation difficulties in preadolescence. *Child Abuse & Neglect*, *38*(12), 2033–2043.

Desai, S., Arias, I., Thompson, M. P., & Basile, K. C. (2002). Childhood victimization and

subsequent adult revictimization assessed in a nationally representative sample of

women and men. *Violence and Victims*, *17*(6), 639–653.

DiLillo, D., & Damashek, A. (2003). Parenting characteristics of women reporting a history of

childhood sexual abuse. *Child Maltreatment*, *8*(4), 319–333.

Dixon, L., Browne, K., & Hamilton-Giachritsis, C. (2005). Risk factors of parents abused as

children: a mediational analysis of the intergenerational continuity of child

maltreatment (Part I). *Journal of Child Psychology and Psychiatry*, *46*(1), 47–57.

Dube, S. R., Anda, R. F., Whitfield, C. L., Brown, D. W., Felitti, V. J., Dong, M., & Giles, W. H. (2005). Long-term consequences of childhood sexual abuse by gender of victim. *American Journal of Preventive Medicine*, *28*(5), 430–438.

Dubowitz, H., Black, M. M., Kerr, M. A., Hussey, J. M., Morrel, T. M., Everson, M. D., & Starr, R. H. (2001). Type and timing of mothers' victimization: effects on mothers and children. *Pediatrics*, *107*(4), 728–735.

Edwards, V. J., Holden, G. W., Felitti, V. J., & Anda, R. F. (2003). Relationship between multiple forms of childhood maltreatment and adult mental health in community respondents: results from the adverse childhood experiences study. *American Journal of Psychiatry*, *160*(8), 1453–1460.

Egeland, B., Bosquet, M., & Chung, A. L. (2002). Continuities and discontinuities in the intergenerational transmission of child maltreatment: Implications for breaking the cycle of abuse. *Early Prediction and Prevention of Child Abuse: A Handbook*, 217–232.

Egeland, B., Jacobvitz, D., & Sroufe, L. A. (1988). Breaking the cycle of abuse. *Child Development*, 1080–1088.

Ehrensaft, M. K., Knous-Westfall, H. M., Cohen, P., & Chen, H. (2015). How does child abuse history influence parenting of the next generation? *Psychology of Violence*, *5*(1), 16.

Essex, M. J., Shirtcliff, E. A., Burk, L. R., Ruttle, P. L., Klein, M. H., Slattery, M. J., … Armstrong, J. M. (2011). Influence of early life stress on later hypothalamic–pituitary–adrenal axis functioning and its covariation with mental health symptoms: a study of the allostatic process from childhood into adolescence. *Development and Psychopathology*, *23*(4), 1039–1058.

Fearon, R. P., Bakermans-Kranenburg, M. J., Van IJzendoorn, M. H., Lapsley, A.-M., & Roisman, G. I. (2010). The significance of insecure attachment and disorganization in the development of children's externalizing behavior: a meta-analytic study. *Child Development*, *81*(2), 435–456.

Feldman, R. (2007). Parent–infant synchrony and the construction of shared timing; physiological precursors, developmental outcomes, and risk conditions. *Journal of Child Psychology and Psychiatry*, *48*(3–4), 329–354.

Feldman, R. (2012a). Oxytocin and social affiliation in humans. *Hormones and Behavior*, *61*(3), 380–391.

Feldman, R. (2012b). Parent–infant synchrony: A biobehavioral model of mutual influences in the formation of affiliative bonds. *Monographs of the Society for Research in Child Development*, *77*(2), 42–51.

Feldman, R., & Eidelman, A. I. (2006). Neonatal state organization, neuromaturation, mother-infant interaction, and cognitive development in small-for-gestational-age premature infants. *Pediatrics*, *118*(3), e869–e878.

Felitti, V. J., Anda, R. F., Nordenberg, D., Williamson, D. F., Spitz, A. M., Edwards, V., … Marks, J. S. (1998). Relationship of childhood abuse and household dysfunction to many of the leading causes of death in adults: The Adverse Childhood Experiences (ACE) Study. *American Journal of Preventive Medicine*, *14*(4), 245–258.

Field, T. (1998). Maternal depression effects on infants and early interventions. *Preventive Medicine*, *27*(2), 200–203.

Fitzgerald, M. M., Shipman, K. L., Jackson, J. L., McMahon, R. J., & Hanley, H. M. (2005). Perceptions of parenting versus parent-child interactions among incest survivors. *Child Abuse & Neglect*, *29*(6), 661–681.

Forman, D. R., O'hara, M. W., Stuart, S., Gorman, L. L., Larsen, K. E., & Coy, K. C. (2007). Effective treatment for postpartum depression is not sufficient to improve the developing mother–child relationship. *Development and Psychopathology*, *19*(2), 585–602.

Fossati, A., Madeddu, F., & Maffei, C. (1999). Borderline personality disorder and childhood sexual abuse: a meta-analytic study. *Journal of Personality Disorders*, *13*(3), 268.

Fraiberg, S., Adelson, E., & Shapiro, V. (1975). Ghosts in the nursery: A psychoanalytic

approach to the problems of impaired infant-mother relationships. *Journal of the

American Academy of Child Psychiatry*, *14*(3), 387–421.

Franke, G. H., & Derogatis, L. R. (2002). *SCL-90-R: Symptom-Checkliste von LR Derogatis:

deutsche Version: Manual*. Beltz Test.

Fuchs, A., Möhler, E., Resch, F., & Kaess, M. (2015). Impact of a maternal history of

childhood abuse on the development of mother–infant interaction during the first year

of life. *Child Abuse & Neglect*, *48*, 179–189.

Fuchs, A., Möhler, E., Resch, F., & Kaess, M. (2016). Sex-specific differences in
adrenocortical

attunement in mothers with a history of childhood abuse and their 5-month-old boys

and girls. Journal of Neural Transmission, 1-10. doi:10.1007/s00702-016-1525-6

Gara, M. A., Allen, L. A., Herzog, E. P., & Woolfolk, R. L. (2000). The abused child as parent:

the structure and content of physically abused mothers' perceptions of their babies.

Child Abuse & Neglect, *24*(5), 627–639.

Halpern, L. F., Coll, C. T. G., Meyer, E. C., & Bendersky, K. (2001). The contributions of

temperament and maternal responsiveness to the mental development of small-for-

gestational-age and appropriate-for-gestational-age infants. *Journal of Applied

Developmental Psychology*, *22*(2), 199–224.

Hardt, J., & Rutter, M. (2004). Validity of adult retrospective reports of adverse childhood

experiences: review of the evidence. *Journal of Child Psychology and Psychiatry*,

45(2), 260–273.

Hart, H., & Rubia, K. (2012). Neuroimaging of child abuse: a critical review. *Frontiers in

Human Neuroscience*, *6*(52), 1–24.

Henschel, S., de Bruin, M., & Möhler, E. (2014). Self-control and child abuse potential in

mothers with an abuse history and their preschool children. *Journal of Child and

Family Studies*, *23*(5), 824–836.

Hibel, L. C., Granger, D. A., Blair, C., & Finegood, E. D. (2015). Maternal-child adrenocortical attunement in early childhood: Continuity and change. *Developmental Psychobiology*, *57*(1), 83–95.

Hinshaw, S. P. (2010). Developmental Psychopathology as a Scientific Discipline: Relevance to Behavioral and Emotional Disorders of Childhood and Adolescence. *Child and Adolescent Psychopathology*, 1.

Hirsh-Pasek, K., & Burchinal, M. (2006). Mother and caregiver sensitivity over time: Predicting language and academic outcomes with variable-and person-centered approaches. *Merrill-Palmer Quarterly*, *52*(3), 449–485.

Hostinar, C. E., & Gunnar, M. R. (2013). Future directions in the study of social relationships as regulators of the HPA axis across development. *Journal of Clinical Child & Adolescent Psychology*, *42*(4), 564–575.

Infurna, M. R., Reichl, C., Parzer, P., Schimmenti, A., Bifulco, A., & Kaess, M. (2016). Associations between depression and specific childhood experiences of abuse and neglect: a meta-analysis. *Journal of Affective Disorders*, *190*, 47–55.

Kaufman, J., & Zigler, E. (1987). Do abused children become abusive parents? *American Journal of Orthopsychiatry*, *57*(2), 186.

Keenan, T. (2002). Negative affect predicts performance on an object permanence task. *Developmental Science*, *5*(1), 65–71.

Kellermann, N. P. (2013). Epigenetic transmission of Holocaust Trauma: Can nightmares be inherited? *The Israel Journal of Psychiatry and Related Sciences*, *50*(1), 33.

Kellogg, N. D., Hoffman, T. J., & Taylor, E. R. (1999). Early sexual experiences among pregnant and parenting adolescents. *Adolescence*, *34*(134), 293.

Kiff, C. J., Lengua, L. J., & Zalewski, M. (2011). Nature and nurturing: Parenting in the context of child temperament. *Clinical Child and Family Psychology Review*, *14*(3), 251–301.

Koverola, C., Papas, M. A., Pitts, S., Murtaugh, C., Black, M. M., & Dubowitz, H. (2005). Longitudinal investigation of the relationship among maternal victimization,

depressive symptoms, social support, and children's behavior and development. *Journal of Interpersonal Violence*, *20*(12), 1523–1546.

Kraybill, J. H., & Bell, M. A. (2013). Infancy predictors of preschool and post-kindergarten executive function. *Developmental Psychobiology*, *55*(5), 530–538.

Landry, S. H., Smith, K. E., Swank, P. R., Assel, M. A., & Vellet, S. (2001). Does early responsive parenting have a special importance for children's development or is consistency across early childhood necessary? *Developmental Psychology*, *37*(3), 387.

Lang, A. J., Rodgers, C. S., & Lebeck, M. M. (2006). Associations between maternal childhood maltreatment and psychopathology and aggression during pregnancy and postpartum. *Child Abuse & Neglect*, *30*(1), 17–25.

Langeland, W., & Dijkstra, S. (1995). Breaking the intergenerational transmission of child abuse: Beyond the mother-child relationship. *Child Abuse Review*, *4*(1), 4–13.

Laurent, H. K., Ablow, J. C., & Measelle, J. (2011). Risky shifts: How the timing and course of mothers' depressive symptoms across the perinatal period shape their own and infant's stress response profiles. *Development and Psychopathology*, *23*(2), 521–538.

Leifer, M., Shapiro, J. P., & Kassem, L. (1993). The impact of maternal history and behavior upon foster placement and adjustment in sexually abused girls. *Child Abuse & Neglect*, *17*(6), 755–766.

Lemelin, J.-P., Tarabulsy, G. M., & Provost, M. A. (2006). Predicting preschool cognitive development from infant temperament, maternal sensitivity, and psychosocial risk. *Merrill-Palmer Quarterly (1982-)*, 779–806.

Lieberman, A. F., Chu, A., Van Horn, P., & Harris, W. W. (2011). Trauma in early childhood: Empirical evidence and clinical implications. *Development and Psychopathology*, *23*(2), 397–410.

Lomanowska, A. M., Boivin, M., Hertzman, C., & Fleming, A. S. (2015). Parenting begets parenting: A neurobiological perspective on early adversity and the transmission of parenting styles across generations. *Neuroscience*.

Lovas, G. S. (2005). Gender and patterns of emotional availability in mother–toddler and

    father–toddler dyads. *Infant Mental Health Journal*, *26*(4), 327–353.

MacMillan, H. L., Fleming, J. E., Streiner, D. L., Lin, E., Boyle, M. H., Jamieson, E., …

    Beardslee, W. R. (2001). Childhood abuse and lifetime psychopathology in a

    community sample. *American Journal of Psychiatry*. Retrieved from

    http://ajp.psychiatryonline.org/doi/abs/10.1176/appi.ajp.158.11.1878

Madigan, S., Atkinson, L., Laurin, K., & Benoit, D. (2013). Attachment and internalizing

    behavior in early childhood: A meta-analysis. *Developmental Psychology*, *49*(4), 672.

Main, M., & Goldwyn, R. (1984). Predicting rejection of her infant from mother's

    representation of her own experience: Implications for the abused-abusing

    intergenerational cycle. *Child Abuse & Neglect*, *8*(2), 203–217.

Martinez-Torteya, C., Dayton, C. J., Beeghly, M., Seng, J. S., McGinnis, E., Broderick, A., …

    Muzik, M. (2014). Maternal parenting predicts infant biobehavioral regulation among

    women with a history of childhood maltreatment. *Development and Psychopathology*,

    26(2), 379–392.

Marysko, M., Reck, C., Mattheis, V., Finke, P., Resch, F., & Moehler, E. (2010). History of

    childhood abuse is accompanied by increased dissociation in young mothers five

    months postnatally. *Psychopathology*, *43*(2), 104–109.

Matheny Jr, A. P. (1989). Temperament and cognition: Relations between temperament and

    mental test scores. Retrieved from http://psycnet.apa.org/psycinfo/1990-97271-014

Maughan, A., & Cicchetti, D. (2002). Impact of child maltreatment and interadult violence on

    children's emotion regulation abilities and socioemotional adjustment. *Child*

    Development, *73*(5), 1525–1542.

McCrory, E., De Brito, S. A., & Viding, E. (2010). Research review: the neurobiology and

    genetics of maltreatment and adversity. *Journal of Child Psychology and Psychiatry*,

    51(10), 1079–1095.

McCrory, E., De Brito, S. A., & Viding, E. (2012). The link between child abuse and psychopathology: a review of neurobiological and genetic research. *Journal of the Royal Society of Medicine*, *105*(4), 151–156.

Mileva-Seitz, V. R., Bakermans-Kranenburg, M. J., & van IJzendoorn, M. H. (2016). Genetic mechanisms of parenting. *Hormones and Behavior*, *77*, 211–223.

Min, M. O., Minnes, S., Kim, H., & Singer, L. T. (2013). Pathways linking childhood maltreatment and adult physical health. *Child Abuse & Neglect*, *37*(6), 361–373.

Miranda, J. K., de la Osa, N., Granero, R., & Ezpeleta, L. (2013). Maternal Childhood Abuse, Intimate Partner Violence, and Child Psychopathology The Mediator Role of Mothers' Mental Health. *Violence against Women*, *19*(1), 50–68.

Mitchell, S. J., Lewin, A., Rasmussen, A., Horn, I. B., & Joseph, J. G. (2010). Maternal distress explains the relationship of young African American mothers' violence exposure with their preschoolers' behavior. *Journal of Interpersonal Violence*. Retrieved from http://jiv.sagepub.com/content/early/2010/05/04/0886260510363423.abstract

Morrel, T. M., Dubowitz, H., Kerr, M. A., & Black, M. M. (2003). The effect of maternal victimization on children: A cross-informant study. *Journal of Family Violence*, *18*(1), 29–41.

Myhre, M. C., Dyb, G. A., Wentzel-Larsen, T., Grøgaard, J. B., & Thoresen, S. (2014). Maternal childhood abuse predicts externalizing behaviour in toddlers: a prospective cohort study. *Scandinavian Journal of Public Health*, *42*(3), 263–269.

Norman, R. E., Byambaa, M., De, R., Butchart, A., Scott, J., & Vos, T. (2012). The long-term health consequences of child physical abuse, emotional abuse, and neglect: a systematic review and meta-analysis. *PLoS Med*, *9*(11), e1001349.

Nuttall, A. K., Valentino, K., Wang, L., Lefever, J. B., & Borkowski, J. G. (2015). Maternal history of parentification and warm responsiveness: The mediating role of knowledge of infant development. *Journal of Family Psychology*, *29*(6), 863.

Oshri, A., Sutton, T. E., Clay-Warner, J., & Miller, J. D. (2015). Child maltreatment types and risk behaviors: Associations with attachment style and emotion regulation dimensions. *Personality and Individual Differences*, *73*, 127–133.

Paolucci, E. O., Genuis, M. L., & Violato, C. (2001). A meta-analysis of the published research on the effects of child sexual abuse. *The Journal of Psychology*, *135*(1), 17–36.

Patton, J. H., Stanford, M. S., Barratt, E. S. (1995). Factor structure of the Barratt impulsiveness scale. *Journal of clinical psychology*, 51, 768-774.

Pears, K. C., & Capaldi, D. M. (2001). Intergenerational transmission of abuse: a two-generational prospective study of an at-risk sample. *Child Abuse & Neglect*, *25*(11), 1439–1461.

Phelps, J. L., Belsky, J., & Crnic, K. (1998). Earned security, daily stress, and parenting: A comparison of five alternative models. *Development and Psychopathology*, *10*(1), 21–38.

Plant, D. T., Barker, E. D., Waters, C. S., Pawlby, S., & Pariante, C. M. (2013). Intergenerational transmission of maltreatment and psychopathology: the role of antenatal depression. *Psychological Medicine*, *43*(3), 519–528.

Putnam, F. W. (2003). Ten-year research update review: Child sexual abuse. *Journal of the American Academy of Child & Adolescent Psychiatry*, *42*(3), 269–278.

Putnam, F. W. (2006). The impact of trauma on child development. *Juvenile and Family Court Journal*, *57*(1), 1–11.

Rijlaarsdam, J., Stevens, G. W., Jansen, P. W., Ringoot, A. P., Jaddoe, V. W., Hofman, A., … Tiemeier, H. (2014). Maternal childhood maltreatment and offspring emotional and behavioral problems maternal and paternal mechanisms of risk transmission. *Child Maltreatment*, 1077559514527639.

Riser, D. (2009). *Parent Trauma History and Parenting Style: Relation to Child Trauma and Child Psychopathology*. Virginia Polytechnic Institute and State University. Retrieved from http://theses.lib.vt.edu/theses/available/etd-05152009-142357/

Roberts, R., O'Connor, T., Dunn, J., & Golding, J. (2004). ALSPAC STUDY TEAM CHILD
ABUSE NEGLECT. *ALSPAC Study Team, Child Abuse Neglect*, *28*, 525.

Rothbart, M. K., Ellis, L. K., & Posner, M. I. (2004). Temperament and self-regulation.
Handbook of Self-Regulation: Research, Theory, and Applications, *2*, 441–460.

Rothbart, M. K., Sheese, B. E., Rueda, M. R., & Posner, M. I. (2011). Developing
mechanisms of self-regulation in early life. *Emotion Review*, *3*(2), 207–213.

Ruttle, P. L., Shirtcliff, E. A., Serbin, L. A., Fisher, D. B.-D., Stack, D. M., & Schwartzman, A.
E. (2011). Disentangling psychobiological mechanisms underlying internalizing and
externalizing behaviors in youth: Longitudinal and concurrent associations with
cortisol. *Hormones and Behavior*, *59*(1), 123–132.

Sameroff, A. (1975). Transactional models in early social relations. *Human Development*,
18(1–2), 65–79.

Sameroff, A. (2009). *The transactional model.* American Psychological Association.
Retrieved from http://psycnet.apa.org/books/11877/001

Sameroff, A. J., & Mackenzie, M. J. (2003). Research strategies for capturing transactional
models of development: The limits of the possible. *Development and
Psychopathology*, *15*(3), 613–640.

Sanders, M. R. (1999). Triple P-Positive Parenting Program: Towards an empirically
validated multilevel parenting and family support strategy for the prevention of
behavior and emotional problems in children. *Clinical Child and Family Psychology
Review*, *2*(2), 71–90.

Saunders, H., Kraus, A., Barone, L., & Biringen, Z. (2015). Emotional availability: theory,
research, and intervention. *Frontiers in Psychology*, *6*. Retrieved from
http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4516809/

Sayal, K., Heron, J., Maughan, B., Rowe, R., & Ramchandani, P. (2014). Infant temperament
and childhood psychiatric disorder: longitudinal study. *Child: Care, Health and
Development*, *40*(2), 292–297.

Scaramella, L. V., Neppl, T. K., Ontai, L. L., & Conger, R. D. (2008). Consequences of socioeconomic disadvantage across three generations: parenting behavior and child externalizing problems. *Journal of Family Psychology*, *22*(5), 725.

Scarpa, A., & others. (2004). The effects of child maltreatment on the hypothalamic-pituitary-adrenal axis. *Trauma, Violence, & Abuse*, *5*(4), 333–352.

Schuetze, P., & Eiden, R. D. (2005). The relationship between sexual abuse during childhood and parenting outcomes: Modeling direct and indirect pathways. *Child Abuse & Neglect*, *29*(6), 645–659.

Shaffer, A., Huston, L., & Egeland, B. (2008). Identification of child maltreatment using prospective and self-report methodologies: A comparison of maltreatment incidence and relation to later psychopathology. *Child Abuse & Neglect*, *32*(7), 682–692.

Sharpe, D., & Faye, C. (2006). Non-epileptic seizures and child sexual abuse: a critical review of the literature. *Clinical Psychology Review*, *26*(8), 1020–1040.

Smith, A. L., Cross, D., Winkler, J., Jovanovic, T., & Bradley, B. (2014). Emotional dysregulation and negative affect mediate the relationship between maternal history of child maltreatment and maternal child abuse potential. *Journal of Family Violence*, *29*(5), 483–494.

Spertus, I. L., Yehuda, R., Wong, C. M., Halligan, S., & Seremetis, S. V. (2003). Childhood emotional abuse and neglect as predictors of psychological and physical symptoms in women presenting to a primary care practice. *Child Abuse & Neglect*, *27*(11), 1247–1258.

Sroufe, L. A. (2005). Attachment and development: A prospective, longitudinal study from birth to adulthood. *Attachment & Human Development*, *7*(4), 349–367.

Stanger, C., & Lewis, M. (1993). Agreement among parents, teachers, and children on internalizing and externalizing behavior problems. *Journal of Clinical Child Psychology*, *22*(1), 107–116.

Steele, B. (1976). Violence within the family. *Child Abuse and Neglect: The Family and the Community*, 3–23.

Stith, S. M., Liu, T., Davies, L. C., Boykin, E. L., Alder, M. C., Harris, J. M., … Dees, J. (2009). Risk factors in child maltreatment: A meta-analytic review of the literature. *Aggression and Violent Behavior*, *14*(1), 13–29.

Stoltenborgh, M., Bakermans-Kranenburg, M. J., Alink, L. R., & IJzendoorn, M. H. (2015). The Prevalence of Child Maltreatment across the Globe: Review of a Series of Meta-Analyses. *Child Abuse Review*, *24*(1), 37–50.

Tarullo, A. R., & Gunnar, M. R. (2006). Child maltreatment and the developing HPA axis. *Hormones and Behavior*, *50*(4), 632–639.

Teicher, M. H., Andersen, S. L., Polcari, A., Anderson, C. M., Navalta, C. P., & Kim, D. M. (2003). The neurobiological consequences of early stress and childhood maltreatment. *Neuroscience & Biobehavioral Reviews*, *27*(1), 33–44.

Thomas, A., & Chess, S. (1977). *Temperament and development.* Brunner/Mazel. Retrieved from http://psycnet.apa.org/psycinfo/1978-03178-000

Tonmyr, L., Draca, J., Crain, J., & MacMillan, H. L. (2011). Measurement of emotional/psychological child maltreatment: A review. *Child Abuse & Neglect*, *35*(10), 767–782.

van de Weijer-Bergsma, E., Wijnroks, L., & Jongmans, M. J. (2008). Attention development in infants and preschool children born preterm: A review. *Infant Behavior and Development*, *31*(3), 333–351.

Wachs, T. D. (1987). Specificity of environmental action as manifest in environmental correlates of infant's mastery motivation. *Developmental Psychology*, *23*(6), 782.

Wegman, H. L., & Stetler, C. (2009). A meta-analytic review of the effects of childhood abuse on medical outcomes in adulthood. *Psychosomatic Medicine*, *71*(8), 805–812.

Wekerle, C., Wall, A.-M., Leung, E., & Trocmé, N. (2007). Cumulative stress and substantiated maltreatment: The importance of caregiver vulnerability and adult partner violence. *Child Abuse & Neglect*, *31*(4), 427–443.

Widom, C. S. (1989). Does violence beget violence? A critical examination of the literature. *Psychological Bulletin*, *106*(1), 3.

Widom, C. S., Czaja, S. J., & DuMont, K. A. (2015). Intergenerational transmission of child

abuse and neglect: Real or detection bias? *Science*, *347*(6229), 1480–1485.

Wolff, M. S., & Ijzendoorn, M. H. (1997). Sensitivity and attachment: A meta-analysis on

parental antecedents of infant attachment. *Child Development*, *68*(4), 571–591.

Yehuda, R., Spertus, I. L., & Golier, J. A. (2001). Relationship between childhood traumatic

experiences and PTSD in adults. *PTSD in Children and Adolescents*, 117–158.

Zalewski, M., Cyranowski, J. M., Cheng, Y., & Swartz, H. A. (2013). Role of maternal

childhood trauma on parenting among depressed mothers of psychiatrically ill

children. *Depression and Anxiety*, *30*(9), 792–799.

Zingraff, M. T., Leiter, J., Myers, K. A., & Johnsen, M. C. (1993). CHILD MALTREATMENT

AND YOUTHFUL PROBLEM BEHAVIOR*. *Criminology*, *31*(2), 173–202.

Zuravin, S. J., & Fontanella, C. (1999). Parenting behaviors and perceived parenting

competence of child sexual abuse survivors. *Child Abuse & Neglect*, *23*(7), 623–632.

Impact of a maternal history of childhood abuse on the development of mother-infant interaction during the first year of life

Fuchs, A., Moehler, E., Resch, F., Kaess, M.

Short:

Childhood abuse affects emotional availability

Affiliations:

Anna Fuchs, Prof. Eva Moehler, Prof. Franz Resch, and PD Dr. Michael Kaess are affiliated to the Department of Child and Adolescent Psychiatry, University of Heidelberg, Blumenstr.8, 69115 Heidelberg, Germany.

Anna Fuchs, Dipl. Psych.

Department of Child and Adolescent Psychiatry, Centre for Psychosocial Medicine,

University of Heidelberg, Blumenstr.8, 69115 Heidelberg

Telephone: 49/6221/5639087, Fax: 49/6221/566941

E-Mail: anna.fuchs@med.uni-heidelberg.de

Abstract

The aim of this study was to examine the impact of a maternal history of abuse on mother-infant interaction (emotional availability; EA) in infancy and early toddlerhood. Over an 18-month period, women giving birth to a child in the local obstetric units were screened using the Childhood Trauma Questionnaire. Women who reported moderate or severe sexual and/or physical abuse were included in the maltreatment group (n=58; MG) and compared with a non-maltreated comparison group (n=61; CG). EA was investigated under experimental conditions when the children were 5 and 12 months of age using the Emotional Availability Scales. While mother-child dyads in the MG showed only very discrete interactional alterations at an infant age of 5 months, their EA differed significantly from the CG at 12 months due to the lack of an increase in EA observed in the MG. Exploratory analyses showed an additional effect of emotional abuse on EA at 12 months. These data indicate that the period when child locomotion develops might represent a critical time window for mothers with a history of abuse. Our results constitute an advance in research on child abuse as they identify a possible time window of non-normative alteration in mother-child interaction. This period could be targeted by strategies to prevent intergenerational transmission of abusive experiences.

Impact of a maternal history of childhood abuse on the development of mother-child interaction during the first year of life

Over the last few decades, childhood maltreatment and its adverse consequences for the individual have been identified as a major public health problem (Norman, Byambaa, De, Butchart, Scott, Vos, 2012). In this context, researchers have also been focusing on a potential transgenerational transmission of childhood maltreatment experiences, embedding corresponding results in a "cycle of abuse" framework. Here, having experienced abuse in childhood increases the risk of perpetrating child maltreatment later as a parent (Egeland, Jacobvitz, & Sroufe, 1988; Widom, 1989). Many studies have provided empirical support for this hypothesis (Berlin, Appleyard, & Dodge, 2011; Dixon, Browne, & Hamilton-Giachritsis, 2005a; Egeland, Bosquet & Chung, 2002; Smith, Cross, Winkler, Jovanovic, & Bradley, 2014), but the results are still inconsistent and the exact mechanisms underlying transgenerational transmission remain unclear (Ertem, Leventhal, & Dobbs, 2000; Langeland & Dijkstra, 1995; Widom, Czaja, & DuMont, 2015).

Focusing on potential pathways, researchers have raised the question of whether experiences of childhood abuse might interfere with later parenting behavior. According to social learning theory, children who grew up without an acceptable role model of parenting might have difficulties in adopting this role themselves (Bert, Guner, & Lanzi, 2009; Pears & Capaldi, 2001). Attachment theorists discuss disadvantageous effects on the development of internal working models as prototypes for all future relationships (Banyard, 2003; Bretherton, 1985; Main & Goldwyn, 1984). Additionally, as childhood maltreatment is closely linked to higher rates of psychopathology in adulthood, symptoms could interfere with the parent's ability to provide optimal parenting - a pathway that has been found for maternal depressive symptoms in particular (DiLillo & Damashek, 2003; Martinez-Torteya et al., 2014; Norman et al., 2012; Schuetze & Das Eiden, 2005). Recently, research has started to highlight the significance of emotion regulation in parenting, which has been shown to be affected by early maltreatment experiences (Briere & Jordan, 2009; Maughan & Cicchetti, 2002; Oshri, Sutton,

Clay-Warner, & Miller, 2015). Mothers who are having trouble regulating their own emotions might show maladaptive strategies in parenting situations, such as aggression or withdrawal (Ehrensaft, Knous-Westfall, Cohen, & Chen, 2015). Supporting this line of reasoning, Smith et al. (2014) were able to show that the relationship between maternal experience of child abuse and later child abuse potential was mediated by maternal emotional dysregulation and negative affect reported in the context of mother-child interaction (Smith et al., 2014). Other results suggest that, especially under stress conditions, physically abused mothers may focus less on their babies ("filtering-out") (Gara, Allen, Herzog, & Woolfolk, 2000). In their review, DiLillo and Damashek (2003) concluded that mothers who had experienced sexual abuse in their childhood seem to be more emotionally distant towards their children.

Research results on effects of maternal maltreatment experiences on mother-child interaction have been inconsistent, which is partly attributable to methodological differences, such as diversity in how maltreatment and interactional quality were measured. Many studies utilized self-report measures to assess parenting behavior, finding significant associations between maternal history of abuse and reported impaired mother-child interaction (e.g. Banyard, 1997; Bert, Guner, & Lanzi, 2009; Dubowitz et al., 2001). Yet, the use of self-reported data on parenting behavior is controversial, especially so in research on victims of maltreatment. Traumatizing childhood events have been associated with avoidant coping strategies in particular, such as dissociation, substance abuse, or tension-reduction behaviors (Briere & Jordan, 2009; Marysko et al., 2010). These strategies could prevent memories and experiences from being integrated, thereby possibly evoking a limited ability to reflect on interpersonal relationships (Bailey, Moran, & Pederson, 2007; Bailey et al., 2012). However, only a few studies so far have applied observational measures of parenting (e.g., Dixon, Hamilton-Giachritsis, & Browne, 2005b; Lyons-Ruth & Block, 1996).

A framework that focuses specifically on the emotional context in mother-child interactions and in which emotional availability in mother-child-interaction can be observationally assessed is represented by Biringen's concept of "Emotional Availability" (EA; Biringen, Robinson, & Emde, 1998). EA is a global or holistic judgment by which the observer

uses contextual cues and clinical judgment to infer the appropriateness of behaviors (Biringen, et al., 2005). It focuses on the emotional exchange between mother and child and refers to the emotional signaling of the parent to the child as well as the signaling of the child to the parent. High scores indicate adequate maternal emotion regulation since "leakage" or open expression of negative emotions would result in lower scoring (Biringen, 2000; Biringen, Robinson, & Emde, 1998). EA has only been examined in a few populations at risk, such as mothers with substance use difficulties or low-income, single mothers (Biringen, Derscheid, Vliegen, Closson, & Easterbrooks, 2014; Easterbrooks, Bureau, and Lyons-Ruth, 2012; Stack et al., 2012). To the best of our knowledge, only two studies have focused on the associations between maternal history of abuse and EA. Results from a sample of first-time mothers under the age of 21 indicate that mothers who report a history of physical abuse show less optimal structuring, less sensitivity, and more hostility while playing with their 18-month-old toddlers (Driscoll & Easterbrooks, 2007). In a sample of 93 mothers and their 4- to 6-year-old children, Bailey et al. (2012) did not find associations between EA and physical/sexual abuse, but neglect, emotional maltreatment, witnessing family violence, and signs of hostility proved to be significantly related to maternal hostility. They suggested that, since studies on physical and sexual abuse rarely controlled for other forms of maltreatment, some effects might be due to other co-occurring forms of maltreatment (Bailey et al., 2012).

However, not only maternal characteristics can exert an influence on the emotional exchange between mother and child. Beginning in the latter half of the child's first year, the developmental milestone of locomotion changes the relation between the infant and its environment dramatically (Anderson et al., 2013). The child discovers a sense of autonomy and control, which creates challenges for parents, such as balancing the need to encourage exploration while discouraging hazards. Additionally, acquisition of locomotion plays an important role in forming an attachment relationship since it is one precondition for a child to proactively seek proximity (Campos et al, 2000). Biringen et al. (1995) reported data from a community-based sample in which communication between mothers and their children was marked not only by more negative clashes, but also by more positive exchanges in a group of

children with more walking experience compared to a group of children with less walking experience. The authors suggested continuing research in clinical samples since mothers in high-risk dyads might react differently to the child's separation from the mother (Biringen, Emde, Campos, & Appelbaum, 1995). For mothers with a history of abuse, it could be particularly challenging to experience their children developing some sort of independence and autonomy. For them, a sense of loss of control might emerge, a situation in which the abused mother might experience again her own helplessness and victimization through interactions with the child (Moehler, Resch, Cierpka, & Cierpka, 2001).

Considering the potential influence of the child's development on the quality of interaction between mother and child, there is a significant lack of knowledge about the trajectory of EA over the course of development since only a few studies so far have used longitudinal designs (Biringen et al., 2014). Additionally, most studies focused on low-risk community samples and an older age group (Biringen et al., 1999; Biringen, Matheny, Bretherton, Renouf, & Sherman, 2000; Bornstein et al., 2010; Bornstein et al., 2006; Lovas, 2005). Bornstein et al. (2010) examined dyads between 5 and 20 months of age and reported discontinuity in sensitivity, structuring, and intrusiveness, arguing that toddlers crossing the threshold to locomotion might set the stage for enhanced emotional exchange in the dyad (Bornstein et al., 2010). Biringen et al. (1999) found an increase in a mother's sensitivity and child's involvement over the course of the child's first 12 months of life (Biringen et al., 1999). In terms of at-risk samples, two studies have assessed groups of low-income mothers and their children during their first year, reporting divergent results: Stack et al. (2012) reported stability and Howes and Obregon (2009) an increase in EA (Howes & Obregon, 2009; Stack et al., 2012). However, Howes and Obregons' sample consisted of highly sensitive mothers reporting positive psychosocial functioning and low levels of stress, which could have buffered negative effects on interactional quality. To the best of our knowledge, our study is the first to report longitudinal EA data in a sample of mothers with a history of childhood abuse.

In summary, it is possible that coercive parent-child interactions may actively contribute to the cycle of abuse, but the mechanisms underlying these relational disturbances are as yet

poorly understood. Observational data and, in particular, analysis of the emotional context of mother-infant interaction in critical dyads should be applied as a useful tool to identify early risk factors. Furthermore, there is a need for continuing investigation of the developmental pathway of EA especially in the context of at-risk populations such as victims of childhood abuse. The analysis of time effects and potential windows of interactional deterioration as a result of childhood maltreatment may consequently contribute to an enhanced understanding of the cycle of abuse, and thereby facilitate abuse prevention by treating pervasive and severe interactional disturbances.

A first study phase at the child's age of 5 months failed to reveal significant differences in EA between mothers with a history of abuse and the CG. Since mothers with a history of abuse might react differently to the child's increasing autonomy, it was hypothesized that, at 12 months, there would be a difference in EA between mothers with a history of maltreatment and CG mothers. As previous results indicate increasing scores in EA for low-risk mothers and stagnating scores for high-risk samples, we expected improvement in EA for CG mothers from 5-12 months and no significant changes in EA for mothers with experiences of childhood maltreatment.

Methods

Participant Recruitment

Before potential participants were approached, the study was approved by the Ethics Committee of the Faculty of Medicine. For an 18-month period, all women giving birth to a child in the cities of Heidelberg and Mannheim, Germany, were contacted by mail (N = 2001). They were presented with an information sheet about the study and a respective consent form, a sociodemographic questionnaire, and the Childhood Trauma Questionnaire (CTQ; Bernstein & Fink, 1999). Written informed consent was obtained from all participating women before study inclusion. Women whose children were born as singleton, term babies (>37th week) with APGAR scores >7 were eligible to participate in the study. Twins and infants < 2500g were excluded.

Out of 2001 mothers who were contacted by mail, 748 completed the CTQ questionnaire (37.4%), and 73 (9.8%) of those scored above the cut-off for moderate-to-severe physical (score > 9) or sexual (score > 7) abuse. Out of these, six had infants who did not meet eligibility criteria (APGAR, birth weight, and date), four had children with repeated infections or acute illnesses preventing them from participating, and six declined for lack of time. Thus, 58 mother-infant pairs were included to form the maltreatment group (MG). From the remaining 675 mothers who scored below the cut-off for moderate to severe physical or sexual abuse, 417 mothers were excluded from the comparison group (CG) because their scores fell in the intermediate group of minor to moderate abuse. Out of the remaining 258 mothers with a score of 0 for sexual or physical abuse, matching was performed according to the following criteria, ordered in priorities: child gender, maternal marital status and education, and number of siblings, resulting in a CG of 61 mothers. The final sample consisted of 58 mothers with a history of abuse (MG) and 61 comparison mothers (CG).

The total sample consisted of N=119 mothers and their children: 63 (53%) of them were boys, and 56 (47%) were girls. At 12 months, all children had developed mobility and were at least able to crawl. Most mothers were highly educated, with 49 (41.2 %) of them reporting to have finished grammar school, and 40 of them (33.6%) reporting to have achieved a university degree. Moreover, 113 (95 %) lived in a stable relationship with the child's father, two lived in a relationship with someone else, and four of them reported being single.

Measures

Maternal History of Abuse. A history of childhood physical or sexual abuse was assessed by the German version (Driessen et al., 2000) of the Childhood Trauma Questionnaire (CTQ; Bernstein & Fink, 1999). The CTQ is a self-administered questionnaire with 28 items that quantifies the frequency of abusive experiences on a 5-point sale, ranging from 0, never, to 5, very often. Different types of childhood trauma are operationalized on five subscales (emotional abuse, physical abuse, sexual abuse, emotional neglect, and physical neglect). Subjects are asked to rate the frequency of abusive experiences during their

childhood and adolescence. Cut-off scores have been determined to define the severity of the abusive experiences: none or minimal, minor, moderate, and severe (Bernstein & Fink, 1999). The CTQ has demonstrated strong psychometric properties in community (Scher, Stein, Asmundson, McCreary & Forde, 2001), clinical (Bernstein et al., 2003), and mixed samples (Spinhoven et al., 2014) and determined to be the leading retrospective measure of childhood maltreatment currently in use (Tonmyr, Draca, Crain & MacMillan, 2011). The subscales of the German CTQ version have shown high internal consistencies ($\alpha \geq 0.80$) with the exception of the "physical neglect" subscale, and construct validity was supported (Klinitzke, Romppel, Häuser, Brähler, & Glaesmer, 2012). Likewise, in our sample of N = 119 mothers, Cronbach's α for each subscale was high (Physical abuse: α =.88; sexual abuse α =.80; emotional abuse: α =.88, and emotional neglect: α =.93) except for the "physical neglect" subscale, which showed only moderate internal consistency (α =.68).

Emotional Availability. Mother-infant dyads from both MG and CG were invited to the laboratory when the infants were 5 months (Phase 1, see Moehler, Biringen, & Poustka, 2007) and 12 months old (range: 11.5.-12.5 mo). Mothers brought their children to the laboratory at a time of day when they were alert, fed, and rested. All examiners were blinded to maternal history of abuse or not. EA was assessed using the Emotional Availability Scales, 3rd Edition (Biringen, Robinson, & Emde, 1998), an internationally established standardized measure to assess the quality of mother-child interaction with good psychometric properties (Biringen, 2000, Biringen et al., 2014). It consists of four scales measuring parental EA and two scales measuring child EA. The parental scales comprise sensitivity, structuring, nonintrusiveness, and nonhostility; the infant scales describe child responsiveness and child involvement. The EA system broadens the concept of attachment by focusing not only on reactions during a stress context – therefore, it can be coded in a variety of contexts such as free play or otherwise structured situations (Biringen & Easterbrooks, 2012). In the present study, mothers and infants were videotaped during a 20-min free play session. The mothers were instructed to "play with your child, as you normally do", and two raters trained for reliability independently

observed the videotaped sessions for both time points. Intraclass correlation coefficients (ICCs) were calculated to assess interrater-reliability using single measures consistency ICCs in a two-way mixed model. For the five months data, the ICCs ranged from .81 to .96. For the twelve months data, the ICC range was .69 to .84.

Maternal Psychopathology. In order to control for potential differences in psychopathology, mothers were asked to fill out the German Version of the Symptom Checklist 90-Revised (SCL-90-R; Franke, 2002), a 90-item self-report inventory measuring psychological distress in nine dimensions and three global scales. The global severity index (GSI), obtained by averaging the scores over the 90 items, is considered to be the best indicator of the current degree of psychological distress (Franke, 2002) and its use has been reinforced by recent validation studies (Urbán et al., 2014). The SCL-90-R has been shown to have satisfactory psychometric properties and has been used widely in research (Derogatis & Unger, 2010; Urbán et al., 2014).

Statistical Analysis

Sample characteristics in relation to a history of abuse were assessed by Student's t-test and Fisher's χ2-test. The relation between EA subscales and a history of abuse was calculated by Student's t-test and controlled by Whitney-Mann U-test because a normal distribution of the interactional characteristics could not necessarily be assumed. However, the results obtained by using the t-test corresponded to those obtained with the Whitney-Mann U-test. In order to examine the differences between the two time points and the potential group differences, a one-way repeated measures analysis of variance (ANOVA) was applied; detailed information was gathered using a repeated-measures t-test for scales that satisfied the normality assumptions and their nonparametric equivalent, the Wilcoxon two-sample, paired, signed-ranks test for scales that did not satisfy these assumptions. In order to control for the potential influence of maternal psychopathology on EA, a hierarchical regression analysis was conducted.

Results

Demographic Data

No statistically significant group differences were found regarding any of the demographic variables examined (see table 1 for sample characteristics for each group). A correlation matrix of associations between demographic data and EA resulted in no significant correlations for the 12-month EA and only two significant correlations for the 5-month EA: maternal age (r=.19, p<.05) and maternal educational status (r=.28, p<.001).

Maternal Psychopathology

MG mothers reported significantly higher levels of symptoms (M=50.47; SD=7.83) than CG mothers (M=43.93; SD=7.45) on the SCL-90-R GSI scale (t(116)=4.64; p<0.001; Cohen's *d*=-.86). Mean scores in both groups were within the average range of reported symptom severity in the population; in addition, the CG reached a mean score close to below average.

Table 1
Matching criteria and sample characteristics for trauma and comparison group.

Demographics	Maltreatment group (n=58)		Comparison group (n=61)		df	Pearson chi-square	p-Value
	n	%	*n*	%			
Child gender (male)[a]	31	53.4	34	55.7	1	0.06	.855
Mother's relationship status[a]							
Mother in a relationship	54	93.1	61	100	1	4.35	.053
Mother married	42	72.4	52	85.2	1	2.95	.115
Mother's educational status[a]							
Intermediate school (or less)	15	26.8	13	21.3			
Grammar school	23	41.1	25	41.0			
University	18	32.1	23	37.7	2	0.62	.732

	Maltreatment group		Comparison group		df	t-Value	p-Value
	M	*SD*	*M*	*SD*			
Age mother[b]	32.45	5.94	32.44	5.02	117	0.01	.996
Birth weight child[b]	3.88	1.09	3.85	1.03	117	0.14	.891
Number of children[b]	1.76	0.82	1.80	0.81	117	−0.29	.767

[a] Pearson chi square.
[b] Student's *t*-test (two-tailed, alpha of .05).

Table 2
Intercorrelations of CTQ-subscales.

CTQ subscales	Emotional abuse	Physical abuse	Sexual abuse	Emotional neglect	Physical neglect
Emotional abuse					
Physical abuse	.642**				
Sexual abuse	.495**	.285**			
Emotional neglect	.729**	.609**	.480**		
Physical neglect	.615**	.498**	.459**	.676**	

Note: Spearman *Rho*; N=119.
** p<.01.

Table 3
Severity of emotional abuse, emotional neglect and physical neglect.

CTQ-subscale		Severity				df	Pearson chi-square	p-Value
		1	2	3	4			
Emotional abuse	CG	61	0	0	0	3	65.79	<.001
	MG	17	15	11	15			
Emotional neglect	CG	61	0	0	0	3	52.15	<.001
	MG	23	14	8	13			
Physical neglect	CG	61	0	0	0	3	36.73	<.001
	MG	31	15	6	6			

Note: Severity – (1) none to minor, (2) minor to moderate, (3) moderate to severe, (4) severe to extreme; CG = 61, MG = 58.

Maternal History of Abuse

The two groups (MG and CG) were created according to maternal CTQ scores on the physical and sexual abuse subscales. Conducting exploratory analyses, we tested intercorrelations between these two abuse scales and the three remaining subscales: emotional abuse, emotional neglect, and physical neglect. All subscales proved to be highly correlated (see table 2). For an overview of the distribution of other forms of maltreatment experiences in our sample, see table 3. While high levels of emotional abuse, emotional neglect, and physical neglect were found in the MG, women in the CG did not report any other forms of childhood maltreatment.

History of Abuse and Emotional Availability

Mean values and standard deviations of the EA Scales (total scale and subscales) are provided in table 4 for both the MG and the CG. Dyads from the MG presented with a significantly lower total score of EA (t(117)=-6.00; p<0.001). In more detail, MG mothers showed significantly lower scores for *sensitivity, structuring*, *nonintrusiveness*, and *nonhostility*. In the 12-month-old children, significantly lower scores on infant *responsiveness* and infant *involvement* were observed. After applying Bonferroni correction for multiple testing, all mean comparison differences except for the *involvement* variable remained significant (see table 4).

Repeated-measures ANOVA was calculated to examine whether there had been significant changes in EA between the age of 5 and 12 months, and whether these changes differed between the MG and the CG (as tested by interactions between group and time-point factors). The ANOVA confirmed significant interactions between time of assessment and group

for the total EA score (see figure 1) and the subscales *sensitivity*, *intrusiveness,* and *responsiveness*. The values for the significant interactions at the subscale level were highly similar to the total-score values (see figure 1). Bonferroni adjusted alpha did not result in a different outcome (see table 5).

Recent studies have raised the question of whether there are mediating or moderating effects of psychopathological symptoms on parenting (e.g., DiLillo & Damashek, 2003; Martinez-Torteya et al., 2014). Hence, we analyzed both pathways by applying regression models. In a combined model of GSI and group membership predicting EA at 12 months, GSI did not show a significant main effect (β=-0.03; *p*=0.733), nor did the interaction term reach statistical significance (β=0.07; p=0.788; see table 6). Furthermore, the mediation model of an indirect pathway did not prove to be significant.

As suggested from earlier research on the association between maternal maltreatment history and parenting, some effects of maternal history of physical or sexual abuse could be due to other co-occurring forms of maltreatment (Bailey et al., 2012). We therefore conducted exploratory hierarchical regressions, examining potential influences of the remaining CTQ scales (emotional abuse, emotional neglect, and physical neglect). A combined model including all CTQ subscales and group membership yielded two significant predictors: "Group" (β=-0.30; *p*=0.005) and "Emotional Abuse" (β=-0.29; *p*=0.007).

Table 4
Group differences at child's age 12 months.

EA subscale	Maltreatment group (n = 58)		Comparison group (n = 61)		Cohen's d	t-Value	Sig. (p)
	M	SD	M	SD			
Sensitivity	5.66	1.32	7.13	1.30	1.12	−6.15	<.001*
Structuring	3.62	0.90	4.14	0.81	0.61	−3.29	.001*
Non-intrusiveness	3.25	0.93	4.30	0.77	1.23	−6.71	<.001*
Non-hostility	3.61	0.95	4.23	0.77	0.72	−3.90	<.001*
Responsiveness	4.70	0.81	5.43	0.87	0.87	−4.76	<.001*
Involvement	4.46	1.14	4.93	1.00	0.44	−2.38	.019
Total	4.22	0.78	5.03	0.69	1.17	−6.00	<.001*

Note: Student's *t*-test.
* Significant *p*-values based on Bonferroni corrected alpha of .0083; *df*= 117 (1:110, corrected for nonhomogenity of variances), *p*-values for mean comparisons are obtained using *t*-test (two-tailed, alpha of .05); range of possible ratings for sensitivity: 1–9; range of possible ratings for others: 1–7.
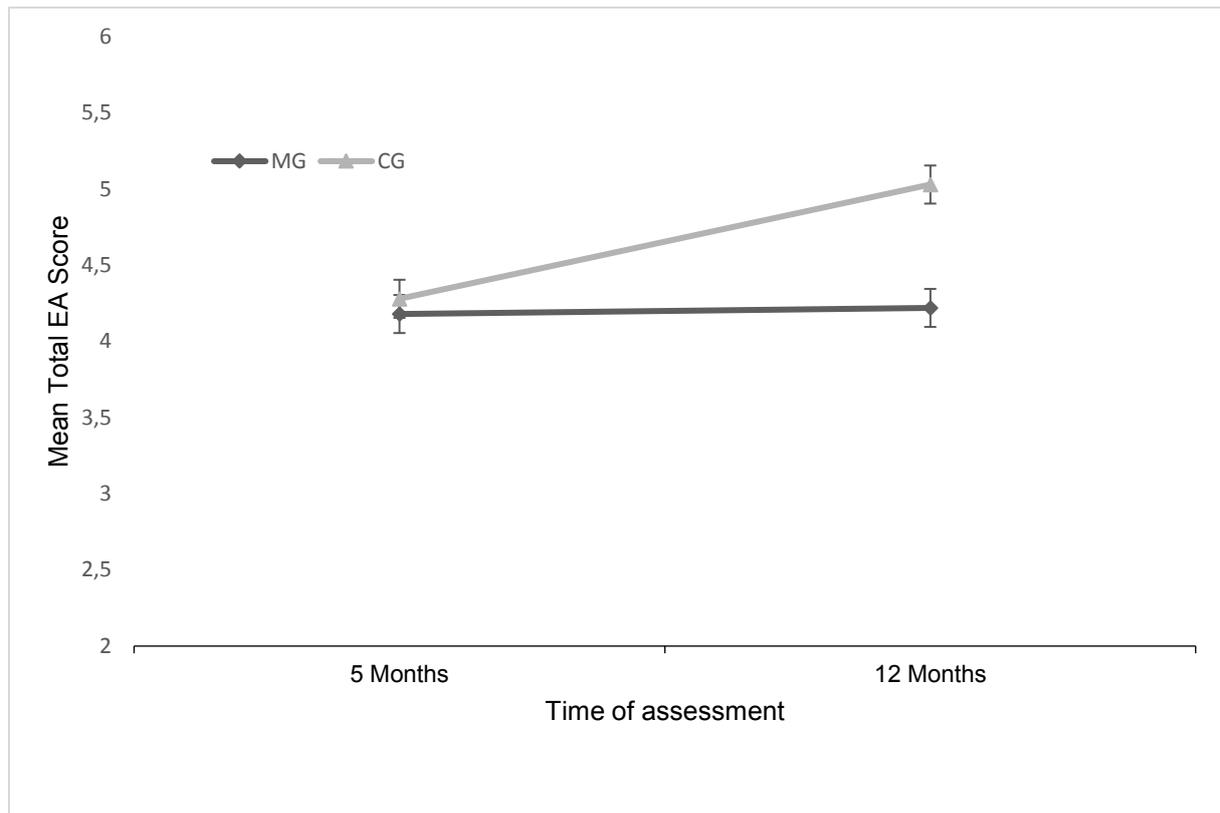
Fig. 1. Change in mean total EA score over time for maltreatment (MG) and comparison (CG) group.

Discussion

We examined the impact of a maternal history of childhood maltreatment on EA during the interaction with their 5- and 12-month-old children. This is the first study to report longitudinal data for EA in a sample of mothers with a history of abuse. We expected improvement in EA for CG mothers from 5 to 12 months and no significant changes in EA for mothers with experiences of childhood maltreatment. Indeed, our findings suggest a possible time window of non-normative alteration in mother-child interaction: While mothers with a history of abuse were found to show only very discrete interactional alterations at an infant age of 5 months compared to a comparison group (Moehler et al., 2007), they differed significantly in EA at the child's age of 12 months. Mothers with a history of abuse did not show the substantial improvement observed in comparison mothers. The effect reported here was not mediated by maternal age, education, psychosocial support, or number of children since the CG was matched for these criteria. Additionally, although mothers in the MG seemed to experience a significantly higher level of psychological distress, GSI neither served as a

mediator between maltreatment and EA, nor was there a significant interaction between history of abuse and GSI. The observed differences could hence be regarded as a specific consequence of early-life trauma and indicate a time-dependent association between maternal history of abuse and EA. The literature indicates that improvement in EA from infancy to early toddlerhood in normally developing dyads is normative, as children and mothers have accommodated to one another better by the time the children reach the age of 1 year. The child's signals become easier to identify, and the children themselves show greater sensitivity to the parent's location and emotional signals (Campos, Kermoian, & Zumbahlen, 1992; Hendrix & Thompson, 2011). Mother and child undergo a tuning process, which could account for the increasing EA scores seen in the CG (Biringen et al., 1995; Biringen et al., 1999). Another line of reasoning refers to the child's enhanced ability to involve the mother by using new abilities such as crawling, walking, or speaking its few first words. This phase is particularly important with respect to the attachment system. A mobile child is now engaging in "active contact behaviors", such as following the mother and seeking proximity (Ainsworth, Blehar, Waters & Wall, 1978), which results in a more intense emotional connectedness. However, the time window of developing locomotion and the resulting issue of the child's first steps into autonomy poses just as much a challenge as it makes emotional exchange easier. Campos et al. (1992) point out that the onset of locomotion generates the possibility of new goals in the child, a feeling of self-efficacy, and consequently a greater likelihood of discrepancy between the child's goals and those of the mother. It might be presumed that child locomotion constitutes a considerable challenge specifically for mothers with a history of abuse. Projective distortions might become more predominant, when the child gains the autonomy to independently move around and perform actions independent from – or even opposed to – its mother's will. A sense of loss of control might emerge, a situation in which the abused mother might experience again her own helplessness and victimization through interactions with the child (Moehler et al., 2001). Our results match findings of Stack et al. (2012), who found continuity in EA scores in a sample of 35 mothers with low-socioeconomic background and histories of childhood aggression and social withdrawal. Given the risk status of both samples,

it is still interesting to see that scores indeed stagnated and did decrease. In our specific sample, most mothers were from a highly educated background, had stable relationships mostly with the child's fathers, and reported a considerable amount of social support. In line with the developmental ecological model of child maltreatment, these represent buffering factors, stabilizing the mother and her interactional qualities (Belsky, 1993). It might be interesting to see, however, which results were found in a sample with fewer resources.

Given recent reports on the importance of maternal psychopathological symptoms (Biringen et al., 2014; DiLillo & Damashek, 2003; Lovejoy et al., 2000), it was surprising to find that, in a joint model of psychopathology and history of childhood abuse, the latter proved to be the only significant factor predicting EA at 12 months. There were neither moderating nor mediating effects of reported global maternal psychopathology. Since we assessed psychopathology using maternal self-report, we cannot rule out the possibility that response bias or a limited ability to self-reflect affected the results. However, mothers from the CG reported significantly lower levels of symptoms than mothers from the MG, which was to be expected. More likely, the findings result from the true nature of our sample. We examined a community-based sample with high levels of social support reporting mostly low or average levels of psychological distress, partly even despite having experienced childhood maltreatment. It is therefore possible that a limited range or a low average symptom severity may have produced weak associations between GSI and EA.

Although the study design focused on the effects of physical and sexual abuse, exploratory analyses showed high intercorrelations between all five CTQ scales, supporting the evidence of frequent co-occurring forms of abuse and neglect (Dong et al., 2004, Claussen & Crittenden, 1991). Furthermore, our analyses suggest an additional impact of childhood emotional abuse in predicting EA at 12 months, supporting the hypothesis that not only physical and sexual abuse but particularly psychological types of maltreatment could account for certain parenting outcomes (Bailey et al., 2012).

Limitations

The study participants were selected on the basis of the mother's CTQ results, which is a retrospective, self-report measure. Consequently, we cannot rule out the possibility of memory distortions or bias. Current evidence, however, supports the utility of such retrospective instruments (Hardt & Rutter, 2004), and the CTQ has been demonstrated to be the leading measure of childhood maltreatment (Tonmyr et al., 2011). Additionally, in the process of recruiting participants, 37% of all contacted mothers replied and agreed to take part in the study, which raises the question of self-selection and generalizability. Recent studies from other medical fields have questioned the assumed correspondence between nonresponse rate and response bias since response representativeness can still be adequate although the rate is low (Locke et al., 2013, Nohr, Frydenberg, Henriksen, & Olsen, 2006). However, we are not able to prove that our preselected sample was representative.

We decided to exclude the intermediate group in order to achieve a very clear distinction between two extreme groups, as our goal was to test the differences between a severe maltreatment group and a healthy control group. Current literature suggests that EGA can be used to increase the power for detecting a linear association, given a fixed sample size (Preacher, 2015). However, future studies should examine the full range of mothers, including those who have experienced minimal to moderate levels of abuse.

We did not administer clinical interviews to evaluate the maternal level of psychopathology. Instead, we used the SCL-90-R as an economic and valid alternative that has been used widely in research (Derogatis & Unger, 2010; Urbán et al., 2014).

Exploratory analysis showed that not only physical and sexual abuse were significant predictors of EA, but emotional abuse as well. However, due to the high intercorrelation of all CTQ subscales, these results must be interpreted with caution. Further research should consider looking at different forms of maltreatment in more detail to be able to disentangle the individual effects on mother-child interaction.

Strengths

This study was based on sampling from the general population and the only manifest difference between the mothers was the history of childhood abuse and neglect, as psychosocial status was carefully matched. Further considerable strengths are the standardized in vivo measure of mother–child interaction as well as the longitudinal assessment of EA from 5 months to 12 months of age, which makes it possible to compare the trajectories of EA over the course of an important developmental phase. To the best of our knowledge, this is the only study reporting longitudinal EA data in a sample of mothers with a history of childhood abuse.

Conclusions

This study identified a vulnerable developmental period, when distortion in mother-child interaction could play a role in an intergenerational transmission of abuse. It can be assumed that infant locomotion constitutes a major risk factor in this context. Additionally, as cerebral plasticity in the first year of life is high (Herschkowitz & Kagan, 2000), preventive interventions should be most effective when targeting this period. Thus, future research on mothers with a history of abuse is crucial in order to identify potential behaviors and vulnerable periods that can be targeted by employing preventive strategies (Croghan & Miell, 1999; Putnam, 2006).

References

Ainsworth, M. D. S., Blehar, M. C., Waters, E., & Wall, S. (2014). *Patterns of attachment: A psychological study of the strange situation*. Psychology Press.

Anderson, D. I., Campos, J. J., Witherington, D. C., Dahl, A., Rivera, M., He, M., … Barbu-Roth, M. (2013). The role of locomotion in psychological development. *Frontiers in psychology*, *4*.

Bailey, H. N., DeOliveira, C. A., Wolfe, V. V., Evans, E. M., & Hartwick, C. (2012). The impact of childhood maltreatment history on parenting: A comparison of maltreatment types and assessment methods. *Child abuse & neglect*, *36*(3), 236–246.

Bailey, H. N., Moran, G., & Pederson, D. R. (2007). Childhood maltreatment, complex trauma symptoms, and unresolved attachment in an at-risk sample of adolescent mothers. *Attachment & Human Development*, *9*(2), 139–161.

Banyard, V. L. (1997). The impact of childhood sexual abuse and family functioning on four dimensions of women's later parenting. *Child abuse & neglect*, *21*(11), 1095–1107.

Banyard, V. L., Williams, L. M., & Siegel, J. A. (2003). The impact of complex trauma and depression on parenting: An exploration of mediating risk and protective factors. *Child maltreatment*, *8*(4), 334–349.

Belsky, J. (1993). Etiology of child maltreatment: A developmental ecological analysis. *Psychological bulletin*, *114*(3), 413.

Berlin, L. J., Appleyard, K., & Dodge, K. A. (2011). Intergenerational continuity in child maltreatment: Mediating mechanisms and implications for prevention. *Child development*, *82*(1), 162–176.

Bernstein, D. P., & Fink, L. F. (1999). Childhood Trauma Questionnaire (CTQ). *San Antonio, Psychological Corporation*.

Bernstein, D. P., Stein, J. A., Newcomb, M. D., Walker, E., Pogge, D., Ahluvalia, T., … others. (2003). Development and validation of a brief screening version of the Childhood Trauma Questionnaire. *Child abuse & neglect*, *27*(2), 169–190.

Bert, S. C., Guner, B. M., & Lanzi, R. G. (2009). The influence of maternal history of abuse on parenting knowledge and behavior. *Family relations*, *58*(2), 176–187.

Biringen, Z. (2000). Emotional availability: conceptualization and research findings. *American Journal of Orthopsychiatry*, *70*(1), 104.

Biringen, Z., Damon, J., Grigg, W., Mone, J., Pipp-Siegel, S., Skillern, S., & Stratton, J. (2005). Emotional availability: Differential predictions to infant attachment and kindergarten adjustment based on observation time and context. *Infant Mental Health Journal*, *26*(4), 295–308.

Biringen, Z., Derscheid, D., Vliegen, N., Closson, L., & Easterbrooks, M. (2014). Emotional availability (EA): Theoretical background, empirical research using the EA Scales, and clinical applications. *Developmental Review*, *34*(2), 114–167.

Biringen, Z., & Easterbrooks, M. (2012). Emotional availability: concept, research, and window on developmental psychopathology. *Development and psychopathology*, *24*(01), 1–8.

Biringen, Z., Emde, R. N., Brown, D., Lowe, L., Myers, S., & Nelson, D. (1999). Emotional availability and emotion communication in naturalistic mother-infant interactions: Evidence for gender relations. *Journal of Social Behavior and Personality*, *14*(4), 463–478.

Biringen, Z., Emde, R. N., Campos, J. J., & Appelbaum, M. I. (1995). Affective reorganization in the infant, the mother, and the dyad: The role of upright locomotion and its timing. *Child Development*, *66*(2), 499–514.

Biringen, Z., Matheny, A., Bretherton, I., Renouf, A., & Sherman, M. (2000). Maternal representation of the self as parent: Connections with maternal sensitivity and maternal structuring. *Attachment & Human Development*, *2*(2), 218–232.

Biringen, Z., Robinson, J.L., & Emde, R.N. (1998): The Emotional Availability Scales, 3rd edition, Boulder: emotionalavailability.com.

Bornstein, M. H., Gini, M., Putnick, D. L., Haynes, O. M., Painter, K. M., Suwalsky, & TD, J. (2006). Short-term reliability and continuity of emotional availability in mother–child dyads across contexts of observation. *Infancy*, *10*(1), 1–16.

Bornstein, M. H., Suwalsky, J. T., Putnick, D. L., Gini, M., Venuti, P., de Falco, S., … de Galperín, C. Z. (2010). Developmental continuity and stability of emotional availability in the family:

Two ages and two genders in child-mother dyads from two regions in three countries. *International journal of behavioral development*, *34*(5), 385–397.

Briere, J., & Jordan, C. E. (2009). Childhood maltreatment, intervening variables, and adult psychological difficulties in women an overview. *Trauma, Violence, & Abuse*, *10*(4), 375–388.

Campos, J. J., Anderson, D. I., Barbu-Roth, M. A., Hubbard, E. M., Hertenstein, M. J., & Witherington, D. (2000). Travel broadens the mind. *Infancy*, *1*(2), 149–219.

Campos, J. J., Kermoian, R., & Zumbahlen, M. R. (1992). Socioemotional transformations in the family system following infant crawling onset. *New Directions for Child and Adolescent Development*, *1992*(55), 25–40.

Claussen, A. H., & Crittenden, P. M. (1991). Physical and psychological maltreatment: Relations among types of maltreatment. *Child Abuse & Neglect*, *15*(1), 5–18.

Croghan, R., & Miell, D. (1999). Born to abuse? Negotiating identity within an interpretative repertoire of impairment. *British journal of social psychology*, *38*(3), 315–335.

Derogatis, L. R., & Unger, R. (2010). Symptom checklist-90-revised. *Corsini encyclopedia of psychology*.

Dixon, L., Browne, K., & Hamilton-Giachritsis, C. (2005). Risk factors of parents abused as children: a mediational analysis of the intergenerational continuity of child maltreatment (Part I). *Journal of Child Psychology and Psychiatry*, *46*(1), 47–57.

Dixon, L., Hamilton-Giachritsis, C., & Browne, K. (2005). Attributions and behaviours of parents abused as children: A mediational analysis of the intergenerational continuity of child maltreatment (Part II). *Journal of Child Psychology and Psychiatry*, *46*(1), 58–68.

Dong, M., Anda, R. F., Felitti, V. J., Dube, S. R., Williamson, D. F., Thompson, T. J., … Giles, W. H. (2004). The interrelatedness of multiple forms of childhood abuse, neglect, and household dysfunction. *Child abuse & neglect*, *28*(7), 771–784.

Driessen, M., Herrmann, J., Stahl, K., Zwaan, M., Meier, S., Hill, A., … Petersen, D. (2000). Magnetic resonance imaging volumes of the hippocampus and the amygdala in women with borderline personality disorder and early traumatization. *Archives of general psychiatry*, *57*(12), 1115–1122.

Driscoll, J. R., & Easterbrooks, M. (2007). Young mothers' play with their toddlers: Individual

    variability as a function of psychosocial factors. *Infant and Child Development*, *16*(6), 649–

    670.

Dubowitz, H., Black, M. M., Kerr, M. A., Hussey, J. M., Morrel, T. M., Everson, M. D., & Starr, R.

    H. (2001). Type and timing of mothers' victimization: effects on mothers and children.

    Pediatrics, *107*(4), 728–735.

Easterbrooks, M., Bureau, J.-F., & Lyons-Ruth, K. (2012). Developmental correlates and

    predictors of emotional availability in mother–child interaction: A longitudinal study from

    infancy to middle childhood. *Development and psychopathology, 24*(01), 65–78.

Egeland, B., Bosquet, M., & Chung, A. L. (2002). Continuities and discontinuities in the

    intergenerational transmission of child maltreatment: Implications for breaking the cycle of

    abuse. *Early prediction and prevention of child abuse: A handbook*, 217–232.

Egeland, B., Jacobvitz, D., & Sroufe, L. A. (1988). Breaking the cycle of abuse. *Child*

    development, 1080–1088.

Ehrensaft, M. K., Knous-Westfall, H. M., Cohen, P., & Chen, H. (2015). How does child abuse

    history influence parenting of the next generation? *Psychology of Violence*, *5*(1), 16.

Ertem, I. O., Leventhal, J. M., & Dobbs, S. (2000). Intergenerational continuity of child physical

    abuse: how good is the evidence? *The Lancet*, *356*(9232), 814–819.

Franke, G. H., & Derogatis, L. R. (2002). *SCL-90-R: Symptom-Checkliste von LR Derogatis:*

    deutsche Version: Manual. Beltz Test.

Gara, M. A., Allen, L. A., Herzog, E. P., & Woolfolk, R. L. (2000). The abused child as parent: the

    structure and content of physically abused mothers' perceptions of their babies. *Child abuse*

    & neglect, *24*(5), 627–639.

Hardt, J., & Rutter, M. (2004). Validity of adult retrospective reports of adverse childhood

    experiences: review of the evidence. *Journal of Child Psychology and Psychiatry*, *45*(2),

    260–273.

Hendrix, R. R., & Thompson, R. A. (2011). Development of self-produced locomotion in the first year: changes in parent perceptions and infant behaviour. *Infant and Child Development*, *20*(3), 288–300.

Herschkowitz, N. (2000). Neurological bases of behavioral development in infancy. *Brain and Development*, *22*(7), 411–416.

Howes, C., & Obregon, N. B. (2009). Emotional availability in Mexican-heritage low-income mothers and children: Infancy through preschool. *Parenting: Science and Practice*, *9*(3-4), 260–276.

Klinitzke, G., Romppel, M., Häuser, W., Brähler, E., & Glaesmer, H. (2012). Die deutsche Version des Childhood Trauma Questionnaire (CTQ) – Psychometrische Eigenschaften in einer bevölkerungsrepräsentativen Stichprobe [The German Version of the Childhood Trauma Questionnaire (CTQ): psychometric characteristics in a representative sample of the general population]. *Psychotherapie, Psychosomatik, medizinische Psychologie*, *62*(2), 47–51.

Langeland, W., & Dijkstra, S. (1995). Breaking the intergenerational transmission of child abuse: Beyond the mother-child relationship. *Child abuse review*, *4*(1), 4–13.

Locke III, G. R., Schleck, C. D., Ziegenfuss, J. Y., Beebe, T. J., Zinsmeister, A. R., Talley, N. J., & others. (2013). A low response rate does not necessarily indicate non-response bias in gastroenterology survey research: a population-based study. *Journal of Public Health*, *21*(1), 87–95.

Lovas, G. S. (2005). Gender and patterns of emotional availability in mother–toddler and father–toddler dyads. *Infant Mental Health Journal*, *26*(4), 327–353.

Lovejoy, M. C., Graczyk, P. A., O'Hare, E., & Neuman, G. (2000). Maternal depression and parenting behavior: A meta-analytic review. *Clinical psychology review*, *20*(5), 561–592.

Lyons-Ruth, K., & Block, D. (1996). The disturbed caregiving system: Relations among childhood trauma, maternal caregiving, and infant affect and attachment. *Infant Mental Health Journal*, *17*(3), 257–275.

Main, M., & Goldwyn, R. (1984). Predicting rejection of her infant from mother's representation of

her own experience: Implications for the abused-abusing intergenerational cycle. *Child

Abuse & Neglect*, *8*(2), 203–217.

Martinez-Torteya, C., Dayton, C. J., Beeghly, M., Seng, J. S., McGinnis, E., Broderick, A., …

Muzik, M. (2014). Maternal parenting predicts infant biobehavioral regulation among women

with a history of childhood maltreatment. *Development and psychopathology*, *26*(02), 379–

392.

Marysko, M., Reck, C., Mattheis, V., Finke, P., Resch, F., & Moehler, E. (2010). History of

childhood abuse is accompanied by increased dissociation in young mothers five months

postnatally. *Psychopathology*, *43*(2), 104–109.

Maughan, A., & Cicchetti, D. (2002). Impact of child maltreatment and interadult violence on

children's emotion regulation abilities and socioemotional adjustment. *Child development*,

73(5), 1525–1542.

Moehler, E., Biringen, Z., & Poustka, L. (2007). Emotional availability in a sample of mothers with

a history of abuse. *American Journal of Orthopsychiatry*. Abgerufen von

http://psycnet.apa.org/psycinfo/2007-19519-014

Möhler, E., Resch, F., Cierpka, A., & Cierpka, M. (2001). The early appearance and

intergenerational transmission of maternal traumatic experiences in the context of mother-

infant interaction. *Journal of child psychotherapy*, *27*(3), 257–271.

Nohr, E. A., Frydenberg, M., Henriksen, T. B., & Olsen, J. (2006). Does low participation in cohort

studies induce bias? *Epidemiology*, *17*(4), 413–418.

Norman, R. E., Byambaa, M., De, R., Butchart, A., Scott, J., & Vos, T. (2012). The long-term

health consequences of child physical abuse, emotional abuse, and neglect: a systematic

review and meta-analysis. *PLoS medicine*, *9*(11), e1001349.

Oshri, A., Sutton, T. E., Clay-Warner, J., & Miller, J. D. (2015). Child maltreatment types and risk

behaviors: Associations with attachment style and emotion regulation dimensions.

Personality and Individual Differences, *73*, 127–133.

Pears, K. C., & Capaldi, D. M. (2001). Intergenerational transmission of abuse: a two-generational prospective study of an at-risk sample. *Child abuse & neglect*, *25*(11), 1439–1461.

Preacher, K. J. (2015). Extreme Groups Designs. *The Encyclopedia of Clinical Psychology*.

Putnam, F. W. (2006). The impact of trauma on child development. *Juvenile and Family Court Journal*, *57*(1), 1–11.

Scher, C. D., Stein, M. B., Asmundson, G. J., McCreary, D. R., & Forde, D. R. (2001). The childhood trauma questionnaire in a community sample: psychometric properties and normative data. *Journal of traumatic stress*, *14*(4), 843–857.

Schuetze, P., & Eiden, R. D. (2005). The relationship between sexual abuse during childhood and parenting outcomes: Modeling direct and indirect pathways. *Child Abuse & Neglect*, *29*(6), 645–659.

Smith, A. L., Cross, D., Winkler, J., Jovanovic, T., & Bradley, B. (2014). Emotional Dysregulation and Negative Affect Mediate the Relationship Between Maternal History of Child Maltreatment and Maternal Child Abuse Potential. *Journal of Family Violence*, 29(5), 483-494.

Spinhoven, P., Penninx, B. W., Hickendorff, M., van Hemert, A. M., Bernstein, D. P., & Elzinga, B. M. (2014). Childhood Trauma Questionnaire: Factor structure, measurement invariance, and validity across emotional disorders. *Psychological assessment*, *26*(3), 717.

Stack, D. M., Serbin, L. A., Girouard, N., Enns, L. N., Bentley, V., Ledingham, J. E., & Schwartzman, A. E. (2012). The quality of the mother–child relationship in high-risk dyads: Application of the Emotional Availability Scales in an intergenerational, longitudinal study. *Development and psychopathology*, *24*(01), 93–105.

Tonmyr, L., Draca, J., Crain, J., & MacMillan, H. L. (2011). Measurement of emotional/psychological child maltreatment: A review. *Child abuse & neglect*, *35*(10), 767–782.

Urbán, R., Kun, B., Farkas, J., Paksi, B., Kökönyei, G., Unoka, Z., … Demetrovics, Z. (2014). Bifactor structural model of symptom checklists: SCL-90-R and Brief Symptom Inventory (BSI) in a non-clinical community sample. *Psychiatry research*, *216*(1), 146–154.

Widom, C. S. (1989). Child abuse, neglect, and adult behavior: research design and findings on criminality, violence, and child abuse. *American Journal of Orthopsychiatry*, *59*(3), 355.

Widom, C. S., Czaja, S. J., & DuMont, K. A. (2015). Intergenerational transmission of child abuse and neglect: Real or detection bias? *Science*, *347*(6229), 1480–1485.

Emotional availability in mother-child interaction: the effects of maternal depression in remission and additional history of childhood abuse

Kluczniok, Dorothea[1]; Boedeker, Katja[2]; Fuchs, Anna[3]; Hindi Attar, Catherine[1]; Fydrich, Thomas[4]; Fuehrer, Daniel[2]; Dittrich, Katja[1]; Reck, Corinna[5]; Winter, Sibylle[2]; Heinz, Andreas[1]; Herpertz, Sabine C.[6]; Brunner, Romuald[3]; Bermpohl, Felix[1]

[1] Department of Psychiatry and Psychotherapy, Charité Campus Mitte, Charité - Universitätsmedizin Berlin, Germany

[2] Department of Child and Adolescent Psychiatry, Psychosomatics and Psychotherapy, Charité Campus Virchow, Charité - Universitätsmedizin Berlin, Germany

[3] Section for Disorders of Personality Development, Clinic of Child and Adolescent Psychiatry, Centre of Psychosocial Medicine, University of Heidelberg, Heidelberg, Germany

[4] Department of Psychology, Humboldt-Universität zu Berlin, Germany

[5] Department of Psychology, Ludwig Maximilian University Munich, Germany

[6] Department for General Psychiatry, Center of Psychosocial Medicine, University of Heidelberg, Germany

Short title: maternal depression & emotional availability

All authors declare that they have no conflicts of interest related to this work and that they approve the final manuscript.

Corresponding author:
Dipl. Psych. Dorothea Kluczniok
Psychiatrische Universitätsklinik der Charité im St. Hedwig Krankenhaus
Charité, Universitätsmedizin Berlin
Große Hamburger Str. 5-11
10115 Berlin
Germany

Email: dorothea.kluczniok@charite.de
Tel.: 0049 - (0)30-2311-2058
Fax: 0049 – (0)30- 2311-2750

Keywords: abuse, maltreatment, neglect; depression; maternal-child; child/adolescent; family/marital

Abstract

Background: The association between maternal depression and adverse outcomes in children is well established. Similar links have been found for maternal childhood abuse. One proposed pathway of risk transmission is reduced maternal emotional availability. Our aim was to investigate whether sensitive parenting is impaired in mothers with depression in remission, and whether among these mothers childhood abuse has an additional impact.

Methods: The mother-child interaction of 188 dyads was assessed during a play situation using the Emotional Availability Scales, which measure the overall affective quality of the interaction: maternal sensitivity, structuring, non-hostility, and non-intrusiveness. Mothers with depression in remission were compared to healthy mothers. Children were between five and 12 years old. Group differences and impact of additional childhood abuse were analyzed by one-factorial analyses of covariance and planned contrasts.

Results: Mothers with depression in remission showed less emotional availability during mother-child interaction compared to healthy control mothers. Specifically, they were less sensitive and, at trend-level, less structuring and more hostile. Among these mothers, we found an additional effect of severe maternal childhood abuse on maternal sensitivity: Mothers with depression in remission and a history of severe childhood abuse were less sensitive than remitted mothers without childhood abuse.

Conclusions: Our data suggest that depression impacts on maternal emotional availability during remission, which might represent a trait characteristic of depression. Mothers with depression in remission and additional severe childhood abuse were particularly affected. These findings may contribute to the understanding of children's vulnerability to develop a depressive disorder themselves.

Introduction

Having a depressed mother can have profound consequences for a child's emotional and behavioral well-being, such as developmental deficits, psychological problems, disruptive behavior and intellectual deficits.[1-5] Maternal history of childhood abuse has also been suggested as a risk factor for adverse development in children.[6,7] Furthermore, depression and childhood abuse often co-occur.[8] Pathways for the transmission of both maternal depression and history of childhood abuse have been proposed on different levels: genetic transmission, neurobiological alterations, observational learning of the child, as well as poor maternal parenting behavior.[9-12] Regarding parenting behavior, two issues remain to be elucidated: First, does maternal depression impact on parenting behavior during remission of depressive symptoms? Second, does a history of childhood abuse have an additional effect among these mothers? The present study sought to address these two questions.

Maternal depression and parenting

Symptoms of depression may prevent depressed mothers to have enough energy and capacity to respond to children's needs.[13,14] Leckman-Westin and colleagues demonstrated that depression contributed to child behavior problems only if mothers also showed poor parenting behavior.[15] Parenting behavior of depressed mothers is often characterized by less emotional availability,[16,17] which refers to the ability to share an emotionally healthy mother-child relationship.[18,19] Previous studies on emotional availability in acutely depressed mothers report reduced sensitivity,[20,21] less structuring,[22] increased hostility,[23] and intrusiveness.[24] While parenting behavior has well been studied during acute depressive episodes,[11] research on parenting behavior in mothers with remitted depression is scarce.[25-27] The present study will address this question in a first analysis step.

Maternal history of childhood abuse in the context of psychopathology

Patients often report additional history of childhood abuse, such as physical or sexual abuse.[28] Based on neurobiological[29,30] and treatment studies,[31,32] it has been suggested that

depressed patients with and without childhood abuse represent two distinct subgroups of depression. This distinction may be critical for the investigation of maternal emotional availability, as childhood abuse has – independently of depression - been associated with reduced parenting skills, [33,34]; but [35] such as less sensitivity,[36-41] less involvement,[42,43] and greater hostility and intrusiveness to the child. [44-46] An additional history of childhood abuse in mothers with remitted depression might pose a synergetic risk for dysfunctional parenting behavior. Only a few studies have investigated the impact of maternal childhood abuse on parenting in women with depression and suggest an additional effect.[47-49] To date, such studies relied on questionnaire data for parenting behavior, diagnostic status and childhood abuse. Additionally, it has been proposed that severity of childhood abuse is critical.[50] Therefore, in a second analysis step, we here studied mothers with remitted depression with different degrees of childhood abuse, i.e., with history of (1) no, (2) mild to moderate, and (3) severe childhood abuse.

We tested two hypotheses: (1) mothers with depression show reduced emotional availability toward their children during remission. (2) This effect is more pronounced in remitted mothers with additional history of childhood abuse (i.e. physical or sexual abuse), with stronger effects in mothers with more severe childhood abuse.

Methods

Participants & Procedure

The current study involved 188 mother-child dyads (N=99 healthy control mothers, N=89 mothers with remitted depression; see Table 1). Maternal groups did not differ with respect to their age, years of education, and IQ. Their children did not differ regarding their age, IQ and gender distribution between groups (see Table 1 for participants' characteristics). Healthy mothers were more likely to cohabit with the child's father than mothers with remitted depression (77% versus 42%, respectively).

Mother-child dyads were recruited in two German study sites (Berlin & Heidelberg) by advertisement (e.g., psychiatrists' and gynecologists' outpatients' clinics). Additionally,

mothers from a previous study were re-contacted.[40,46] Healthy control mothers did not differ between study sites in age, years of education, partnership status and child's age and child's sex. As an inclusion criterion, mother and child had to live together, also in case of shared custody. Children were between five and 12 years of age and attended already primary school. All mothers were required to have a HAMD score of below or equal seven to assure full remission in case they had an episode of depression in the past.[52] Exclusion criteria for mothers were: neurological diseases, acute axis I disorders (i.e. anxiety disorders, post-traumatic stress disorder, affective disorders, eating disorders, and alcohol or substance dependence) and lifetime history of schizophrenia or manic episodes as assessed by the Mini International Neuropsychiatric Interview (M.I.N.I.[53]), and one of the following three personality disorders: emotional-unstable, anxious-avoidant, antisocial personality disorder (based on the International Personality Disorder Examination (IPDE[54]). Mothers with depression in remission had the following comorbid life-time diagnoses: panic disorder (n=9), obsessive compulsive disorder (n=1), social phobia (n=2), post-traumatic stress disorder (n=2), generalized anxiety disorder (n=1), anorexia nervosa (n=2), and bulimia nervosa (n=2). Intake of benzodiazepines within the last six months was an exclusion criterion, because consumption and withdrawal of these substances may have particularly strong impact on mother-child interaction. Medication with antidepressants did not represent an exclusion criterion; however the dosage had to be stable for at least two weeks prior to study entrance.

To rule out differences in maternal intellectual abilities, we used a German vocabulary test (Wortschatztest, WST[55]). Exclusion criteria for children were: meeting DSM-IV criteria for autistic disorder and an IQ score below 70. To assess children's intellectual abilities we applied either the Culture Fair Intelligence Test I revised for children between five and eight years of age (CFT 1-R[56]) or the CFT 20-R[57] for children from the age of nine or above. Dropout was as follows: 36 mother-child dyads could not be re-contacted after they had agreed to participate. Eleven dyads were excluded because the mother was acutely depressed at testing time (n=6), met DSM-IV criteria for alcohol or drug dependence (n=2), or the child either met DSM-IV criteria for autistic disorder (n=2) or had an IQ score below 70 (n=1). Three dyads

were not invited, because the child's father did not give informed consent for the child's study participation. We included 188 mother-child dyads in analysis.

Approval for the study was obtained by the ethics committees of the Charité – Universitätsmedizin Berlin and the Faculty of Medicine of Heidelberg. Written informed consent was obtained from all participants after the nature of the procedure was explained. The present study was performed within the framework of the UBICA ("Understanding and Breaking the Intergenerational Cycle of Abuse") multicenter project which investigates the effects of maternal history of abuse on mother-child interaction and child wellbeing.

Table 1: Participants' demographic and clinical characteristics

	Healthy control mothers (N=99)	Mothers with depression in remission (N=89)	p
Mothers			
Age (SD)	39.2 (5.2)	40.2 (6.0)	>.05
Years of education (SD)	17.4 (3.3)	16.9 (3.8)	>.05
IQ (SD)	106.1 (11.4)	106.3 (11.2)	>.05
Living together with child's father (% yes)	76.8	41.6	<.001[a]
HAMD (SD)	1.2 (1.5)	2.5 (2.1)	<.001[b]
Number of depressive episodes (SD)	---	2.3 (1.5)	
Mean time elapsed since last depressive episode (months (SD))	---	61.6 (58.6)	
Previous psychotherapeutic treatment (%)	---	82	
Previous psychiatric treatment (%)	---	44.9	
Children			
Age	7.8 (1.5)	8.3 (1.7)	>.05
IQ	107.1 (12.7)	104.5 (13.5)	>.05
Sex (% girls)	51.5	61.8	>.05

Notes: SD: standard deviation; [a]chi-square calculation; [b]t-test two-sided

Measures

Emotional Availability Scales (EAS, 4th Edition, Biringen, (2008)[51]): To observe maternal emotional availability mother-child dyads were videotaped in a standardized playroom setting. For the first 15 minutes, mother and child were told to play as they normally would in a free play situation. For further six minutes, dyads performed a puzzle task ("Shape by Shape") that was designed to be too difficult for the child. Mothers were instructed to help their child as they normally would do but not to solve the puzzle for the child. The EA scales are rated on a one to seven scale across the two situations. We were particularly interested in maternal emotional availability and will therefore report on the four adult scales.

In brief, high *maternal sensitivity* is characterized by positive and authentic maternal affect, maternal awareness of, and responsiveness to timing of child behavior. Low scores indicated maternal behavior that lacks general positive affect, appropriate awareness of, and responsiveness to child's emotional expressions. As sensitivity is meant to be a dyadic construct, a mother could only receive high scores if her child also appeared to be highly responsive and involving.[17] Maternal *structuring* addresses the ability to adequately scaffold a child's activities. *Non-intrusiveness* refers to a lack of over-protection, over-stimulation, and interference, therefore maintaining a child's autonomy. *Non-hostility* is described by lack of signs of anger, impatience, and boredom. Many studies have supported the validity of the EA scales with associations between emotional availability and mother-child attachment[20, 22] or maternal perspective taking. [21, 23] More detailed descriptions can be found in Biringen et al. (2014).[17]

EA scales were coded by three researchers (one senior clinical psychologist, and two psychologists who hold a Master's degree of clinical psychology), who have been approved as reliable to code by Zeynep Biringen after an extensive training period. Coders were blind to maternal history of depression and childhood abuse and videos were randomly assigned to them. Every video (n=188) was rated independently by at least two coders, coding discrepancies were resolved through discussion. For the maternal subscales, interrater

reliability for pairs of raters ranged between r=.78 and r=.86 for "sensitivity", between r=.81 and r=.87 for "structuring", between r=.82 and r=.86 for "non-intrusiveness", and between r=.84 and r=.90 for "non-hostility" (average-measure intra-class correlations), indicating excellent agreement.[58] The internal consistency coefficient for the four adult scales was Cronbach's α=.81, indicating excellent internal reliability of the construct of maternal emotional availability.[58]

Maternal depression: To assess maternal history of depression (and other diagnoses of acute and lifetime DSM-IV axis I disorders), we implemented the Mini International Neuropsychiatric Interview (M.I.N.I.[53]), a fully structured diagnostic interview for screening DSM axis I disorders. Previous research has shown good inter-rater reliability.[59,60] To assure full remission, we additionally applied the Hamilton Depression Scale (HAMD[61,62]). A score of below or equal seven is considered as remission.[63] The HAMD has good concurrent validity with other depression severity assessment scales.[64]

Maternal history of childhood abuse: As questionnaire data on childhood abuse may not capture the relevant context and may be limited in encompassing breadth and timing of experience, we conducted the Childhood Experience of Care and Abuse interview (CECA[65]; German version[66]). This is a semi-structured clinical interview that is designed to collect retrospective accounts of adverse childhood experience (up to an age of 17 years), such as physical and sexual abuse, emotional abuse, neglect, and antipathy. All experiences were rated by the interviewer on 4-point scales of severity ('severe, 'moderate', 'mild' or 'little/none') according to predetermined criteria and manualized threshold examples. Interviewers had been intensively trained by the developer of the interview. Good interrater reliability has been demonstrated for the CECA[65,67]. The physical and sexual abuse scales were used to denote history of childhood abuse for our analyses.

Statistical Analysis

To examine possibly confounding group differences, we first explored descriptive data on maternal and child demographic and clinical characteristics. To test our first hypothesis, we

used univariate analyses of covariance (ANCOVA) with history of depression (yes/no) as between-subject factor and partnership status, and HAMD scores as covariates. As it has been suggested to account for additional adverse childhood experiences,[38] we also took the sum score of the CECA main scales (physical abuse, sexual abuse, neglect, antipathy, emotional abuse) as covariate. Bonferroni correction was applied to account for multiple testing (p≤.0125).

In a second analysis step, ANCOVAs were run to evaluate effects of additional history of childhood abuse on emotional availability among the remitted group compared to a healthy control group without any history of childhood abuse (i.e. a score of 'little/none' on both CECA scales physical and sexual abuse; n=56). We subdivided the remitted depression group according to their degree of childhood abuse in three groups: remitted depression a) without history of childhood abuse (i.e. a score of 'little/none' on both CECA scales physical and sexual abuse; n=19), b) with mild to moderate history of childhood abuse (i.e. a score of 'mild' or 'moderate' on one or both CECA scales physical and sexual abuse; n=56), c) with severe history of childhood abuse (i.e. a score of 'severe' on one or both CECA scales physical and sexual abuse; n=14). We added partnership status, HAMD scores, as well as the remaining CECA main scales (neglect, antipathy, emotional abuse) as covariates. Bonferroni correction was applied to account for multiple testing (p≤.0125). As we were particularly interested in the comparison of mothers with remitted depression with and without childhood abuse, we chose the remitted group without childhood abuse as reference group for post-hoc contrast analyses. If the contrast analysis revealed a significant result, we further confirmed our hypothesis by a hierarchical regression analysis within mothers with remitted depression. HAMD scores, as well as the remaining CECA main scales (neglect, antipathy, emotional abuse) were entered as one block in the first step. In the second step, a sum score of physical and sexual childhood abusive experiences was entered with lower scores indicating higher severity of childhood abuse. All calculations were conducted using SPSS for Windows (Version 18).

Results

Impact of remitted depression on maternal emotional availability

Sensitivity: We found a significant effect of remitted depression on maternal sensitivity scores ($F_{(1,181)}$=10.034; p=.002; η^2=.052). Remitted mothers had significantly lower sensitivity scores than healthy mothers (Table 2). Assessing the effect of partnership status, we found no significant influence on maternal sensitivity (F(1,181)=1.843; p=.176; η^2=.010). In addition, we used a one-stage random sample design to stratify our sample by the presence of the father, and found the same effect of depression in remission (Wald-F(1,87)=22.767, p=.000).

Structuring: The effect of remitted depression showed a trend toward significance ($F_{(1,181)}$=5.236; p=.023; η^2=.028). Remitted mothers tended to scaffold the activity of their child to a lesser extent than healthy controls.

Intrusiveness: There was no significant effect of remitted depression on maternal intrusiveness ($F_{(1,181)}$=0.444; p=.51; η^2=.002).

Hostility: We found a trend-wise effect of remitted depression on hostility ($F_{(1,181)}$=3.928; p=.038; η^2=.024). Remitted mothers tended to show more signs of hostility than healthy controls.

Impact of additional history of childhood abuse on emotional availability

To test the additional impact of maternal childhood abuse, we computed a one-factorial ANCOVA consisting of four groups of mothers: (1) healthy without childhood abuse, remitted depression (2) without childhood abuse, (3) with mild to moderate childhood abuse, and (4) with severe childhood abuse.

Sensitivity: We found a significant effect of group ($F_{(1,135)}$=6.689; p<.001; η^2=.129). Planned contrasts revealed that remitted mothers with severe childhood abuse showed significantly lower sensitivity compared to remitted mothers without childhood abuse (p<.01; Figure 1, Table 3). There was no difference between remitted mothers without childhood abuse and remitted mothers with mild to moderate degrees of childhood abuse (p>.05). Remitted mothers without childhood abuse had lower sensitivity scores than healthy control mothers without childhood abuse (p<.05).

Regression analysis revealed that the sum score of physical and sexual childhood abuse tended to be a significant predictor (beta=.253; p=.071) for maternal sensitivity, explaining 6.4% of the variance. Regression results are displayed in Table 4.

Structuring: There was a trend for the effect of group ($F_{(1,135)}$=2.885; p=.038; η^2=.06). Planned contrasts were not analyzed.

Intrusiveness: The main effect of group did not reach significance ($F_{(1,135)}$=2.225; p>.05; η^2=.05). Planned contrasts were not analyzed.

Hostility: We found a significant main effect of group ($F_{(1,135)}$=3.877; p=.011; η^2=.08). Planned contrasts revealed that there was no significant difference between remitted mothers with severe childhood abuse and remitted mothers without childhood abuse (p=.088). There were no significant differences between remitted mothers without childhood abuse and remitted mothers with mild to moderate childhood abuse (p>.05). Remitted mothers without childhood abuse showed more signs of hostility than healthy control mothers without childhood abuse (p=.051).

TABLE 2. Means and standard deviations of Emotional Availability Scales in mothers

	Group		
	Healthy control mothers (*n* = 98)	Mothers with depression in remission (*n* = 89)	*P*
Sensitivity (SD)	4.6 (0.9)	4.0 (0.9)	<.01[a]
Structuring (SD)	4.8 (0.8)	4.4 (0.8)	<.05
Nonintrusiveness (SD)	5.2 (0.9)	5.1 (1.1)	.78
Nonhostility (SD)	5.8 (1.0)	5.4 (1.1)	<.05

Notes: SD, standard deviation.
[a]Statistically significant after Bonferroni correction for multiple testing was applied (significance threshold: *P* < .0125).

TABLE 3. Means and standard deviation of Emotional Availability Scales in mothers: effect of additional history of childhood abuse

	Group				
	HC w/o CA (n = 56)	rMDD w/o CA (n = 19)	rMDD and mild-moderate CA (n = 56)	rMDD and severe CA (n = 14)	P^a
Sensitivity (SD)	4.7 (0.8)	4.2 (0.9)[c,d]	4.0 (0.9)	3.6 (1.2)	<.001[b]
Structuring (SD)	4.1 (0.8)	4.4 (0.8)	4.5 (0.7)	4.1 (0.8)	<.05
Nonintrusiveness (SD)	5.3 (0.8)	5.2 (1.1)	5.3 (1.0)	4.6 (1.3)	.09
Nonhostility (SD)	6.0 (0.9)	5.5 (1.1)	5.5 (1.0)	5.0 (1.2)	<.05

Notes: HC, healthy controls; rMDD, mothers with at least one remitted episode of depression; CA, childhood abuse; w/o, without; SD, standard deviation; mild-moderate CA is defined by a score of "mild" or "moderate" on the physical or sexual subscale of the Childhood Experience of Care and Abuse (CECA) Interview; severe CA is defined by a score of "severe" on the physical or sexual subscales of the CECA Interview.
[a]P-values indicate significance level of the main effect of group (ANCOVA).
[b]Statistically significant after Bonferroni correction for multiple testing was applied (significance threshold: $P < .0125$).
[c]Planned contrast between HC and rMDD without CA significant at $P < .05$.
[d]Planned contrast between rMDD without any CA and rMDD with severe CA significant at $P < .05$.

TABLE 4. Hierarchical regression analysis predicting maternal sensitivity from demographics, and severity of childhood abuse among mothers with depression in remission (n = 89)

Emotional Availability Scale	Predictor variables	R^2 change	R	R^2 adjusted	F	Beta coefficient (95% CI)	P
Sensitivity	Step 1	.026	.161	−.020	0.561		>.05
	HAMD					−.078 (−.135 to .063)	
	Neglect					−.140 (−.418 to .110)	
	Antipathy					−.004 (−.229 to .222)	
	Emotional abuse					.088 (−.173 to .372)	
	Step 2	.038	.253	.007	1.133		>.05
	Childhood abuse					.253 (−.013 to .329)	0.071

Notes: Childhood abuse: sum score of physical and sexual childhood abuse.
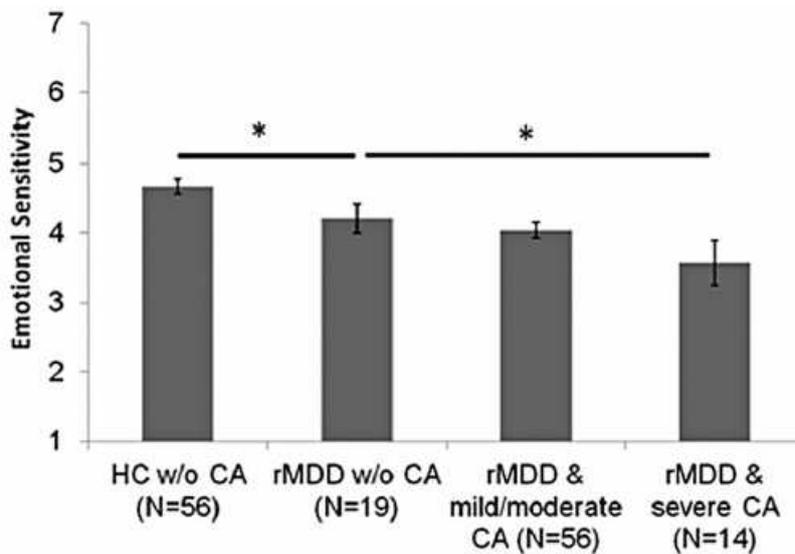

Figure 1. HC, healthy control mothers; rMDD, mothers with at least one remitted episode of depression; w/o, without; CA, childhood abuse; mild-moderate CA is defined by a score of mild or moderate on the physical or sexual subscale of the Childhood Experience of Care and Abuse (CECA) Interview; severe CA is defined by a score of severe on the physical or sexual subscales of the CECA Interview; asterisks indicate planned contrast between "HC w/o CA" and "rMDD without any CA" (P = .039) and between "rMDD without any CA" and "rMDD with severe CA" (P = .009).

Discussion

In this present study, parenting behavior has been observed in 188 mother-child dyads to investigate the effect of remitted depression and of additional childhood abuse on maternal emotional availability. We found impaired maternal sensitivity, and trend-wise reduced structuring and non-hostility in remitted mothers. Within this group of remitted mothers, the sub-group with history of severe childhood abuse showed significantly lower sensitivity compared to the sub-group without childhood abuse. Our findings suggest that (a) depression impacts on maternal emotional availability also during remission and (b) the sub-group of mothers with additional history of severe childhood abuse seems to be particularly affected.

Impact of maternal history of depression on maternal emotional availability

Previous studies on maternal parenting in acutely depressed mothers have reported reduced emotional availability.[11,20-24] Adding to this literature, we here found similar alterations of maternal sensitivity, structuring abilities, and maternal hostility in mothers remitted from depression. These data suggest that children of mothers suffering from depression may be affected by impaired maternal parenting behavior not only during the mothers' acute depressive episodes but also during remission. It is obvious that persistent alterations of parenting behavior will have greater impact on the children's development and well-being, e.g., it may affect the child's intellectual development[68,69] and add to emotional and behavioral problems[5, 70-72]

While the majority of studies on maternal parenting in depression have focused on acute depressive episodes, a few earlier studies have investigated remitted mothers.[25-27] One study examined the speech pattern of mothers with remitted depression and found them to respond less quickly to their 3-year-old infants.[25] Stein and colleagues observed mother-infant interactions and found remitted mothers to less maintain their infant's interest and attention in playing.[26] In the last study, mother-adolescent dyads were asked to reflect on their relationship,[27] and remitted mothers were reported to be less engaged with their adolescent child. The present study differs from previous studies on remitted mothers in the following

aspects: 1) To the best of our knowledge, this is the first study investigating the parenting behavior of remitted mothers of school-aged children (five to 12 years old). This age range might be an important time window for the impact of remitted depression on children's intellectual achievements and social adjustment.[73] 2) We used the Emotional Availability Scales,[50] which have the advantage of being an emotion-focused measure that refers to the overall affective quality of the relationship and is assessed by independent raters. Furthermore the scales take a dyadic perspective into account where the child is not only the recipient but also contributes to the interaction. We acknowledge that the scoring of maternal emotional availability might also depend on the child's behavior and reactions which we have not analyzed in the present study. Future studies may address the impact of the child's behavior and temperament on maternal parenting behavior.

The question arises why mothers with depression exhibit impaired parenting behavior even during remission. One likely explanation is that the impairments are direct consequences of the depression, representing alterations that persist even after remission of typical depressive symptoms. The impairments reported here may thus represent a trait characteristic of depression. This explanation is supported by a growing number of studies in remitted patients showing persisting impairments also in other cognitive and affective domains.[74,75] We acknowledge that we do not have data on maternal emotional availability prior or during acute depressive episodes which would be necessary to definitely confirm this assumption. However, our results in remission may motivate mothers at all states of depression to actively seek treatment of both depression and impaired maternal sensitivity. Time of remission might be a critical period for mothers to train and improve their parenting qualities. An alternative explanation is that residual depressive symptoms in our remitted mothers drive the effects. Although HAMD scores differed significantly between groups, we consider this explanation very unlikely, given that the mean HAMD score of 2.5 in the remitted depression group is by no means clinically relevant. In addition, HAMD scores were included as covariates in our analyses. A third explanation would be that impaired parenting behavior is related to secondary (potentially hidden) group factors. To exclude such confounding factors we have matched

groups for mothers' and children's age and sex, and included partnership status as a covariate (which turned out to have no significant effect on maternal sensitivity). In an additional analysis, we stratified our groups by maternal partnership status; this analysis still showed a significant effect of remitted depression on maternal sensitivity. We acknowledge that further confounding factors (e.g., supportiveness of child's father, other social support, impact of additional life events) may exist that were not considered in our study.

Given the high incidence of childhood abuse in depression[76] and the impact of maternal childhood abuse on parental behavior,[33,34] history of childhood abuse must be considered a particularly important factor in any study investigating the effect of depression on parenting behavior. To account for this factor we have taken the following steps: in analysis 1, comparing mothers with versus without history of depression, we have included history of childhood abuse as a covariate. In analysis 2, distinguishing sub-groups of depression, we provide a direct comparison between remitted mothers without childhood abuse and healthy control mothers without childhood abuse. We thus conclude that the reported effect of remitted depression exists independent of effects of childhood abuse.

Impact of severity of childhood abuse on emotional availability among mothers with depression in remission

Several studies showed that a considerable number of individuals with depression also have a history of childhood abuse.[76,77] In theory, effects of remitted depression and childhood abuse could add up. Alternatively, it is also possible that the effect of maternal psychopathology is more pronounced and overrides the effect of childhood abuse. Our data show, besides the effect of remitted depression, an additional effect of severe childhood abuse on maternal emotional availability. Specifically, remitted mothers with a history of severe childhood abuse showed reduced maternal sensitivity during mother-child interaction. Our regression analysis confirmed the additional effect of severity of childhood abuse among mothers with depression in remission, however only at trend-level.

Our data show, besides the effect of remitted depression, and additional effect of physical and sexual childhood abuse on maternal emotional availability. Specifically, severity of childhood abuse predicted reduced scores for maternal sensitivity even after controlling for history of depression.

Although several studies have investigated the effects of childhood abuse[33,34,40] and some studies the effects of remitted depression,[25-27] only few studies have investigated both risk factors at the same time.[47-49] These studies differ from the present study in the following regards: first, previous studies nicely disentangled effects of childhood abuse and depression, but did not specifically focus on additive effects. Second, previous studies also included acutely depressed mothers, while the present study only included remitted mothers. Third, in comparison to previous studies, we directly observed mother-child interaction during a play situation and assessed its quality by independent and blinded raters using the EA scales. This allowed us to observe and rate more subtle affective and behavioral aspects of maternal parenting behavior that are presumably not captured by self reports based on questionnaire measures.

Notably, the additional effect of childhood abuse was only found in remitted mothers with severe childhood abuse. Severe abuse was in our present study defined as severe physical maltreatment (e.g., ongoing physical abuse in childhood with life threatening or severe injuries) or severe sexual abuse (e.g., repeated sexual contact with a relative or known adult). Remitted mothers with mild to moderate childhood physical or sexual abuse (e.g., including being repeatedly slapped or hit by a belt, or one's breasts and genitals being touched) did not differ significantly from remitted mothers without childhood abuse. The absence of an additional effect of mild to moderate childhood abuse might be due to sample size. An alternative explanation is that, in these cases, the history of depression may be the determining factor, overriding effects of mild to moderate childhood abuse.

Notably, the additional effect of childhood abuse was only found for maternal sensitivity. One explanation might be that physical and sexual childhood abuse specifically impacts on

maternal sensitive behavior. An alternative explanation is that, for the other subscales, the history of depression may be the determining factor, overriding effects of physical and sexual childhood abuse.

Limitations

A number of limitations of the present study have to be considered. First, our total sample size (n=188) and especially the one of the remitted group with severe experiences of childhood abuse were fairly small (n=14), which is due to the challenge of recruiting mother-child dyads fulfilling all inclusion criteria. Second, the present data do not allow conclusions on maternal parenting behavior during and prior to the onset of maternal depression. An acutely depressed comparison group or longitudinal investigations of maternal sensitivity would be desirable to disentangle preexisting alterations from consequences of depression. Third, other types of childhood abuse, such as emotional abuse or neglect, could also have adverse effects on the mother-child interaction [78]. The effects of these types of abuse were not studied here, because maternal childhood abusive experiences were defined as physical or sexual abuse in the present study. Accordingly, our recruitment did not focus on emotional abuse and neglect and sample sizes are rather unbalanced with regard to these variables (neglect: severe (n=5), moderate (n=10), mild (n=38), little/none (n=92); emotional abuse: severe (n=5), moderate (n=5), mild (n=17), little/none (n=118); however, in our analyses, we took these forms of childhood abuse as covariates into account. Fourth, because the present study focused on mothers with depression, it does not provide the comparison between healthy mothers with versus without history of childhood abuse. This comparison would have allowed replicating earlier studies that have identified the effect of childhood abuse (that exists independent of depression) and disentangled effects of childhood abuse and depression.[47; 49] Fifth, the age range of children has been relatively wide for studying mother-child interaction. However, it should be noted that there was no difference in children's age between groups. Sixth, we acknowledge that only the results for maternal sensitivity remained significant after Bonferroni correction.

Conclusion

Altogether, during remission, mothers with depression showed reduced emotional availability, particularly maternal sensitivity. This finding appears to be relevant for both mothers and children, as persistently reduced sensitivity may contribute to continuing social interaction problems in mothers and through social learning also impact on the offspring. Our findings can therefore help to explain the well-established unfortunate finding of increased behavioral and emotional problems in children of parents with depression. Clinicians should be aware that maternal sensitivity might be reduced even though mothers have remitted from typical symptoms of depression. Our results in remission may motivate mothers to actively seek treatment both of depression and of impaired maternal sensitivity. For affected mothers, the remission status might be a critical time period to train and improve their parenting qualities. In addition, our results in remitted mothers suggest an additional effect of severe childhood abuse. Both mothers and children might benefit from early interventions focusing on parenting behavior with particular emphasis on maternal sensitivity.

Correspondence

Dipl. Psych. Dorothea Kluczniok

Psychiatrische Universitätsklinik der Charité im St. Hedwig Krankenhaus

Charité, Universitätsmedizin Berlin

Große Hamburgerstr. 5-11

10115 Berlin

Germany

Email: dorothea.kluczniok@charite.de

Tel.: 0049 - (0)30-2311-2904

Fax: 0049 – (0)30- 2311-2750

References

1.   Carter, A.S., F.E. Garrity-Rokous, R. Chazan-Cohen, et al., *Maternal depression and comorbidity: predicting early parenting, attachment security, and toddler social-emotional problems and competencies.* Journal of the American Academy of Child & Adolescent Psychiatry, 2001. **40**(1): p. 18-26.

2.   Cicchetti, D., F.A. Rogosch, and S.L. Toth, *Maternal depressive disorder and contextual risk: Contributions to the development of attachment insecurity and behavior problems in toddlerhood.* Development and psychopathology, 1998. **10**(02): p. 283-300.

3.   Lyons-Ruth, K., M.A. Easterbrooks, and C.D. Cibelli, *Infant attachment strategies, infant mental lag, and maternal depressive symptoms: predictors of internalizing and externalizing problems at age 7.* Dev Psychol, 1997. **33**(4): p. 681-92.

4.   Cummings, E.M. and P.T. Davies, *Maternal depression and child development.* Journal of Child Psychology and Psychiatry, 1994. **35**(1): p. 73-112.

5.   Goodman, S.H., M.H. Rouse, A.M. Connell, et al., *Maternal depression and child psychopathology: a meta-analytic review.* Clinical child and family psychology review, 2011. **14**(1): p. 1-27.

6.   Miranda, J.K., N. de la Osa, R. Granero, et al., *Multiple mediators of the relationships among maternal childhood abuse, intimate partner violence, and offspring psychopathology.* Journal of interpersonal violence, 2013. **28**(14): p. 2941-2965.

7.   Myhre, M.C., G.A. Dyb, T. Wentzel-Larsen, et al., *Maternal childhood abuse predicts externalizing behaviour in toddlers: a prospective cohort study.* Scandinavian journal of public health, 2014. **42**(3): p. 263-269.

8.   Molnar, B.E., S.L. Buka, and R.C. Kessler, *Child sexual abuse and subsequent psychopathology: results from the National Comorbidity Survey.* American journal of public health, 2001. **91**(5): p. 753.

9.	Berlin, L.J., K. Appleyard, and K.A. Dodge, *Intergenerational continuity in child maltreatment: Mediating mechanisms and implications for prevention.* Child development, 2011. **82**(1): p. 162-176.

10.	Dixon, L., C. Hamilton-Giachritsis, and K. Browne, *Attributions and behaviours of parents abused as children: A mediational analysis of the intergenerational continuity of child maltreatment (Part II).* Journal of Child Psychology and Psychiatry, 2005. **46**(1): p. 58-68.

11.	Lovejoy, M.C., P.A. Graczyk, E. O'Hare, et al., *Maternal depression and parenting behavior: A meta-analytic review.* Clinical psychology review, 2000. **20**(5): p. 561-592.

12.	Testa, M., J.H. Hoffman, and J.A. Livingston, *Intergenerational transmission of sexual victimization vulnerability as mediated via parenting.* Child abuse & neglect, 2011. **35**(5): p. 363-371.

13.	Goodman, S.H. and I.H. Gotlib, *Risk for psychopathology in the children of depressed mothers: a developmental model for understanding mechanisms of transmission.* Psychol Rev, 1999. **106**(3): p. 458-90.

14.	Letourneau, N., M. Stewart, C.L. Dennis, et al., *Effect of home-based peer support on maternal-infant interactions among women with postpartum depression: a randomized, controlled trial.* Int J Ment Health Nurs, 2011. **20**(5): p. 345-57.

15.	Leckman-Westin, E., P.R. Cohen, and A. Stueve, *Maternal depression and mother-child interaction patterns: association with toddler problems and continuity of effects to late childhood.* J Child Psychol Psychiatry, 2009. **50**(9): p. 1176-84.

16.	Ainsworth, M.D.S., *The Bowlby-Ainsworth attachment theory.* Behavioral and Brain Sciences, 1978. **1**(03): p. 436-438.

17.	Biringen, Z., D. Derscheid, N. Vliegen, et al., *Emotional availability (EA): Theoretical background, empirical research using the EA Scales, and clinical applications.* Developmental Review, 2014. **34**(2): p. 114-167.

18.	Emde, R.N., *Next steps in emotional availability research.* Attachment & Human Development, 2000. **2**(2): p. 242-248.

19.   Emde, R.N., *Emotional availability: Critical questions and research horizons.* Development and psychopathology, 2012. **24**(01): p. 125-129.

20.   Easterbrooks, M.A., J.F. Bureau, and K. Lyons-Ruth, *Developmental correlates and predictors of emotional availability in mother-child interaction: a longitudinal study from infancy to middle childhood.* Dev Psychopathol, 2012. **24**(1): p. 65-78.

21.   Trapolini, T., J.A. Ungerer, and C.A. McMahon, *Maternal depression: relations with maternal caregiving representations and emotional availability during the preschool years.* Attach Hum Dev, 2008. **10**(1): p. 73-90.

22.   Easterbrooks, M.A., G. Biesecker, and K. Lyons-Ruth, *Infancy predictors of emotional availability in middle childhood: the roles of attachment security and maternal depressive symptomatology.* Attach Hum Dev, 2000. **2**(2): p. 170-87.

23.   Lok, S.M. and C.A. McMahon, *Mothers' thoughts about their children: Links between mind‐mindedness and emotional availability.* British Journal of Developmental Psychology, 2006. **24**(3): p. 477-488.

24.   Vliegen, N., P. Luyten, and Z. Biringen, *A multimethod perspective on emotional availability in the postpartum period.* Parenting: Science and Practice, 2009. **9**(3-4): p. 228-243.

25.   Breznitz, Z. and T. Sherman, *Speech patterning of natural discourse of well and depressed mothers and their young children.* Child Development, 1987: p. 395-400.

26.   Stein, A., D. Gath, J. Bucher, et al., *The relationship between post-natal depression and mother-child interaction.* The British journal of psychiatry: the journal of mental science, 1991. **158**: p. 46.

27.   Tarullo, L.B., E.K. DeMulder, P.E. Martinez, et al., *Dialogues with preadolescents and adolescents: Mother-child interaction patterns in affectively ill and well dyads.* Journal of Abnormal Child Psychology, 1994. **22**(1): p. 33-51.

28.   Heim, C., D.J. Newport, T. Mletzko, et al., *The link between childhood trauma and depression: insights from HPA axis studies in humans.* Psychoneuroendocrinology, 2008. **33**(6): p. 693-710.

29.   Heim, C., D.J. Newport, A.H. Miller, et al., *Long-term neuroendocrine effects of childhood maltreatment.* JAMA, 2000. **284**(18): p. 2321.

30.   Teicher, M. H., & Samson, J. A. (2013). Childhood maltreatment and psychopathology: a case for ecophenotypic variants as clinically and neurobiologically distinct subtypes. American Journal of Psychiatry, 170(10), 1114.

31.   Nanni, V., Uher, R., & Danese, A. (2012). Childhood maltreatment predicts unfavorable course of illness and treatment outcome in depression: a meta-analysis. American Journal of Psychiatry, 169(2), 141-151.

32.   Nemeroff, C.B., C.M. Heim, M.E. Thase, et al., *Differential responses to psychotherapy versus pharmacotherapy in patients with chronic forms of major depression and childhood trauma.* Proceedings of the National Academy of Sciences, 2003. **100**(24): p. 14293-14296.

33.   Leifer, M., T. Kilbane, T. Jacobsen, et al., *A three-generational study of transmission of risk for sexual abuse.* Journal of Clinical Child and Adolescent Psychology, 2004. **33**(4): p. 662-672.

34.   Sidebotham, P., J. Golding, and A.S. Team, *Child maltreatment in the "Children of the Nineties": A longitudinal study of parental risk factors.* Child abuse & neglect, 2001. **25**(9): p. 1177-1200.

35.   Ertem, I.O., J.M. Leventhal, and S. Dobbs, *Intergenerational continuity of child physical abuse: how good is the evidence?* The Lancet, 2000. **356**(9232): p. 814-819.

36.   Banyard, V.L., *The impact of childhood sexual abuse and family functioning on four dimensions of women's later parenting.* Child abuse & neglect, 1997. **21**(11): p. 1095-1107.

37.   Chung, E.K., L. Mathew, A.C. Rothkopf, et al., *Parenting attitudes and infant spanking: The influence of childhood experiences.* Pediatrics, 2009. **124**(2): p. e278-e286.

38.   DiLillo, D. and A. Damashek, *Parenting characteristics of women reporting a history of childhood sexual abuse.* Child Maltreat, 2003. **8**(4): p. 319-33.

39.   Pears, K.C. and D.M. Capaldi, *Intergenerational transmission of abuse: a two-generational prospective study of an at-risk sample.* Child abuse & neglect, 2001. **25**(11): p. 1439-1461.

40.   Fuchs, A., E. Möhler, F. Resch, et al., *Impact of a maternal history of childhood abuse on the development of mother–infant interaction during the first year of life.* Child abuse & neglect, 2015.

41.   Pereira, J., K. Vickers, L. Atkinson, et al., *Parenting stress mediates between maternal maltreatment history and maternal sensitivity in a community sample.* Child abuse & neglect, 2012. **36**(5): p. 433-437.

42.   Bert, S.C., B.M. Guner, and R.G. Lanzi, *The influence of maternal history of abuse on parenting knowledge and behavior.* Family Relations, 2009. **58**(2): p. 176-187.

43.   Douglas, A.R., *Reported anxieties concerning intimate parenting in women sexually abused as children.* Child Abuse & Neglect, 2000. **24**(3): p. 425-434.

44.   Driscoll, J.R. and M. Easterbrooks, *Young mothers' play with their toddlers: Individual variability as a function of psychosocial factors.* Infant and Child Development, 2007. **16**(6): p. 649-670.

45.   Lyons-Ruth, K. and D. Block, *The disturbed caregiving system: Relations among childhood trauma, maternal caregiving, and infant affect and attachment.* Infant Mental Health Journal, 1996. **17**(3): p. 257-275.

46.   Moehler, E., Z. Biringen, and L. Poustka, *Emotional availability in a sample of mothers with a history of abuse.* Am J Orthopsychiatry, 2007. **77**(4): p. 624-8.

47.   Ammerman, R.T., C.E. Shenk, A.R. Teeters, et al., *Impact of depression and childhood trauma in mothers receiving home visitation.* Journal of child and family studies, 2012. **21**(4): p. 612-625.

48.   Cohen, L.R., D.A. Hien, and S. Batchelder, *The impact of cumulative maternal trauma and diagnosis on parenting behavior.* Child maltreatment, 2008. **13**(1): p. 27-38.

49. Zalewski, M., J.M. Cyranowski, Y. Cheng, et al., *Role of maternal childhood trauma on parenting among depressed mothers of psychiatrically ill children.* Depression and anxiety, 2013. **30**(9): p. 792-799.

50. Newcomb, M.D. and T.F. Locke, *Intergenerational cycle of maltreatment: A popular concept obscured by methodological limitations.* Child abuse & neglect, 2001. **25**(9): p. 1219-1240.

51. Biringen, Z. *The emotional availability (EA) scales Manual (4th ed.).* Retrieved from www.emotionalavailability.com.

52. Rush, A.J., H.C. Kraemer, H.A. Sackeim, et al., *Report by the ACNP Task Force on response and remission in major depressive disorder.* Neuropsychopharmacology, 2006. **31**(9): p. 1841-1853.

53. Lecrubier, Y., D. Sheehan, E. Weiller, et al., *The Mini International Neuropsychiatric Interview (MINI). A short diagnostic structured interview: reliability and validity according to the CIDI.* European psychiatry, 1997. **12**(5): p. 224-231.

54. Loranger, A.W., A. Janca, and N. Sartorius, *Assessment and diagnosis of personality disorders: The ICD-10 international personality disorder examination (IPDE).* 1997: Cambridge University Press.

55. Schmidt, K.H. and P. Metzler, *WST-Wortschatztest.* Handbuch, Goettingen: Beltz Test, 1992.

56. Weiss, R. and J. Osterland, *CFT 1, Grundintelligenztest Skala 1 [Culture Fair Intelligence Test, Scale 1](RB Cattell, 1966), German version.* Göttingen: Hogrefe, 1997.

57. Weiss, R., B. Albinus, and D. Arzt, *Grundintelligenztest Skala 2-Revision (CFT 20-R).* 2006: Hogrefe.

58. Cicchetti, D.V., *Guidelines, criteria, and rules of thumb for evaluating normed and standardized assessment instruments in psychology.* Psychological assessment, 1994. **6**(4): p. 284.

59.   Sheehan, D.V., Y. Lecrubier, K.H. Sheehan, et al., *The Mini-International Neuropsychiatric Interview (MINI): the development and validation of a structured diagnostic psychiatric interview for DSM-IV and ICD-10.* Journal of clinical psychiatry, 1998. **59**: p. 22-33.

60.   Sheehan, D., Y. Lecrubier, K. Harnett Sheehan, et al., *The validity of the Mini International Neuropsychiatric Interview (MINI) according to the SCID-P and its reliability.* European Psychiatry, 1997. **12**(5): p. 232-241.

61.   Hamilton, M., *A rating scale for depression.* Journal of neurology, neurosurgery, and psychiatry, 1960. **23**(1): p. 56.

62.   Hamilton, M., *Hamilton depression scale.* ECDEU Assessment Manual For Psychopharmacology, Revised Edition. Rockville, MD: National Institute of Mental Health, 1976: p. 179-92.

63.   Zajecka, J.M., *Treating depression to remission.* Journal of Clinical Psychiatry, 2003. **64**(15): p. 7-12.

64.   Maier, W., R. Buller, M. Philipp, et al., *The Hamilton Anxiety Scale: reliability, validity and sensitivity to change in anxiety and depressive disorders.* Journal of affective disorders, 1988. **14**(1): p. 61-68.

65.   Bifulco, A., G.W. Brown, and T.O. Harris, *Childhood Experience of Care and Abuse (CECA): a retrospective interview measure.* J Child Psychol Psychiatry, 1994. **35**(8): p. 1419-35.

66.   Kaess, M., P. Parzer, M. Mattern, et al., *[Childhood Experiences of Care and Abuse (CECA) - validation of the German version of the questionnaire and interview, and results of an investigation of correlations between adverse childhood experiences and suicidal behaviour].* Z Kinder Jugendpsychiatr Psychother, 2011. **39**(4): p. 243-52.

67.   Bifulco, A., G.W. Brown, A. Lillie, et al., *Memories of childhood neglect and abuse: corroboration in a series of sisters.* J Child Psychol Psychiatry, 1997. **38**(3): p. 365-74.

68. Hay, D.F., P. Asten, A. Mills, et al., *Intellectual problems shown by 11-year-old children whose mothers had postnatal depression.* Journal of Child Psychology and Psychiatry, 2001. **42**(07): p. 871-889.

69. Jensen, S., I. Dumontheil, and E. Barker, *Developmental inter-relations between early maternal depression, contextual risks, and interpersonal stress, and their effect on later child cognitive functioning.* Depression and anxiety, 2014. **31**(7): p. 599-607.

70. Cox, A., C. Puckering, A. Pound, et al., *The impact of maternal depression in young children.* Journal of Child Psychology and Psychiatry, 1987. **28**(6): p. 917-928.

71. Betts, K.S., G.M. Williams, J.M. Najman, et al., *Maternal depressive, anxious, and stress symptoms during pregnancy predict internalizing problems in adolescence.* Depression and anxiety, 2014. **31**(1): p. 9-18.

72. Landman-Peeters, K., J. Ormel, E.L. Van Sonderen, et al., *Risk of emotional disorder in offspring of depressed parents: Gender differences in the effect of a second emotionally affected parent.* Depression and anxiety, 2008. **25**(8): p. 653-660.

73. Murray, L., D. Sinclair, P. Cooper, et al., *The socioemotional development of 5-year-old children of postnatally depressed mothers.* Journal of Child Psychology and Psychiatry, 1999. **40**(08): p. 1259-1271.

74. Lange, C., M. Adli, E. Zschucke, et al., *Affective set-shifting deficits in patients with major depression in remission.* J Psychiatr Res, 2012. **46**(12): p. 1623-6.

75. Mathews, A. and C. MacLeod, *Cognitive vulnerability to emotional disorders.* Annu. Rev. Clin. Psychol., 2005. **1**: p. 167-195.

76. MacMillan, H.L., J.E. Fleming, D.L. Streiner, et al., *Childhood abuse and lifetime psychopathology in a community sample.* American Journal of Psychiatry, 2014.

77. Brown, G.R. and B. Anderson, *Psychiatric morbidity in adult inpatients with childhood histories of sexual and physical abuse.* American journal of Psychiatry, 1991. **148**(1): p. 55-61.

78. Bailey, H. N., DeOliveira, C. A., Wolfe, V. V., Evans, E. M., & Hartwick, C. (2012). The impact of childhood maltreatment history on parenting: A comparison of maltreatment types and assessment methods. Child abuse & neglect, 36(3), 236-246.

Sex specific differences in adrenocortical attunement in mothers with a history of childhood abuse and their five months old boys and girls

A. Fuchs, E. Möhler, F. Resch, M. Kaess

Affiliations:

A. Fuchs and M. Kaess are affiliated to the Section for "Translational Psychobiology in Child and Adolescent Psychiatry", Department of Child and Adolescent Psychiatry, Centre for Psychosocial Medicine, University of Heidelberg, Blumenstr.8, 69115 Heidelberg, Germany. A. Fuchs, E. Möhler, F. Resch, and M. Kaess are affiliated to the Department of Child and Adolescent Psychiatry, Centre for Psychosocial Medicine, University of Heidelberg, Blumenstr.8, 69115 Heidelberg, Germany.

Corresponding author:

Anna Fuchs, Dipl. Psych.

Department of Child and Adolescent Psychiatry, Centre for Psychosocial Medicine,

University of Heidelberg, Blumenstr.8, 69115 Heidelberg

Telephone: 49/6221/5639087, Fax: 49/6221/566941

E-Mail: anna.fuchs@med.uni-heidelberg.de

Sex specific differences in adrenocortical attunement in mothers with a history of childhood abuse and their five months old boys and girls

Abstract

Recent evidence points to the existence of a neurobiological attunement between mother and child, e.g. associations between maternal and child hypothalamic-pituitary-adrenal (HPA)-axis functioning. As maternal history of abuse (HoA) has been shown to negatively affect mother-child-interaction and HPA-axis functioning, we theorized those experiences to exert an influence on cortisol attunement, and we examined the role of infant gender in this context. Shortly after birth of their first child, a community sample of women was screened using the Childhood Trauma Questionnaire. Mothers reporting moderate or severe sexual and/or physical abuse were included in the maltreatment group (n=41; MG) and compared with a non-maltreated comparison group (n=47; CG). At the child's age of five months, mother and infant baseline salivary cortisol was collected on two consecutive days between eleven and one o'clock. Correlation analyses confirmed an association between maternal and infant salivary cortisol levels for the complete sample. However, hierarchical regression models revealed a moderating role of maternal HoA and infant gender: in the CG, cortisol attunement was only significant in mother-daughter dyads, whereas in the MG, we found cortisol levels to be associated only in mother-son dyads. Consequently, alterations of neurobiological attunement between mother and child might compose a mechanism for the transgenerational transmission of adverse childhood experiences.

Keywords: child maltreatment; attunement; HPA-axis; cortisol; mother-child interaction; gender

Introduction

Examining the relationship between mothers and their children has been a core area of developmental research for decades (Bornstein, 2013; Brazelton, Koslowski, & Main, 1974). In addition, research trying to illuminate mechanisms of transgenerational transmission of child abuse builds on the study of mother-child-interaction across generations (Dixon, Hamilton-Giachritsis, & Browne, 2005; Egeland, Jacobvitz, & Sroufe, 1988). Multiple terms, such as co-regulation, reciprocity or bidirectionality, have been used to describe the temporal and dynamic process of behavioral and emotional transactions between mother and child. Between an infant's age of three to six months, mother-child-interaction becomes more and more mutually regulated, forming a couple-specific "dance" (Feldman, 2012; Tronick, 1989). This process, which is here labeled as "attunement" (Bornstein, 2013), is considered to be adaptive, and to exert a positive impact on offspring's developmental outcomes (Feldman, 2012; Sroufe, 2000). Behavioral mother-child-attunement, for example, has been associated with increased self-regulation capabilities, attachment security and lower levels of behavior problems (Beebe et al., 2010; Criss, Shaw, & Ingoldsby, 2003; De Wolff & Van Ijzendoorn, 1997; Kochanska & Kim, 2014; Suveg, Shaffer, & Davis, 2015). In case of a maternal history of childhood abuse (HoA), however, results suggest this attunement to be disturbed, which appears to heighten the risk for transgenerational transmission of adverse childhood experiences (Dixon et al., 2005; Fuchs, Möhler, Resch, & Kaess, 2015).

Only recently, theorists have started to include biology into the construct of harmonious mother-child relationships, aiming at a more integrated, holistic framework (Feldman, 2007; Ruttle et al., 2011). In light of this, mother-offspring "interactional attunement" refers not only to the matching of behavior and affective states during social contact, but to the matching of physiological processes as well (Feldman, 2007; 2012). A system appearing to be part of this physiological attunement between mother and offspring is the hypothalamic–pituitary–adrenal (HPA) axis. The HPA axis releases the stress hormone cortisol, (CT), a glucocorticoid helping to restore homeostasis in case of environmental demands. Cortisol has been shown to be under strong social regulation in infancy (Hostinar & Gunnar, 2013; Tarullo & Gunnar, 2006). Over the last 15 years, several independent research groups have reported significant associations between maternal and child cortisol levels in diverse samples and study designs. Gitau and colleagues (1998; 2004) were able to identify concordance between paired maternal and fetal plasma cortisol as well as corticotrophin releasing hormone (CRH) levels even before birth (Gitau, Cameron, Fisk, & Glover, 1998; Gitau, Fisk, & Glover, 2004). Continuing in infancy, four studies reported salivary cortisol attunement in mother-child pairs, two of them examining samples of preterm infants before and after holding (Castral et al., 2015; Neu et al., 2009), one study investigating dyads participating in an infant sleep training program (Middlemiss, Granger, Goldberg, & Nathans, 2012), and one study examining six months old

3

infants from a low risk community sample before and after the still face procedure (Feldman, Singer & Zagoory, 2010). However, sample sizes were small ranging between n=20 to n =53. Studies reporting attunement in toddlerhood mainly focused on salivary cortisol levels before and after stress paradigms (Atkinson et al., 2013; Feldman, Vengrober, Eidelmann-Rothman, & Zagoory-Sharon, 2013; Hibel, Granger, Blair, & Finegood, 2015), thereby using diverse samples such as children exposed to continuous war (Feldman et al., 2013) or a low income, non-urban sample (Hibel et al., 2015). Additionally, attunement in salivary cortisol levels between mother and child has been shown in middle childhood (Bright, Granger, & Frick, 2012; Granger, 1998; LeMoult, Chen, Foland-Ross, Burley, & Gotlib, 2015, Williams et al., 2013) and even in adolescence (Papp, Pendry, & Adam, 2009; Saxbe et al., 2014) for both basal cortisol levels as well as pre/post-challenge designs. In summary, there is valid evidence for the existence of an "endocrine fit" (Feldman et al., 2013) in mothers and their children.

However, since this is a relatively new area of research, there are only a few studies so far who have been trying to identify influencing factors and trajectories of cortisol attunement. Recent evidence suggest a strong susceptibility to environmental factors: stress or noise have been shown to exert a detrimental effect on cortisol attunement (Hibel et al., 2015; Neu et al., 2009). In contrast, mild challenge, maternal sensitivity or time spent together have been found to have a supporting effect on cortisol attunement (Atkinson et al., 2013; Papp et al., 2009; Ruttle et al., 2011; Sethre-Hofstad, Stansbury, & Rice, 2002). These studies seem to indicate that maternal factors and characteristics of the mother-child relationship may be meaningful in the development of adrenocortical attunement, but there are no studies examining the impact of a maternal history of abuse (HoA) on cortisol attunement.

Assuming associations between this apparent physiological attunement system and maternal history of childhood abuse would be in line with a vast body of literature describing a detrimental impact of HoA on behavioral and affective attunement (Bert, Guner, & Lanzi, 2009; Dixon, Hamilton-Giachritsis, & Browne, 2005; Fuchs et al., 2015; Lyons-Ruth & Block, 1996; Smith, Cross, Winkler, Jovanovic, & Bradley, 2014). Furthermore, HoA has been shown to provoke dysregulation of the HPA-axis, especially in victims of chronic maltreatment, placement into foster care or institutional deprivation (Bernard, Butzin-Dozier, Rittenhouse & Dozier, 2010; Tarullo & Gunnar, 2006; Feldman et al., 2013; Bernard et al., 2015). Females, who have experienced childhood sexual abuse, seem to exhibit different developmental trajectories in basal cortisol production compared to nonabused females (Trickett, Noll, Susman, Shenk, & Putnam, 2010). However, consequences of potentially altered HPA-axis-functioning for mother-child-attunement in HoA-victims is vastly understudied and therefore a subject of speculation.

An important factor, which has been ignored in most studies examining cortisol attunement, is child gender - supposedly due to small sample sizes or different foci of the studies. Three research groups included and reported gender analysis in their studies (Ruttle et al., 2011; Saxbe et al., 2014; Williams et al., 2013), but none of them examined infants. Saxbe and Colleagues (2014) measured parent and child cortisol level in a community sample before, during and after a conflict discussion task. They found attunement between parents and adolescents to be higher in same-gender dyads (Saxbe et al., 2014). Ruttle and colleagues (2011) examined preschool children and their mothers with mostly low socioeconomic backgrounds and found cortisol attunement to be more common in high sensitivity mother-daughter dyads than in high sensitivity mother-son dyads (Ruttle et al., 2011). The third study, Williams and colleagues (2013), reported the interesting find of a stronger attunement in mothers and sons in a sample characterized by a high prevalence of anxiety disorders in mothers. Mothers and sons exhibited flattened diurnal cortisol more frequently than mothers and girls (Williams et al., 2013). Tronick and Reck (2009) concluded from their studies that, due to their lower self-regulatory skills, infant boys tend to be affectively more reactive towards their mothers (Tronick & Cohn, 1989; Tronick & Reck, 2009; Weinberg, Tronick, Cohn, & Olson, 1999). As they are less capable to self-regulate, infant boys put more focus on their mothers, and display more signals expressing distress and demands for contact than girls do. Girls, on the other hand, seem to have a more object driven focus, show greater constancy in emotion and better self-regulation of emotional states (Feldman, 2003; Rothbart & Gartstein, 2003; Tronick & Reck, 2009; Weinberg et al., 1999). In light of this, it could be hypothesized that infant boys are more vulnerable to maternal behavioral, affective or physiological dysregulation.

Indeed, a higher susceptibility in boys in the context of transgenerational transmission of stress has already been shown in animal models (Bock et al., 2014). In case of maternal HoA, which has been associated with dysregulated HPA-axis functioning, girls would be able to protect themselves by "tuning out" physiologically, whereas boys would be especially "tuned in", as shown in the study of Williams and colleagues (2013). Furthermore, as boys seem to be more reactive and demanding in early interaction, this might lead to them being the center of maternal attention more frequently, making it easier for mothers to know their needs and react on them, even physiologically. This could be especially effective in case of lower maternal emotional availability, as it has been shown in mothers with HoA (Fuchs et al., 2015).

In conclusion, there seems to be valid evidence for the existence of an adrenocortical attunement between mothers and their infant boys and girls. However, studies on influencing factors and trajectories of cortisol attunement are lacking. Some results indicate that maternal childhood experiences could exert an influence on the association, and maternal history of

abuse is suggested as a likely candidate. A second factor possibly influencing cortisol attunement between mother and infant is infant gender. We therefore investigated the following hypotheses:

Hypotheses

1. First, we expected to find an association between maternal baseline salivary cortisol and infant baseline salivary cortisol as an indicator of mother-child adrenocortical attunement.

2. Secondly, we hypothesized that maternal experiences of HoA would have a detrimental effect on mother-child adrenocortical attunement.

3. Third, we expected gender of the infant to exert an influence on the association between cortisol attunement and impact of HoA. For the comparison group (CG), we expected significant correlations for both genders. For the maltreatment group (MG), we expected higher attunement in mother-son dyads than in mother-daughter dyads.

Method

Participant Recruitment and Study Design

The study was approved by the Institutional Review Board of the Faculty of Medicine, University of Heidelberg, Germany. For an 18-month period, all women giving birth to a child in the cities of Heidelberg and Mannheim, were contacted by mail (N = 2001). They were presented with an information sheet about the study and a respective consent form, a sociodemographic questionnaire, and the Childhood Trauma Questionnaire (CTQ; Bernstein & Fink, 1999). Written informed consent was obtained from all participating women before study inclusion. Women whose children were born as singleton, term babies (>37th week) with APGAR scores >7 were eligible to participate in the study. Twins and infants < 2500g were excluded.

Out of 2001 mothers who were contacted by mail, 748 completed the CTQ (37.4%), and 73 (9.8%) of those scored above the cut-off for moderate-to-severe abuse on the physical (score > 9) and/or sexual abuse scale (score > 7). Out of these, six had infants who did not meet eligibility criteria (APGAR, birth weight, and date), four had children with repeated infections or acute illnesses preventing them from participating, and six declined for lack of time. Thus, 58 mother-infant pairs were included to form the maltreatment group (MG). From the remaining 675 mothers who scored below the cut-off for moderate to severe physical or sexual abuse, 417 mothers were excluded from the comparison group (CG) because their scores fell in the intermediate group of minor to moderate abuse. Out of the remaining 258 mothers with a score of 0 for sexual or physical abuse, matching was performed according to the following criteria,

ordered in priorities: child gender, maternal marital status and education, and number of siblings, resulting in a CG of 61 mothers. The original sample consisted of 58 mothers with a history of abuse (MG) and 61 comparison mothers (CG). Detailed results of the study have been described elsewhere (Fuchs et al., 2015; Moehler, Biringen, & Poustka, 2007).

As the study of cortisol was not implemented in the original study proposal but added as a supplement, we were not able to assess the first 12 of the originally examined 119 mother-infant dyads. In addition, 19 mother-infant-pairs had to be excluded due to participant refusal or insufficient sample quality. Out of the original sample, complete cortisol data were available from 88 mother-infant dyads. There were no differences between the excluded dyads and the remaining 88 mother-infant pairs in terms of level of psychopathology ($t(116)=.11$; $p=.914$), maternal age ($t(117)=-.50$; $p=.616$), maternal smoking habits χ^2 (4, 119)=4.38, $p=.36$), child gender (χ^2 (1, 119)=.03, $p=.86$) or maternal education ($\chi^2(2, 119)=1.19$, p=.553). Additionally, the proportion of women assigned to the CG compared to women assigned to the MG was stable ($z = 1.46$, $p=0.144$).

Final sample

The final sample consisted of N=88 mothers and their five months old infants. Percentage of male infants did not significantly differ in MG (n=23; 56.1%) and CG (n=24; 51.1%). Most mothers were highly educated, with n=38 (44.2%) of the 88 mothers reporting to have finished grammar school, and n=27 (31.4%) of them reporting to have achieved a university degree. Moreover, n=85 (96.6%) lived in a stable relationship with the child's father (see table 1 for further information and group comparisons).

Table 1 Sample characteristics for maltreatment and comparison group

Demographics	Maltreatment group ($n = 41$)		Comparison group ($n = 47$)		df	Pearson-Chi-square	p value
	n	%	n	%			
Child gender (male)[a]	23	56.1	24	51.1	1	0.22	0.637
Mother's relationship status[a]							
Mother in a relationship	38	92.7	47	100	1	3.56	0.059
Mother married	32	78.0	41	87.2	1	1.31	0.253
Mother's educational status[a]							
Intermediate school (or less)	10	25.6	11	23.4			
Grammar school	17	43.6	21	44.7			
University	12	30.8	15	31.9	2	0.58	0.971
	M	SD	M	SD	df	t value	p value
Age mother[b]	32.07	5.69	32.49	5.06	86	−0.36	0.717
Birth weight child[b]	3.93	1.15	3.87	1.05	86	0.23	0.817
Salivary cortisol mother (ng/mL)	2.09	1.27	2.08	1.33	86	0.04	0.965
Salivary cortisol child (ng/mL)	2.67	1.78	3.00	1.41	86	−0.92	0.353
SCL-90 global severity index[b]	0.47	0.31	0.22	0.20	86	4.53	<0.001

[a] Pearson Chi-square
[b] Student's t-test (two-tailed, alpha of 0.05)

Measures

Maternal and infant cortisol. During their lab visit, mothers were given detailed instruction for at home cortisol collection. Basal salivary cortisol levels were collected on two consecutive days using salivette collection devices (Sarstedt, Germany). Mother-child dyads had to chew on cotton rolls at the same time for three minutes between eleven o'clock am and one o'clock pm. Mothers were asked, with reference to both themselves and their infants, to refrain from brushing their teeth, eating, and drinking 60 min before procedures to avoid contamination. All samples were assayed in duplicate (on two consecutive days) and the average of the duplicates was used in all analyses. Subjects were instructed to collect saliva out of their oral cavity in a quiet and non-stressed situation, store the salivettes in the fridge (-20°C) and send them back in a covered envelope. The salivettes were centrifuged at 300rpm for 5 minutes. Salivary-free cortisol concentrations were measured at the Steroid Laboratory of the Department of Pharmacology, University of Heidelberg, by a specific in-house radioimmunoassay (RIA) using tritiated steroid (Amersham Biosciences, Freiburg, Germany) and antibodies, raised and characterized in the steroid laboratory, as described elsewhere (Vecsei, 1979). Cortisol was extracted from 500-µl saliva aliqots using dichloromethane prior to RIA. The intra-assay coefficient of variation (CV) was 5.95% and inter-assay CV was <10%.

Maternal History of Abuse. A history of childhood physical or sexual abuse was assessed by the German version (Driessen et al., 2000) of the Childhood Trauma Questionnaire (CTQ; Bernstein & Fink, 1999). The CTQ is a self-administered questionnaire with 28 items that quantifies the frequency of abusive experiences on a 5-point sale, ranging from 0, never, to 5, very often. Different types of childhood trauma are operationalized on five subscales (emotional abuse, physical abuse, sexual abuse, emotional neglect, and physical neglect). Subjects are asked to rate the frequency of abusive experiences during their childhood and adolescence. Cut-off scores have been determined to define the severity of the abusive experiences: none or minimal, minor, moderate, and severe (Bernstein & Fink, 1999). The CTQ has demonstrated strong psychometric properties in community (Scher, Stein, Asmundson, McCreary & Forde, 2001), clinical (Bernstein et al., 2003), and mixed samples (Spinhoven et al., 2014) and determined to be the leading retrospective measure of childhood maltreatment currently in use (Tonmyr, Draca, Crain & MacMillan, 2011). The subscales of the German CTQ version have shown high internal consistencies ($α ≥ 0.80$) with the exception of the "physical neglect" subscale, and construct validity was supported (Klinitzke, Romppel, Häuser, Brähler, & Glaesmer, 2012). Likewise, in our sample of N = 119 mothers, Cronbach's α for each subscale was high (Physical abuse: $α = .88$; sexual abuse $α = .80$; emotional abuse: $α = .88$, and emotional neglect: $α = .93$) except for the "physical neglect" subscale, which showed only moderate internal consistency ($α = .68$).

Maternal Psychopathology. In order to control for potential differences in psychopathology, mothers were asked to fill out the German Version of the Symptom Checklist 90-Revised (SCL-90-R; Franke, 2002), a 90-item self-report inventory measuring psychological distress in nine dimensions and three global scales. The global severity index (GSI), obtained by averaging the scores over the 90 items, is considered to be the best indicator of the current degree of psychological distress (Franke, 2002) and its use has been reinforced by recent validation studies (Urbán et al., 2014). The SCL-90-R has been shown to have satisfactory psychometric properties and has been used widely in research (Derogatis & Unger, 2010; Urbán et al., 2014).

Statistical Analyses

To test mother-child cortisol synchrony, we examined correlations using the spearman *roh* correlation coefficient. In addition, we conducted hierarchical multiple regression analyses (Aiken & West, 1991) to control for potential confounds and subsequently add variables of interest to the regression model. Child cortisol level was the dependent variable in the regression model. For all hypotheses, we included the following control variables in block one: maternal age, birth weight child and maternal psychopathology, as these factors have been found to influence behavioral attunement (Easterbrooks, Chaudhuri, & Gestsdottir, 2005; Belsky & Jaffee, 2006; Bornstein, 2013). To test the first hypothesis of a mother-child cortisol attunement, maternal cortisol was entered in block 2 (see table 2). For the second hypothesis, the factor group was added in block 3, and the group x maternal cortisol interaction was added to the model in block 4. Finally, the two- way interactions between gender, group and maternal cortisol were added in block 5, and their three-way interaction in block 6. In addition, we applied the PROCESS macro written by Andres Hayes (Hayes, 2012). PROCESS probes the interaction term using an alternative method for making inferences about indirect effects that does not rely on the normality assumption by applying bias corrected bootstrapping intervals (Preacher & Hayes, 2008). The number of bootstrap samples used to determine 95% bias-corrected bootstrap confidence intervals was 5000. For dichotomous moderators, PROCESS produces the conditional effects of the independent variable ("simple slopes") at each of the two values of the moderator, along with a standard error, *t*-, and *p*-value. Variable W moderates the relationship between the independent and the dependent variable for values of W where the confidence bands do not contain zero (Preacher, Rucker, & Hayes, 2007).

Results

No statistically significant group differences were found regarding any of the demographic variables examined (see table 1 for sample characteristics for each group). Cortisol mean values were M=2.07 ng/ml (SD 1.29 ng/ml) for mothers and M=2.83 ng/ml (SD 1.59 ng/ml) for infants. Regarding hypothesis 1, our results show a significant association between maternal

baseline salivary cortisol and infant baseline salivary cortisol (Spearman's *roh*; N=88, *r*=.23, *p*=.034). Regression analyses confirmed the predictive value of maternal cortisol in respect to child cortisol above and beyond potential confounding variables such as maternal psychopathology (see table 2). As for hypotheses 2, hierarchical regression analysis did not confirm a moderating effect of maternal HoA, as the interaction term did not reach significance. In addition, neither did we find significant main effects of maternal HoA or gender on child cortisol level, nor did any of the two-way interaction terms reach significance (see table 2). However, by testing hypothesis 3, we found a significant three-way-interaction between maternal HoA, maternal cortisol level and child gender (*ß*=1.58; *p*<0.01; see table 2). Applying the PROCESS macro (Hayes, 2012) results show significant attunement in the CG only in mother-daughter pairs, whereas in the MG, only mother's and son's cortisol level display significant associations (see figure 1a+b). In both groups, significant relations are positive, meaning higher maternal cortisol is associated with higher child cortisol (for an overview of the conditional effect see table 3). Table 4 summarizes the conditional effect of the interaction between maternal cortisol level and maternal HoA on child cortisol level, depending on gender: In our sample, maternal HoA exerts its influence on adrenocortical attunement only in mother-son-dyads.

Table 2 Maternal history of childhood abuse, maternal cortisol and child gender as predictors for child cortisol levels

Model	Predictor	β	t	β_{sig}
(1) $R^2 = 0.033$	Gender	0.01	0.08	0.938
	Birth weight	0.03	0.27	0.786
	Maternal age	−0.04	−0.39	0.697
	SCL 90 GSI	−0.18	−1.68	0.097
(2) $R^2 = 0.106$	$Cort^m$	0.27	2.57	0.012
(3) $R^2 = 0.107$	Group	0.04	0.34	0.734
(4) $R^2 = 0.131$	$Cort^m$ × group	−0.57	−1.37	0.174
(5) $R^2 = 0.136$	$Cort^m$ × gender	0.23	0.64	0.523
	Group × gender	0.07	0.14	0.886
(6) $R^2 = 0.217$	$Cort^m$ × group × gender	3.67	2.83	<0.01

Hierarchical regression analysis

GSI Global severity index (SCL 90-R), $Cort^m$ maternal salivary baseline cortisol, *Group* MG/CG; dependent variable: infant salivary baseline cortisol ($Cort^c$); $\alpha = 0.05$

Table 3 Conditional effect of $Cort^M$ on $Cort^C$ at values of gender and group

Gender	Group	β (SE)	t	β_{sig}	LLCI	ULCI
Male	MG	0.80 (0.23)	3.53	<0.01	0.35	1.25
Male	CG	−0.05 (0.19)	−0.28	0.777	−0.14	0.32
Female	MG	0.03 (0.36)	0.08	0.935	−0.70	0.76
Female	CG	0.83 (0.33)	2.51	0.014	0.17	1.49

MG Maltreatment group, *CG* comparison group, $Cort^m$ maternal baseline cortisol, $Cort^c$ infant baseline cortisol, level of confidence for confidence intervals: 95 %

Table 4 Conditional effect of the $Cort^M$*group interaction on $Cort^C$ at values of gender

Gender	β (SE)	t	β_{sig}	LLCI	ULCI
Male	−0.85 (0.30)	−2.88	<0.01	−1.44	−0.26
Female	0.80 (0.49)	1.63	0.108	−0.18	1.79

$Cort^m$ Maternal baseline cortisol, $Cort^c$ infant baseline cortisol, level of confidence for confidence intervals: 95 %
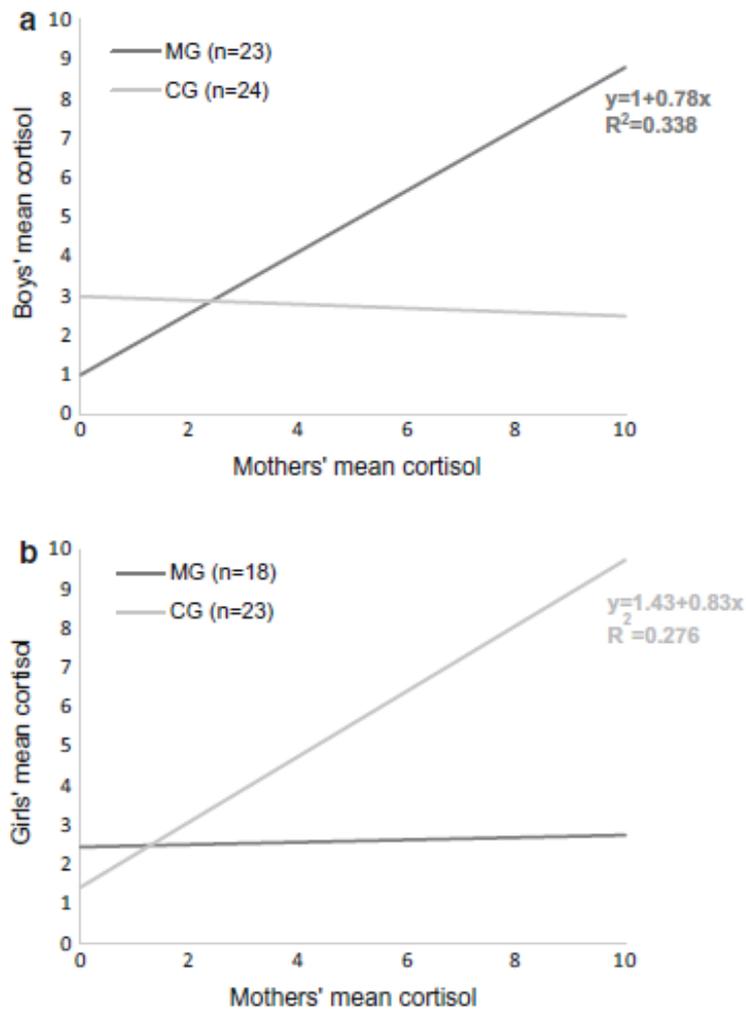
Fig. 1 a Mother–son-adrenocortical attunement. b Mother–daughter-adrenocortical attunement. *MG* Maltreatment group, *CG* comparison group

Discussion

We examined adrenocortical attunement in mothers with a history of childhood abuse and their five months old infants. In line with previous work (e.g. Castral et al., 2015; Feldman et al., 2010), we were able to confirm an association between maternal and infant salivary cortisol levels both in mother-daughter and mother-son dyads. In addition, we identified two important moderating factors influencing the link between maternal and child physiological systems: maternal history of childhood abuse and child gender.

In the CG, our data show adrenocortical attunement in girls and their mothers, but not in boys and their mothers. Correspondingly, stronger links of physiological attunement in mother-daughter-pairs have been reported in two previous studies focusing on normative samples and older age groups (Ruttle et al., 2011; Saxbe et al., 2014). Thus, this is the first study to describe stronger attunement in mother-daughter-pairs compared to mother-son-pairs in an infant sample. Generally, growing evidence suggests sex-specific HPA-response patterns, especially in adult samples (Kirschbaum, Kudielka, Gaab, Schommer, & Hellhammer, 1999),

whereas research on gender differences in HPA-axis-activity in children or even infants is more sparse (Hatzinger et al., 2007; Kudielka, Buske-Kirschbaum, Hellhammer, & Kirschbaum, 2004). However, preliminary evidence indicates gender differences in baseline and stress-elicited HPA-system activity already in preschool age (Hatzinger et al., 2007; Rosmalen et al., 2005; Williams et al., 2013). According to Feldman (2003), who studied 100 first-time mothers and fathers interacting with their 5-month-old infants, attunement might build on the infant's biological rhythms. A gender specific physiological system, in addition to gender specific affective reactivity and interactional quality (Feldman, 2007; Weinberg et al., 1999), might be more easily matched in same-sex dyads (Feldman, 2003). That way, girls would be more "tuned in" than boys in normative samples of mother-child-dyads.

Contrary to this, in the MG, we found significant adrenocortical attunement only in mothers and their sons. Examining a high-risk sample characterized by a high prevalence of anxiety disorders in mothers, Williams and colleagues (2013) reported a similar effect of gender in adrenocortical attunement: mothers showing flatter diurnal slopes tended to have children with a similar diurnal profile only if they had sons. Recent results indicate adrenocortical attunement to be dependent on sensitive behavior on part of the mother, linking higher sensitivity to higher attunement (Atkinson et al, 2013; Hibel et al., 2015; Ruttle et al., 2011; Sethre-Hofstadt et al, 2002). Previous studies have also indicated a possible link between both maternal history of childhood abuse and maternal anxiety disorders and less optimal parenting behavior in infancy (Smith et al., 2014; Fuchs et al., 2015; Nicol-Harper, Harvey, & Stein, 2007; Feldman et al., 2009). One might hypothesize that, under risk conditions such as lowered maternal sensitivity, mothers are more strongly attuned to boys. Research findings suggest that infant boys, potentially due to lower self-regulatory capacities, put more focus on their mothers, demand for contact more than girls do and, in addition, display more signals expressing distress (Rothbart & Gartstein, 2003; Tronick & Cohn, 1989; Weinberg et al., 1999). This could be in line with results describing mothers of infant sons reporting higher levels of parenting stress than mothers of infant girls (Scher & Sharabany, 2005). As a consequence, boys might provoke higher amount of attention from mothers, and, as they seem to be highly reactive, expressive and less withdrawn, mothers would have to invest less effort in understanding their needs and responding adequately. In case of lower maternal sensitivity, the reactive, demanding interactional style of infant boys might provoke and allow mothers to be "attuned". Infant girls, however, seem to have higher effortful control capabilities (Else-Quest, Hyde, Hill Goldsmith, & Van Hulle, 2006), evidence greater emotional stability over time (Tronick & Cohn, 1989) and display more withdrawal (Rothbart & Gartstein, 2003). Consequently, attunement between mothers less likely to provide high sensitive care and their female infants might be impaired. In conclusion, in normative mother-infant-pairs with normative behavioral interactional quality, the underlying same-sex biological systems might lead to higher attunement in mother-

daughter- than mother-son-dyads. However, in at-risk mother-infant-pairs, whose behavioral attunement system might be disturbed, interactional qualities of the infant such as reactiveness and expressiveness might become a matter of high importance. This could potentially lead to infant boys showing higher physiological attunement to their mothers with a history of childhood abuse.

Interestingly, we did not find any direct effect of maternal psychopathological symptoms on adrenocortical mother-child-attunement in our sample. Since we assessed psychopathology using maternal self-report, we cannot rule out the possibility that response bias or a limited ability to self-reflect affected the results. In addition, we were not able to investigate the full history of mothers' psychopathology. However, we examined a community-based sample with high levels of social support reporting mostly low or average levels of psychological distress. The missing link between maternal psychopathological symptoms and adrenocortical attunement could be due to limited range or low average symptom severity. To elucidate the associations between physiological attunement and psychopathology, future studies should therefore include clinical samples.

Furthermore, contrary to earlier research (Bernard et al., 2015; Trickett et al., 2010), we did not find significant differences in mean values of salivary cortisol between MG and CG. However, as we assessed basal cortisol levels on two consecutive days, we did not examine awakening response or followed up on the diurnal rhythm of cortisol activity of those dyads. We therefore cannot completely rule out the possibility that there might still be a difference in HPA activity between both groups.

Strengths

This study was based on sampling from the general population and the only manifest difference between mothers was the history of childhood abuse and neglect, as psychosocial status was carefully matched. In addition, this is the first study to examine adrenocortical attunement in mothers with and without a history of childhood abuse, thereby contributing to the yet limited number of studies examining influential factors of physiological attunement. It is also the first study to focus on the effect of gender on attunement in infancy.

Limitations

In our study, we examined cross-sectional intercorrelation between salivary baseline cortisol, hypothesized to reflect concurrent attunement between mother and child. However, in current literature, cortisol assessment usually comprises of analyzing cortisol awakening response data and diurnal trajectories of cortisol, requiring multiple assessment points per day. It would be interesting to see associations between cortisol attunement, HoA and gender in time-lagged analysis. Both assessment methods represent distinct constructs and therefore different theoretical implications. Cross-sectional intercorrelation might reflect transmission of arousal

from one person to another, whereas covariation around a trajectory could reflect similar reactivity to a shared context (Saxbe et al., 2015). A deeper understanding of both processes would be beneficial, as well as longitudinal data on attunement over the course of development. Additionally, there is evidence that an individual's diurnal cortisol rhythm may be influenced by genetic mechanisms (Van Hulle, Shirtcliff, Lemery-Chalfant, & Goldsmith, 2012), which suggests further investigation of genetic factors. However, Schreiber et al. (2006) were able to show that family members had similar cortisol levels not only due to genetic influences, but also depending on the degree to which they shared environmental factors. Cortisol levels have also been shown to be affected by menstrual cycle, which we did not include in our analyses. Additionally, due to limited resources, we did not use clinical interviews to screen for current or history of maternal psychopathology. We did, however, control for current symptomatology using a valid and broadly utilized questionnaire. At last, in a recent study, Saxbe and Collegues (2014) were able to show not only adrenocortical attunement between adolescents and their mothers, but between youth and their fathers also. It would have been interesting to see if this recent finding might be replicable in an infant sample, where mothers usually are the main caretaker of the child.

Conclusion

This is the first study examining adrenocortical attunement in a sample of mothers with a history of abuse. Our findings indicate an important role of maternal childhood experiences, interacting with the child's gender, as there was significant attunement in the MG only in mother-son-dyads, and in the CG only in mother-daughter dyads. Consequently, in addition to behavioral attunement and dependent on child gender, physiological attunement between mother and child might compose a mechanism for the transgenerational transmission of adverse childhood experiences.

There are many questions unanswered. It is suggested that higher level of physiological attunement is associated with positive developmental outcome as it is the case in behavioral attunement (Feldman, 2012). However, empirical evidence to underline this assumption is lacking. Examining samples such as mothers with a history of abuse, who have been shown to display dysregulated HPA-functioning, question arises whether a strong coupling between mother and child is still beneficial. It may be possible that, in this case, strong adrenocortical attunement changes from being a protective to being a risk factor in development. Inferring from our results, boys might then be at greater risk than girls are, which has also been shown in animal studies (Bock et al., 2014). Furthermore, the exact mechanisms and trajectories of physiological attunement are vastly unknown. Prospective longitudinal studies are needed to shed light on functioning, influential factors, developmental pathways and, ultimately, consequences for the developing child.

Acknowledgments

References

Atkinson, L., Gonzalez, A., Kashy, D. A., Santo Basile, V., Masellis, M., Pereira, J., … Levitan, R. (2013). Maternal sensitivity and infant and mother adrenocortical function across challenges. *Psychoneuroendocrinology*, *38*(12), 2943–2951.

Beebe, B., Jaffe, J., Markese, S., Buck, K., Chen, H., Cohen, P., … Feldstein, S. (2010). The origins of 12-month attachment: A microanalysis of 4-month mother–infant interaction. *Attachment & Human Development*, *12*(1-2), 3–141.

Belsky, J., & Jaffee, S., (2006). The multiple determinants of parenting. *Developmental Psychopathology, Risk, Disorder, and Adaptation*, *3*, 38.

Bernard, K., Butzin-Dozier, Z., Rittenhouse, J., & Dozier, M. (2010). Cortisol production patterns in young children living with birth parents vs children placed in foster care following involvement of Child Protective Services. *Archives of Pediatrics & Adolescent Medicine*, *164*(5), 438–443.

Bernstein, D. P., & Fink, L. F. (1999). Childhood Trauma Questionnaire (CTQ). *San Antonio, Psychological Corporation*.

Bernstein, D. P., Stein, J. A., Newcomb, M. D., Walker, E., Pogge, D., Ahluvalia, T., … others. (2003). Development and validation of a brief screening version of the Childhood Trauma Questionnaire. *Child Abuse & Neglect*, *27*(2), 169–190.

Bert, S. C., Guner, B. M., & Lanzi, R. G. (2009). The influence of maternal history of abuse on parenting knowledge and behavior. *Family Relations*, *58*(2), 176–187.

Bock, J., Poeschel, J., Schindler, J., Börner, F., Shachar-Dadon, A., Ferdman, N., … Poeggel, G. (2014). Transgenerational sex-specific impact of preconception stress on the development of dendritic spines and dendritic length in the medial prefrontal cortex. *Brain Structure and Function*, 1–9.

Bornstein, M. H. (2013). Mother-infant attunement: A multilevel approach via body, brain, and behavior. *The Infant Mind: Origins of the Social Brain*, 266–298.

Brazelton, T. B., Koslowski, B., & Main, M. (1974). The origins of reciprocity: The early mother-infant interaction. Retrieved from http://psycnet.apa.org/psycinfo/1974-22730-007

Bright, M. A., Granger, D. A., & Frick, J. E. (2012). Do infants show a cortisol awakening

    response? *Developmental Psychobiology*, *54*(7), 736–743.

Castral, T. C., Warnock, F., Dos Santos, C. B., Daré, M. F., Moreira, A. C., Antonini, S. R. R., &

    Scochi, C. G. S. (2015). Maternal mood and concordant maternal and infant salivary cortisol

    during heel lance while in kangaroo care. *European Journal of Pain*, *19*(3), 429–438.

Criss, M. M., Shaw, D. S., & Ingoldsby, E. M. (2003). Mother–son positive synchrony in middle

    childhood: Relation to antisocial behavior. *Social Development,* 12(3), 379-400.

Derogatis, L. R., & Unger, R. (2010). Symptom checklist-90-revised. *Corsini Encyclopedia of*

    Psychology. Retrieved from

    http://onlinelibrary.wiley.com/doi/10.1002/9780470479216.corpsy0970/full

Dixon, L., Hamilton-Giachritsis, C., & Browne, K. (2005). Attributions and behaviours of parents

    abused as children: A mediational analysis of the intergenerational continuity of child

    maltreatment (Part II). *Journal of Child Psychology and Psychiatry*, *46*(1), 58–68.

Egeland, B., Jacobvitz, D., & Sroufe, L. A. (1988). Breaking the cycle of abuse. *Child*

    Development, 1080–1088.

Else-Quest, N. M., Hyde, J. S., Goldsmith, H. H., & Van Hulle, C. A. (2006). Gender differences in

    temperament: a meta-analysis. *Psychological Bulletin*, *132*(1), 33.

Feldman, R. (2003). Infant–mother and infant–father synchrony: The coregulation of positive

    arousal. *Infant Mental Health Journal*, *24*(1), 1–23.

Feldman, R. (2007). Parent–infant synchrony and the construction of shared timing; physiological

    precursors, developmental outcomes, and risk conditions. *Journal of Child Psychology and*

    Psychiatry, *48*(3-4), 329–354.

Feldman, R. (2012). Parent–infant synchrony: A biobehavioral model of mutual influences in the

    formation of affiliative bonds. *Monographs of the Society for Research in Child Development*,

    77(2), 42–51.

Feldman, R., Granat, A., Pariente, C., Kanety, H., Kuint, J., & Gilboa-Schechtman, E. (2009).

    Maternal depression and anxiety across the postpartum year and infant social engagement,

fear regulation, and stress reactivity. *Journal of the American Academy of Child & Adolescent Psychiatry*, 48(9), 919-927.

Feldman, R., Singer, M., & Zagoory, O. (2010). Touch attenuates infants' physiological reactivity to stress. *Developmental Science*, *13*(2), 271–278.

Feldman, R., Vengrober, A., Eidelman-Rothman, M., & Zagoory-Sharon, O. (2013). Stress reactivity in war-exposed young children with and without posttraumatic stress disorder: Relations to maternal stress hormones, parenting, and child emotionality and regulation. *Development and Psychopathology*, *25*(4pt1), 943–955.

Franke, G. H., & Derogatis, L. R. (2002). *SCL-90-R: Symptom-Checkliste von LR Derogatis: deutsche Version: Manual*. Beltz Test.

Fuchs, A., Möhler, E., Resch, F., & Kaess, M. (2015). Impact of a maternal history of childhood abuse on the development of mother–infant interaction during the first year of life. *Child Abuse & Neglect*, *48*, 179–189.

Gartstein, M. A., & Rothbart, M. K. (2003). Studying infant temperament via the revised infant behavior questionnaire. *Infant Behavior and Development*, *26*(1), 64–86.

Gitau, R., Cameron, A., Fisk, N. M., & Glover, V. (1998). Fetal exposure to maternal cortisol. *The Lancet.* 352(9129), 707-708.

Gitau, R., Fisk, N. M., & Glover, V. (2004). Human fetal and maternal corticotrophin releasing hormone responses to acute stress. *Archives of Disease in Childhood-Fetal and Neonatal Edition*, *89*(1), F29–F32.

Granger, D. A. (1998). Children's salivary cortisol, internalising behaviour problems, and family environment: Results from the Concordia Longitudinal Risk Project. *International Journal of Behavioral Development*, *22*(4), 707–728.

Hatzinger, M., Brand, S., Perren, S., von Wyl, A., von Klitzing, K., & Holsboer-Trachsler, E. (2007). Hypothalamic–pituitary–adrenocortical (HPA) activity in kindergarten children: importance of gender and associations with behavioral/emotional difficulties. *Journal of Psychiatric Research*, 41(10), 861-870.

Hayes, A. F. (2012). *PROCESS: A versatile computational tool for observed variable mediation, moderation, and conditional process modeling*. Retrieved from http://is.muni.cz/el/1423/podzim2014/PSY704/50497615/hayes_2012_navod_process.pdf

Hibel, L. C., Granger, D. A., Blair, C., & Finegood, E. D. (2015). Maternal-child adrenocortical attunement in early childhood: Continuity and change. *Developmental Psychobiology*, *57*(1), 83–95.

Hostinar, C. E., & Gunnar, M. R. (2013). Future directions in the study of social relationships as regulators of the HPA axis across development. *Journal of Clinical Child & Adolescent Psychology*, *42*(4), 564–575.

Isabella, R. A., & Belsky, J. (1991). Interactional synchrony and the origins of infant-mother attachment: A replication study. *Child Development*, *62*(2), 373–384.

Kirschbaum, C., & Hellhammer, D. H. (1994). Salivary cortisol in psychoneuroendocrine research: recent developments and applications. *Psychoneuroendocrinology*, *19*(4), 313–333.

Kirschbaum, C., Kudielka, B. M., Gaab, J., Schommer, N. C., & Hellhammer, D. H. (1999). Impact of gender, menstrual cycle phase, and oral contraceptives on the activity of the hypothalamus-pituitary-adrenal axis. *Psychosomatic medicine*, 61(2), 154-162.

Klinitzke, G., Romppel, M., Häuser, W., Brähler, E., & Glaesmer, H. (2012). Die deutsche Version des Childhood Trauma Questionnaire (CTQ)–psychometrische Eigenschaften in einer bevölkerungsrepräsentativen Stichprobe [The German Version of the Childhood Trauma Questionnaire (CTQ): psychometric characteristics in a representative sample of the general population]. *Psychotherapie, Psychosomatik, Medizinische Psychologie*, *62*(2), 47–51.

Kochanska, G., & Kim, S. (2014). A complex interplay among the parent–child relationship, effortful control, and internalized, rule-compatible conduct in young children: evidence from two studies. *Developmental psychology*, 50(1), 8.

Kudielka, B. M., Buske-Kirschbaum, A., Hellhammer, D. H., & Kirschbaum, C. (2004). HPA axis responses to laboratory psychosocial stress in healthy elderly adults, younger adults, and children: impact of age and gender. *Psychoneuroendocrinology,* 29(1), 83-98.

LeMoult, J., Chen, M. C., Foland-Ross, L. C., Burley, H. W., & Gotlib, I. H. (2015). Concordance of mother–daughter diurnal cortisol production: Understanding the intergenerational transmission of risk for depression. *Biological Psychology*, *108*, 98–104.

Lyons-Ruth, K., & Block, D. (1996). The disturbed caregiving system: Relations among childhood trauma, maternal caregiving, and infant affect and attachment. *Infant Mental Health Journal*, *17*(3), 257–275.

Middlemiss, W., Granger, D. A., Goldberg, W. A., & Nathans, L. (2012). Asynchrony of mother–infant hypothalamic–pituitary–adrenal axis activity following extinction of infant crying responses induced during the transition to sleep. *Early Human Development*, *88*(4), 227–232.

Moehler, E., Biringen, Z., & Poustka, L. (2007). Emotional availability in a sample of mothers with a history of abuse. *American Journal of Orthopsychiatry*. Retrieved from http://psycnet.apa.org/psycinfo/2007-19519-014

Nicol-Harper, R., Harvey, A. G., & Stein, A. (2007). Interactions between mothers and infants: Impact of maternal anxiety. *Infant Behavior and Development*, 30(1), 161-167.

Neu, M., Laudenslager, M. L., & Robinson, J. (2008). Coregulation in salivary cortisol during maternal holding of premature infants. *Biological Research for Nursing*. Retrieved from http://brn.sagepub.com/content/early/2008/11/21/1099800408327789.short

Papp, L. M., Pendry, P., & Adam, E. K. (2009). Mother-adolescent physiological synchrony in naturalistic settings: within-family cortisol associations and moderators. *Journal of Family Psychology*, *23*(6), 882.

Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods*, *40*(3), 879–891.

Preacher, K. J., Rucker, D. D., & Hayes, A. F. (2007). Addressing moderated mediation hypotheses: Theory, methods, and prescriptions. *Multivariate Behavioral Research*, *42*(1), 185–227.

Rosmalen, J. G. M., Oldehinkel, A. J., Ormel, J., De Winter, A. F., Buitelaar, J. K., & Verhulst, F. C. (2005). Determinants of salivary cortisol levels in 10–12 year old children; a population-based study of individual differences. *Psychoneuroendocrinology*, 30(5), 483-495.

Ruttle, P. L., Shirtcliff, E. A., Serbin, L. A., Fisher, D. B.-D., Stack, D. M., & Schwartzman, A. E. (2011). Disentangling psychobiological mechanisms underlying internalizing and externalizing behaviors in youth: Longitudinal and concurrent associations with cortisol. *Hormones and Behavior*, *59*(1), 123–132.

Saxbe, D. E., Margolin, G., Spies Shapiro, L., Ramos, M., Rodriguez, A., & Iturralde, E. (2014). Relative influences: Patterns of HPA axis concordance during triadic family interaction. *Health Psychology*, *33*(3), 273.

Scher, A., & Sharabany, R. (2005). Parenting anxiety and stress: Does gender play a part at 3 months of age?. *The Journal of genetic psychology*, 166(2), 203-214.

Scher, C. D., Stein, M. B., Asmundson, G. J., McCreary, D. R., & Forde, D. R. (2001). The childhood trauma questionnaire in a community sample: psychometric properties and normative data. *Journal of Traumatic Stress*, *14*(4), 843–857.

Schreiber, J. E., Shirtcliff, E., Van Hulle, C., Lemery-Chalfant, K., Klein, M. H., Kalin, N. H., … Goldsmith, H. H. (2006). Environmental influences on family similarity in afternoon cortisol levels: twin and parent–offspring designs. *Psychoneuroendocrinology*, *31*(9), 1131–1137.

Sethre-Hofstad, L., Stansbury, K., & Rice, M. A. (2002). Attunement of maternal and child adrenocortical response to child challenge. *Psychoneuroendocrinology*, *27*(6), 731–747.

Smith, A. L., Cross, D., Winkler, J., Jovanovic, T., & Bradley, B. (2014). Emotional Dysregulation and Negative Affect Mediate the Relationship Between Maternal History of Child Maltreatment and Maternal Child Abuse Potential. *Journal of Family Violence*, 1–12.

Spinhoven, P., Penninx, B. W., Hickendorff, M., van Hemert, A. M., Bernstein, D. P., & Elzinga, B. M. (2014). Childhood Trauma Questionnaire: Factor structure, measurement invariance, and validity across emotional disorders. *Psychological Assessment*, *26*(3), 717.

Sroufe, L. A. (2000). Early relationships and the development of children. *Infant Mental Health Journal*, 21(1-2), 67-74.

Suveg, C., Shaffer, A., & Davis, M. (2016). Family stress moderates relations between physiological and behavioral synchrony and child self-regulation in mother–preschooler dyads. *Developmental psychobiology*, 58(1), 83-97.

Tarullo, A. R., & Gunnar, M. R. (2006). Child maltreatment and the developing HPA axis. *Hormones and Behavior*, *50*(4), 632–639.

Tonmyr, L., Draca, J., Crain, J., & MacMillan, H. L. (2011). Measurement of emotional/psychological child maltreatment: A review. *Child Abuse & Neglect*, *35*(10), 767–782.

Trickett, P. K., Noll, J. G., Susman, E. J., Shenk, C. E., & Putnam, F. W. (2010). Attenuation of cortisol across development for victims of sexual abuse. *Development and Psychopathology*, *22*(01), 165–175.

Tronick, E., & Reck, C. (2009). Infants of depressed mothers. *Harvard Review of Psychiatry*, *17*(2), 147–156.

Tronick, E. Z. (1989). Emotions and emotional communication in infants. *American Psychologist*, *44*(2), 112.

Tronick, E. Z., & Cohn, J. F. (1989). Infant-mother face-to-face interaction: Age and gender differences in coordination and the occurrence of miscoordination. *Child Development*, 85–92.

Urbán, R., Kun, B., Farkas, J., Paksi, B., Kökönyei, G., Unoka, Z., … Demetrovics, Z. (2014). Bifactor structural model of symptom checklists: SCL-90-R and Brief Symptom Inventory (BSI) in a non-clinical community sample. *Psychiatry Research*, *216*(1), 146–154.

Van Hulle, C. A., Shirtcliff, E. A., Lemery-Chalfant, K., & Goldsmith, H. H. (2012). Genetic and environmental influences on individual differences in cortisol level and circadian rhythm in middle childhood. *Hormones and Behavior*, *62*(1), 36–42.

Vecsei, P. (1979). Glucocorticoids: cortisol, cortisone, corticosterone, compound S, and their metabolites. *Methods of hormone radioimmunoassay*, 767-796.

Weinberg, M. K., Tronick, E. Z., Cohn, J. F., & Olson, K. L. (1999). Gender differences in

emotional expressivity and self-regulation during early infancy. *Developmental Psychology*,

35(1), 175.

Williams, S. R., Cash, E., Daup, M., Geronimi, E. M., Sephton, S. E., & Woodruff-Borden, J.

(2013). Exploring patterns in cortisol synchrony among anxious and nonanxious mother and

child dyads: A preliminary study. *Biological Psychology*, *93*(2), 287–295.

Wolff, M. S., & Ijzendoorn, M. H. (1997). Sensitivity and attachment: A meta-analysis on parental

antecedents of infant attachment. *Child Development*, *68*(4), 571–591.

Transgenerationale Einflussfaktoren kindlicher Inhibitionskontrolle: Mütterliche Trauma-Erfahrung, Depression und Impulsivität

Anna Fuchs*, Daniel Führer*, Anna-Lena Bierbaum, Anna-Lena Zietlow, Catherine Hindi Attar, Corinne Neukel, Dorothea Kluczniok, Michael Kaess, Anna Kramschuster, Corinna Reck, Eva Möhler, Ulrike Lehmkuhl, Felix Bermpohl, Romuald Brunner, Franz Resch*, Katja Bödeker*

Summary

Children's level of inhibitory functioning has been shown to be positively associated with child adjustment over the course of development. Examining a sample of 194 mothers and their 5 to 12 year old children, we analyzed whether children of mothers with a history of childhood abuse (n=30), mothers with remitted depression (n=38), mothers with a history of abuse and remitted depression (n=51) and children of comparison group mothers (n=75) differed in their inhibitory performance. In addition, we examined the role of maternal impulsivity. Children's level of inhibitory functioning was assessed using three subtests of the developmental neuropsychological assessment battery NEPSY. Assignment to one of the four groups was based on recognized and valid clinical interviews. Maternal impulsivity was measured using a self report questionnaire. Data analyses did not reveal any group differences in children's inhibitory performance. However, we found a moderating effect of maternal impulsivity: Children whose mothers reported a history of childhood abuse and high levels of impulsivity were found to show lower levels of inhibition than children whose mothers reported a history of abuse and low levels of impulsivity. Implications for research and clinical practice are discussed.

Keywords: Inhibition, Impulsivity, Childhood Abuse, Depression, Transgenerational

Zusammenfassung

Inhibitorische Funktionen spielen eine wichtige Rolle bei der erfolgreichen Anpassung des Kindes im Entwicklungsverlauf. Auf der Grundlage einer Stichprobe von 194 Müttern und ihren 5 bis 12 Jahre alten Kindern analysierten wir, ob sich die Kinder von Müttern mit Missbrauchserfahrungen in der eigenen Kindheit (N=30), Müttern mit remittierter Depression (N=38), Müttern mit Missbrauchserfahrungen und remittierter Depression (N=51) und Mütter einer Kontrollgruppe (N =75) in ihrer Inhibitionsleistung unterschieden. Zudem wurde die Rolle der mütterlichen Impulsivität in diesem Zusammenhang untersucht. Die kindliche Inhibitionsleistung wurde durch drei Subtests der neuropsychologischen Testbatterie NEPSY erfasst. Die Gruppenzugehörigkeit der Mütter wurde auf der Grundlage anerkannter klinischer Interviews ermittelt, die mütterliche Impulsivität durch Selbstbericht erfasst. Die

Berechnungen ergaben keine signifikanten Unterschiede in der Inhibitionsleistung der Kinder in Abhängigkeit von der Gruppenzugehörigkeit ihrer Mütter. Es zeigte sich jedoch ein moderierender Effekt der mütterlichen Impulsivität: Kinder, deren Mütter sowohl traumatische Kindheitserfahrungen als auch höhere Impulsivität berichteten, machten in den Inhibitionsaufgaben mehr Fehler als die Kinder, deren Mütter traumatische Erfahrungen und niedrigere Impulsivität berichteten. Implikationen für Forschung und Praxis werden diskutiert.

Schlagwörter: Inhibition, Impulsivität, Kindesmisshandlung, Depression, Transgenerational

Einleitung

Die Fähigkeit der Inhibition erlaubt es dem Menschen, Aufmerksamkeit, Gedanken, Emotionen und Verhalten zu kontrollieren. Er ist somit in der Lage, sich über vorherrschende internale oder externale Impulse hinwegzusetzen und statt dessen eine Reaktion zu zeigen, welche in der entsprechenden Situation erforderlich oder angemessen ist (Diamond, 2013). Nach Barkley (1997) stellen inhibitorische Funktionen die Grundlage für komplexere Exekutive Funktionen (EF) dar. Sie sind ein bedeutsamer Faktor der erfolgreichen Anpassung des Kindes im Entwicklungsverlauf: Gute Inhibitionsleistungen in der Kindheit werden in Zusammenhang gebracht mit akademischer Leistung (Sjöwall, Bohlin, Rydell, & Thorell, 2015), sozialer Kompetenz (Holmes, Kim-Spoon, & Deater-Deckard, 2015) und psychischer Gesundheit (Schoemaker, Mulder, Dekovic, & Matthys, 2013; Weyandt et al., 2013). Auch im Hinblick auf langfristige Effekte konnte gezeigt werden, dass Kleinkinder, die warteten, bis sie an der Reihe waren, weniger leicht abgelenkt und weniger impulsiv waren, im Erwachsenenalter erfolgreichere Schulverläufe aufwiesen sowie körperlich fitter, emotional stabiler und zufriedener mit ihrem Leben waren (Moffitt, 2011). Bislang hat sich die Forschung weitestgehend auf den Einfluss der Hirnreifung sowie des kindlichen Temperaments auf die Inhibitionsleistung konzentriert. Umweltvariablen wie der Erziehungsstil oder die Beziehungsqualität zu Bezugspersonen, welche zur Entwicklung der Inhibitionsleistung beitragen und dementsprechend interindividuelle Unterschiede erklären könnten, wurden bedeutend seltener untersucht (Anderson, 2002; Roskam, Stievenart, Meunier, & Noël, 2014).

Transgenerationale Auswirkungen auf die kindliche Inhibitionsleistung

Zu den bedeutendsten Einflussfaktoren auf die Umwelt, in der Kinder aufwachsen, zählen mütterliche depressive Erkrankungen sowie Missbrauchs- und Misshandlungserfahrungen in der eigenen Kindheit der Mütter (Dixon, Browne, & Hamilton-Giachritsis, 2005; Goodman & Gotlib, 1999). Durch ihre Interaktion mit dem Kind, durch die Schaffung einer bestimmten Lebensumwelt und durch die Darstellung eines Rollenvorbildes können Mütter auf die Entwicklung der exekutiven und selbstregulatorischen Fähigkeiten des Kindes einwirken (Blair et al., 2011; Bridgett, Burt, Edwards, & Deater-Deckard, 2015; Kraybill & Bell, 2013). Roskam et al. (2014) zeigten beispielsweise, dass das Erziehungsverhalten der Eltern einen signifikanten Zusammenhang mit der kindlichen Inhibitionsleistung aufwies. So können Eltern durch positive Verstärkung, konsistente Erziehungsregeln und Tagesstruktur sowie Unterstützung der Autonomieentwicklung ihrer Kinder aktiv zur Entwicklung einer positiven Inhibitions- und Regulationsfähigkeit beitragen (Roskam et al., 2014). Auch in einer von Blair et al. (2011) durchgeführten, 1292 Familien umfassenden Längsschnitt-Studie waren Erziehungsverhalten und Haushaltfaktoren (Einkommen, Wohnsituation und Sicherheit) mit kindlicher EF-Leistung assoziiert (Blair et al., 2011; für einen Überblick über die Studienlage

zu Erziehung und selbstregulatorische Fähigkeiten des Kindes siehe Bridgett et al., 2015). Hinsichtlich der Auswirkungen traumatischer Kindheitserfahrungen der Mutter ist uns jedoch nur eine Studie bekannt. Henschel et al. (2013) untersuchten in einer Stichprobe von 87 Dyaden, ob sich zwei bis drei Jahre alte Kinder von Müttern mit Misshandlungserfahrungen in der Kindheit von Kindern einer Kontrollgruppe in Bezug auf ihre Ergebnisse in der „Effortful Control Battery" (Kochanska & Knaack, 2003) unterschieden. Sie fanden keinen signifikanten Unterschied der Gruppen. Einschränkend ist jedoch festzustellen, dass nur zwei der 14 Untertests der Batterie durchgeführt worden waren, was möglicherweise die Interpretierbarkeit einschränkt (Henschel, De Bruin, & Möhler, 2013). Wenig untersucht sind auch die Auswirkungen mütterlicher Depression auf kindliche Impulskontrolle (Comas, Valentino, & Borkowski, 2014).

Die Erforschung transgenerationaler Prozesse sollte sich nicht auf die Analyse direkter Effekte beschränken, sondern auch ein weiterführendes Verständnis möglicher Übertragungsmechanismen zum Ziel haben. Dies impliziert die Identifikation von Faktoren, welche gefundene Zusammenhänge erklären können, oder diese nur unter bestimmten Bedingungen sichtbar werden lassen. Einer dieser Faktoren, welche sowohl eine vermittelnde (Mediator) als auch eine bedingende Rolle (Moderator) im Zusammenhang zwischen mütterlicher Misshandlungserfahrungen und Depression in der Vorgeschichte einnehmen könnte, stellt die mütterliche Impulsivität dar.

Belastende Ereignisse in der Kindheit scheinen die intraindividuelle Entwicklung inhibitorischer Fähigkeiten negativ zu beeinflussen. Studien deuten hierbei auf einen überdauernden, bis ins Erwachsenenalter reichenden Effekt hin (DePrince, Weinzierl, & Combs, 2009; Nikulina & Widom, 2013; Pechtel & Pizzagalli, 2011). Auswirkungen von Kindesmisshandlung, Kindesmissbrauch und Vernachlässigung wurden sowohl in Bezug auf geringere inhibitorische Kontrolle (Gould et al., 2012) als auch in Bezug auf erhöhte Impulsivität im Erwachsenenalter beschrieben (Brodsky et al., 2001; Corstorphine, Waller, Lawson & Ganis, 2007; Henschel et al., 2013; Gaher, Arens, & Shishido, 2013; Möhler et al., 2009). Auch für depressive Erkrankungen zeigen Studien Zusammenhänge mit neurokognitiver Performanz auf, insbesondere bei schwer erkrankten Erwachsenen (Baune, Czira, Smith, Mitchell, & Sinnamon, 2012). Depressive Studienteilnehmer wiesen eine erhöhte Fehleranzahl sowie erhöhte Reaktionszeiten in Inhibitionsaufgaben auf, sowohl in Reaktion auf negative als auch auf neutrale Stimuli (Gohier et al., 2009; Joormann & Gotlieb, 2010). Zugleich konstatieren die Autoren einer Meta-Analyse, dass bei Probanden mit depressiven Erkrankungen ein höheres Ausmaß an Impulsivität vorliegt (Saddichha & Schuetz, 2014). Basierend auf diesen Ergebnissen ist zu vermuten, dass sowohl Mütter mit Misshandlungserfahrungen in der eigenen Kindheit als auch depressive Mütter möglicherweise selbst höhere Impulsivität und niedrigere Inhibitionskontrolle aufweisen. Sie

könnten somit als Modell und auch im Erziehungsverhalten größere Schwierigkeiten haben, optimale Lernumwelten bereitzustellen und die inhibitorische Entwicklung des Kindes zu fördern, wodurch sich eine transgenerationale Weitergabe inhibitorischer Defizite ergäbe.

Zugleich ist jedoch auch denkbar, dass ein signifikanter Effekt der mütterlichen Erfahrungen in der Kindheit und der mütterlichen Depression nur bei gleichzeitig hoher Ausprägung der Impulsivität sichtbar wird. Boutwell und Beaver (2010) argumentieren hierzu, dass es für Mütter mit niedriger Selbstkontrolle eine weit größere Herausforderung darstellen könnte, ihre Kinder auf der Grundlage konsistenter Regeln zu erziehen (Boutwell & Beaver, 2010). In ihrem Überblicksartikel konstatieren Crandall, Deater-Deckard und Riley (2015), dass Mütter mit Defiziten in der kognitiven und emotionalen Kontrolle insbesondere in Stresssituationen Schwierigkeiten haben könnten, optimal auf ihre Kinder zu reagieren (Crandall et al, 2015). Es gibt zudem Hinweise darauf, dass Kinder aus Haushalten, welche sich durch weniger klare Strukturen auszeichnen, erhöhte Impulsivitätswerte aufweisen (Dumas et al., 2005). Da Mütter mit traumatischen Kindheitserfahrungen oder Depression in der Vergangenheit möglicherweise bereits höheren Belastungen ausgesetzt waren, ergäbe sich bei zusätzlich erhöhten Impulsivitätswerten ein additiver Effekt, welcher sich negativ auf das Erziehungsverhalten und damit auch auf die kindliche Inhibitionsleistung auswirken könnte. Somit würden sich die Auswirkungen mütterlicher Misshandlungserfahrungen in der Kindheit sowie mütterlicher remittierter Depression auf die kindliche Inhibitionsleistung insbesondere unter der Bedingung einer hohen Impulsivität der Mütter zeigen.

Zusammenfassend lässt sich feststellen, dass im Hinblick auf die kindliche Inhibitionsfähigkeit insbesondere Misshandlungserfahrungen in der Kindheit der Mütter, jedoch auch die mütterliche Depression von der Forschung vernachlässigte Bereiche darstellen (Bridgett et al., 2015). Auch mögliche Mechanismen und Wirkpfade, beispielsweise über die mütterliche Impulsivität, sind empirisch kaum untersucht. Wir haben demnach folgende Hypothesen aufgestellt:

1. Die Inhibitionskontrolle von Kindern ist geringer, wenn bei ihrer Mutter eine remittierte Depression und/ oder belastende Kindheitserfahrungen vorliegen.
2. 2.1 Die Impulsivität von Müttern ist höher, wenn bei ihnen eine remittierte Depression und/ oder belastende Kindheitserfahrungen vorliegen.
   2.2 Die Gruppenzugehörigkeit der Mütter wirkt sich auf die Impulsivitätswerte aus, welche wiederum die Inhibitionskontrolle des Kindes beeinflusst (Mediation)
3. Die Zusammenhänge zwischen der Gruppenzugehörigkeit und der Inhibitionskontrolle des Kindes liegen insbesondere dann vor, wenn die Mutter höhere Impulsivitätswerte aufweist (Moderation)

Da bisherige Ergebnisse gezeigt haben, dass Alter, Intelligenz (IQ) und psychiatrische Erkrankungen (z. B. ADHS) des Kindes sowie die sozioökonomischen Merkmale der Familie

mit der Entwicklung der Inhibitionsleistung in Zusammenhang stehen (Anderson, 2002; Blair et al., 2011; Halse, 2014; Sarsour et al. 2011), wurden diese Variablen als Kontrollvariablen in die Analysen einbezogen.

Methoden

Durchführung und Stichprobe

Die vorliegende Studie wurde im Rahmen des multizentrischen Forschungskonsortiums *Understanding and Breaking the Intergenerational Cycle of Abuse* (BMBF Förder-Nr. 01KR1207C) durchgeführt. Es lag für jede beteiligte Institution ein Votum der zuständigen Ethikkommission vor. Über eine breit angelegte Öffentlichkeitsarbeit wurden in den Zentren Berlin und Heidelberg Frauen mit Schulkindern im Alter zwischen 5-12 Jahren rekrutiert. Eingeschlossen wurden Mütter, die im Verlauf ihres Lebens an Depression erkrankt waren und/oder die in ihrer Kindheit körperliche Misshandlung bzw. sexuellen Missbrauch (im Folgenden: traumatische Kindheitserfahrungen) erlebt haben, und Mütter ohne diese beiden Belastungsfaktoren. Das Studiendesign umfasste demnach folgende vier Gruppen von Mutter-Kind-Dyaden: Mütter mit Depression in der Vorgeschichte und ohne traumatische Kindheitserfahrungen (DEP), Mütter ohne Depression in der Vorgeschichte und mit traumatischen Kindheitserfahrungen (T), Mütter mit Depression in der Vorgeschichte und mit traumatischen Kindheitserfahrungen (DEP+T) sowie Mütter ohne Depression in der Vorgeschichte und ohne traumatische Kindheitserfahrungen (KG). Ausgeschlossen wurden Dyaden, bei denen die Mutter eine psychotische, bipolare oder Suchterkrankung oder eine körperliche bzw. geistige Behinderung aufwies sowie Dyaden, bei denen beim Kind eine Autismus-Spektrum-Störung oder eine körperliche bzw. geistige Behinderung vorlag. Für ihre Teilnahme erhielten die Mutter-Kind-Paare eine finanzielle Aufwandsentschädigung.

Nach Aufklärung und Einwilligung in die Studienteilnahme (*informed written consent*) wurden Mutter und Kind jeweils getrennt voneinander untersucht. Es wurden die Daten von 194 Mutter-Kind-Dyaden ausgewertet, von denen 71 (37%) aus dem Heidelberger Zentrum stammten. Die Untersuchungsgruppen waren hinsichtlich mütterlicher und kindlicher Charakteristika vergleichbar, unterschieden sich aber für den Partnerschaftsstatus der Mutter und die Anzahl weiterer Kinder. Mütter der Kontrollgruppe waren im Vergleich zu Müttern der anderen Gruppen häufiger mit dem Vater des Kindes verheiratet. Mütter mit traumatischen Kindheitserfahrungen hatten im Durchschnitt mehr Kinder, was darauf zurückzuführen ist, dass die Heidelberger Mütter mehr Kinder hatten als die Berliner Mütter. Tabelle 1 zeigt die soziodemografischen Merkmale der Studienteilnehmer. Als Indikator für den Sozioökonomischen Status wurden die Ausbildungsjahre der Mutter herangezogen. Zwischen den Zentren bestanden keine weiteren Unterschiede hinsichtlich der aufgeführten Merkmale.

Tabelle 1: Soziodemografische Merkmale der Studienteilnehmer (N = 194)

		KG	T	DEP	DEP+T	p	ES
		75 (39)	30 (15)	38 (20)	51 (26)		
Kind							
Geschlecht: Mädchen	N (%)	39 (52)	14 (47)	22 (58)	33 (65)	>.05	.128
Alter	M (SD)	7,8 (1,5)	8,0 (1,4)	8,6 (1,8)	8,0 (1,6)	>.05	.036
Intelligenz	M (SD)	108 (13)	106 (11)	101 (11)	107 (15)	>.05	.031
Psychiatrische Behandlung: ja	N (%)	2 (3) [a]	0 [a]	7 (18) [b]	0 [a]	<.001	.328
Mutter							
Alter	M (SD)	39,8 (4,7)	38,6 (6,7)	39,9 (5,7)	40,5 (6,2)	>.05	.011
Ausbildungsjahre	M (SD)	17,2 (3,1)	18,3 (4,1)	16,9 (3,7)	16,8 (4,0)	>.05	.017
Familienform							
Partnerschaft:	leiblicher Vater	61 (81) [a]	20 (67) [a, b]	14 (37) [b]	23 (45) [b]		
	anderer Mann	4 (5) [a]	4 (13) [a]	6 (16) [a]	5 (10) [a]		
	alleinerziehend	10 (13) [a]	6 (20) [a, b]	18 (47) [b]	23 (45) [b]	<.001	.438
Anzahl weiterer Kinder	M (SD)	1,1 (0,6)	1,7 (0,9)	1,0 (0,8)	0,9 (0,8)	<.001	.089
Mütterliche Belastung							
Körperliche Misshandlung[1]	N (%)	0	24 (80)	0	34 (67)	<.001	.776
Sexueller Missbrauch[1]	N (%)	0	8 (27)	0	28 (55)	<.001	.613
remittierte Depression (HAMD)[2]	M (SD)	0,9 (1,2)	2,3 (2,4)	2,5 (2,0)	2,4 (2,1)	<.001	.152

Anmerkungen: Häufigkeit = N, Mittelwert = M, Standardabweichung = SD, Effektstärke = ES, gesunde Kontrollmütter = KG, Mütter mit traumatischen Kindheitserfahrungen = T, Mütter mit Depression in der Vorgeschichte = DEP, Mütter mit Depression in der Vorgeschichte und traumatischen Kindheitserfahrungen = DEP+T. Hochgestellte Buchstaben bezeichnen signifikante Gruppenunterschiede (p < .05); [1] Anzahl der Mütter mit „ausgeprägtem" oder „mäßigem" Missbrauch; [2] cut-off für Remission der Depression: ≤ 7

Instrumente

Inhibitorische Kontrolle des Kindes: Aus der neuropsychologischen Testbatterie NEPSY (*Developmental NEuroPSYchological Assessment*), zweite Auflage (Korkman, Kirk & Kemp, 2007), wurde die Skala „Aufmerksamkeit und Exekutive Funktionen" (EF) eingesetzt. In die hier berichteten Analysen gingen alle Untertests ein, welche die inhibitorische Kontrolle erfassen: *Response Set* (RS), *Inhibition-Inhibition* (INI) und *Statue* (ST). Es wurde die Summe der Fehlerwerte dieser Untertests gebildet, so dass die inhibitorische Kontrolle des Kindes hoch ist, wenn der Wert gering ist. Die internen Konsistenzen der Untertests variieren in der Eichstichprobe altersabhängig zwischen α=.48 (INI 7-12-Jahre) und α=.88 (ST 5-6 Jahre), ebenso die Test-Retest-Reliabilität zwischen r_{tt}=.35 (INI 9-12 Jahre) und r_{tt} =.88 (ST 5-6 Jahre) (Korkman et al., 2007). Die konvergente Validität mit anderen Verfahren zur Erfassung der EF wird von den Testautoren als gegeben beurteilt.

<u>Intelligenz des Kindes:</u> Für die Messung der kognitiven Leistungsfähigkeit des Kindes fokussierten wir auf den fluiden Aspekt der Intelligenz und setzten den Grundintelligenztest (CFT) ein, bis zu einem Alter von 8;11 Jahren die Skala 1 (CFT 1-R; Weiß & Osterland, 2013) und ab einem Alter von 9;0 Jahren die Skala 2 (CFT 20-R; Weiß, 2006). Beide Verfahren wurden jeweils in der Kurzform (ohne Zeitverlängerung) durchgeführt. Bei der Skala 1 wurde der Kennwert des zweiten Testteils verwendet, da nur dieser den Ausprägungsgrad der grundlegenden Intelligenz abbildet. Den älteren Kindern wurde der erste Testteil der Skala 2 vorgegeben. Die Test-Retest-Reliabilität der verwendeten Testteile beider Verfahren ist vergleichbar und liegt zwischen gut und sehr gut: r=.94 für Teil 2 des CFT 1-R (Weiß & Osterland, 2013) sowie r=.85 für Teil 1 des CFT 20-R (Weiß, 2006). Die Validität beider Testverfahren konnte mehrfach gezeigt werden.

<u>Depression der Mutter:</u> Zur Erfassung einer zurückliegenden Depression wurde das *Mini International Neuropsychiatric Interview* (M.I.N.I.; Lecrubier et al., 1997) mit der Mutter durchgeführt. Dabei handelt es sich um ein vollstrukturiertes klinisches Interview zur Erfassung von aktuellen und Lebenszeit-Diagnosen der 1. Achse des DSM-IV. Studien belegen die konvergente Validität dieses Verfahrens mit anderen klinischen Interviews (z. B. Sheehan et al., 1998) sowie eine gute bis hervorragende Interrater-Reliabilität (Sheehan et al., 1997). Zum Ausschluss einer aktuell vorliegenden Depression wurde zudem die *Hamilton Depression Scale* (HAMD; Hamilton, 1976), ein strukturiertes klinisches Interview zur Messung des Schweregrads depressiver Symptome in den letzten 7 Tagen, durchgeführt. Ein Wert kleiner oder gleich sieben indiziert eine in Remission befindliche Depression (Zajecka & Beeler, 2003). Es besteht eine hohe konvergente Validität mit anderen Instrumenten zur Einschätzung des Schweregrads einer Depression (Maier, Buller, Philipp, & Heuser, 1988).

<u>Kindheitserfahrungen von Misshandlung und Missbrauch der Mutter:</u> Erfahrungen von körperlicher Misshandlung und/ oder sexuellem Missbrauch in der Kindheit der Mutter wurden mit dem *Childhood Experience of Care and Abuse Interview* (CECA; Bifulco, Brown, & Harris, 1994) erfasst. Mit diesem semi-strukturierten Interview werden Vorliegen und Ausmaß verschiedener Belastungen von der Kindheit bis zum 17. Lebensjahr retrospektiv erfragt. Die Angaben der Mutter zu körperlicher Misshandlung, psychischem und sexuellem Missbrauch, Ablehnung und Antipathie der Eltern wurden von geschulten Interviewern auf einer 4-stufigen Skala hinsichtlich der Intensität beurteilt. Der Wert 1 wird bei „ausgeprägten" Formen kodiert. Dies sind bei körperlicher Misshandlung Gewaltvorfälle, bei denen schwere oder lebensbedrohliche Verletzungen wahrscheinlich sind (z. B. Prügel mit Kontrollverlust des Täters, Einsatz von Waffen) und bei sexuellem Missbrauch jedweder penetrative sexuelle Kontakt. „Mäßige" Formen werden mit dem Wert 2 kodiert und beinhalten bei körperlicher Misshandlung u.a. Schläge mit der Faust oder Gegenständen, Tritte und Bisse.

Mäßiger sexueller Missbrauch wird als jedweder nicht-penetrativer sexueller Kontakt operationalisiert. Beide Ausprägungsgrade werden von den Autoren des Interviews als Kriterium für das Vorliegen eines Traumas definiert. Einschluss in die Trauma-Gruppen erfolgte demnach bei Zuteilung einer dieser beiden Werte. Gute bis sehr gute Kennwerte für die interne Konsistenz, Interrater-Reliabilität und für die konvergente Validität wurden sowohl für die Originalversion (Bifulco et al., 1994) als auch für die deutsche Adaptation (Kaess et al., 2015) gezeigt. Die vorliegende Studie fokussiert auf das Vorliegen einer körperlichen Misshandlung und/ oder eines sexuellen Missbrauchs in der Kindheit der Mutter.

Impulsivität der Mutter: Es wurde der Summenwert der *Barrat Impulsiveness Skale* (BIS-11; Patton, Stanford & Barratt, 1995) verwendet. Auf einer Skala von 1 („kaum/ niemals") bis 4 („fast immer") werden kognitive, emotionale und auch behaviorale Aspekte von Impulsivität im Selbstbericht der Mutter erfasst. Die deutschsprachige Version des Verfahrens weist in der Eichstichprobe eine ausreichende interne Konsistenz auf (α=.69) und differenziert gut zwischen verschiedenen klinischen Gruppen (Preuss et al., 2008).

Statistische Analysen

Die Überprüfung von Gruppenunterschieden hinsichtlich soziodemografischer Variablen, kindlicher Inhibitionskontrolle und mütterlicher Impulsivität erfolgte mittels deskriptiver Statistik, Chi²-Tests sowie Varianz- und Kovarianzanalysen.

Den Kriterien zur Prüfung von Mediationseffekten von Baron & Kenny (1986) folgend, wurden zunächst die bivariaten Korrelationen von kindlicher Inhibitionskontrolle, mütterlicher Gruppenzugehörigkeit und mütterlicher Impulsivität berechnet. Um zusätzlich für die in der Literatur berichteten Effekte von Alter, Intelligenz (IQ), psychiatrischer Erkrankung des Kindes und sozioökonomischem Status zu kontrollieren, wurde anschließend ein hierarchisches Regressionsmodell mit dem Gesamtfehlerwert der Inhibitionskontrolle als abhängige Variable berechnet. In vier Blöcken wurden folgende Prädiktoren in das Modell aufgenommen: (1) Kontrollvariablen: Alter des Kindes, Intelligenzquotient (IQ) des Kindes, psychiatrische Behandlung des Kindes (ja/ nein), Ausbildungsjahre der Mutter (2) Gruppenzugehörigkeit der Mutter: Depression in der Vorgeschichte (ja/ nein) und traumatische Kindheitserfahrungen (ja/ nein), (3) Impulsivität der Mutter. Zur Überprüfung von Moderationseffekten wurden im letzten Block (4) die Interaktionsterme von Impulsivität der Mutter mit Depression und Kindheitstrauma eingefügt. Alle Prädiktoren wurden zuvor am Mittelwert der Stichprobe zentriert.

Ein Mediationseffekt mütterlicher Impulsivität liegt vor, wenn sich ein signifikanter Einfluss der Gruppenzugehörigkeit zeigt (Block 2), der sich bei Hinzunahme der mütterlichen Impulsivität in das Modell verringert (partielle Mediation) oder verschwindet (totale Mediation; Block 3). Eine Moderation liegt vor, wenn die Interaktion von mütterlicher

Gruppenzugehörigkeit und Impulsivität signifikant ist. Die maximale Irrtumswahrscheinlichkeit bei der Testung der Hypothesen wurde auf 5% (p<.05) festgelegt. Alle Analysen wurden mit der Statistiksoftware SPSS 22 durchgeführt.

Ergebnisse

Gruppenunterschiede bei kindlicher Inhibitionskontrolle und mütterlicher Impulsivität

Zur Prüfung der ersten Hypothese, dass sich Kinder von Müttern mit bzw. ohne Depression in der Vorgeschichte sowie mit bzw. ohne traumatischen Kindheitserfahrungen in ihren Inhibitionsleistungen voneinander unterscheiden, wurde eine 2-faktorielle Kovarianzanalyse durchgeführt. Kontrolliert wurde für die Ausbildungsjahre der Mutter, Alter des Kindes, Intelligenz des Kindes und psychiatrische Behandlung des Kindes. Es zeigten sich keine signifikanten Unterschiede in den Inhibitionsleistungen der Kinder zwischen den vier Gruppen, die auf den Effekt mütterlicher remittierter Depression ($F_{(1, 185)}$=0,142, p>.05, part. η^2=.001) oder mütterlicher traumatischer Kindheitserfahrungen ($F_{(1, 185)}$=1,014, p>.05, part. η^2=.006) zurückzuführen waren.

Die Hypothese 2.1, dass Gruppenunterschiede in der mütterlichen Impulsivität durch eine remittierte Depression oder durch traumatische Kindheitserlebnisse erklärt werden können, wurde mittels 2-faktorieller ANOVA geprüft. Es zeigte sich ein signifikanter Haupteffekt für die remittierte Depression ($F_{(1, 185)}$=12,436, p<.05, part. η^2=.064), nicht jedoch für traumatische Kindheitserfahrungen ($F_{(1, 185)}$=1,043, p>.05, part. η^2=.006); vgl. Abb. 1). Mütter mit einer Depression in der Vorgeschichte berichteten die höchste Impulsivität (M=64,1 ± 10,6), gefolgt von Müttern mit Depression und traumatischen Kindheitserfahrungen (M=60,0 ± 7,6) und Müttern mit traumatischen Kindheitserfahrungen und ohne Depression in der Vorgeschichte (M=58,0 ± 7,7). Die geringste Impulsivität berichteten Mütter der Kontrollgruppe (M=56,7 ± 8,3).

Die Bedeutung mütterlicher Impulsivität für den Zusammenhang zwischen kindlicher Inhibitionskontrolle und mütterlichen Belastungen

Zunächst wurden die bivariaten Zusammenhänge von kindlicher Inhibitionskontrolle mit Alter und Intelligenz (IQ) des Kindes sowie mit der mütterlichen Gruppenzugehörigkeit und Impulsivität geprüft. Tabelle 2 gibt die Ergebnisse wieder. Es zeigte sich eine signifikante negative Korrelation mittlerer Stärke mit dem Alter des Kindes, d.h. mit zunehmendem Alter der Kinder nahm die Fehlerzahl ab. Die Intelligenz und psychiatrische Behandlung des Kindes wie auch die Länge der mütterlichen Ausbildung hatten keinen Einfluss auf die Inhibitionsleitungen des Kindes. Weder die Zugehörigkeit der Mutter zur Depressions- oder Traumagruppe noch die selbstberichtete mütterliche Impulsivität standen in systematischem bivariaten Zusammenhang mit der kindlichen Inhibitionsleistung.

Tabelle 2: Bivariater Zusammenhang von Inhibitionsfehlern mit kindlichen und mütterlichen Variablen

	Interkorrelationen			Kind		Mutter		
	RS	INI	ST	Alter	IQ	DEP[1]	T[1]	IMP
RS		.363***	.066	-.308***	-.095	-.070	.061	-.074
INI			.103	-.326**	-.139	.009	.019	-.070
ST				-.198**	.014	.075	.124	.012
Gesamt-Inh	.606***	.766***	.625**	-.414***	-.107	.000	.098	-.061

Anmerkungen: Korrelationen von Inhibitionsfehler im Untertest *Response Set* (RS), Inhibitionsfehler im Untertest *Inhibition* (INI), Inhibitionsfehler im Untertest *Statue* (ST) und der Summe der Inhibitionsfehler (Gesamt-Inh) mit den Kontrollvariablen Alter und Intelligenz (IQ) des Kindes sowie mit den mütterlichen Variablen Depression in der Vorgeschichte (DEP), traumatische Kindheitserfahrung (T) und Impulsivität (IMP). [1]Spearman-Korrelation, alle anderen Pearson-Korrelationen, * p < .05, ** p < .01, ***p < .001

In der anschließend durchgeführten hierarchischen Regressionsanalyse wurden die Kontrollvariablen Alter, Intelligenz und psychiatrische Behandlung des Kindes (ja/nein) sowie Ausbildungsjahre der Mutter als Prädiktoren (Block 1) aufgenommen. In den nächsten beiden Schritten wurde jeweils der einzelne Beitrag der mütterlichen Variablen Depression in der Vorgeschichte (ja/nein) und traumatische Kindheitserfahrung (ja/nein) sowie der Impulsivität der Mutter getestet. Wir fanden auch bei statistischer Kontrolle der Block-1-Prädiktoren keinen transgenerationalen Effekt von mütterlicher Gruppenzugehörigkeit sowie mütterlicher Impulsivität auf die kindlichen Inhibitionsleistungen (vgl. Tab. 3). Der von uns postulierte Mediationseffekt für die mütterliche Impulsivität konnte entsprechend der Kriterien von Baron und Kenny (1986) daher in den vorliegenden Daten nicht gezeigt und somit die entsprechende Hypothese nicht bestätigt werden.

Die für die Prüfung der Moderationshypothese relevanten Interaktionsterme der Gruppenzugehörigkeit und Impulsivität wurden schließlich im 4. Block als Prädiktoren in die Regressionsanalyse aufgenommen. Es zeigte sich ein signifikanter Interaktionseffekt von mütterlicher Impulsivität und mütterlichem Kindheitstrauma für die Inhibitionsleistungen des Kindes. Das zusätzliche Vorliegen ausgeprägter Impulsivität bei Müttern mit traumatischen Kindheitserfahrungen war bei den Kindern mit signifikant mehr Inhibitionsfehlern assoziiert; d.h. diese Kinder verfügten über eine geringere inhibitorische Kontrolle (vgl. Abb. 2). Bei Kindern von Müttern ohne traumatische Kindheitserfahrungen zeigte sich eine nicht signifikante Tendenz von weniger Inhibitionsfehlern des Kindes bei stärkerer Impulsivität der Mutter. Bei Vorliegen eines mütterlichen Traumas und niedriger Impulsivität zeigten die Kinder jedoch stärkere Inhibitionsleistungen. Für eine remittierte Depression fanden wir keinen signifikanten Moderationseffekt der Impulsivität.

Tabelle 3: Zusammenfassung der hierarchischen Regressionsanalyse zur Vorhersage der Variable „Summe der Inhibitionsfehler"

Variable	B	SE	β	adj. R²	Δ R²	Δ F
1. Block				.171		10,050***
Alter Kind	-1.888	0.314	-0.436***			
Intelligenz Kind	-0.044	0.037	-0.084			
Psychiatrische Vorbehandlung Kind	0.723	2.416	0.022			
Ausbildungsjahre Mutter	-0.058	0.139	-0.029			
2. Block				.164	.003	0.285
Depression in der Vorgeschichte	-0.459	1.024	-0.033			
Traumatische Kindheitserfahrungen	0.750	1.038	0.054			
3. Block				.162	.003	0.551
Impulsivität Mutter	-0.041	0.055	-0.054			
4. Block				.183	.030	3.170*
Depression x Impulsivität	-0.005	0.116	-0.022			
Trauma x Impulsivität	0.289	0.120	1.247*			

Anmerkungen: Angegeben sind die unstandardisierten Betakoeffezienten (B) mit Standardfehler (SE), die standardisierten Betakoeffizienten (β), der adjustierte multiple Korrelationskoeffizient (adj. R²), die schrittweise Zunahme der multiplen Korrelation (Δ R²) und die Änderungen der F-Werte (Δ F). * p < .05, ** p < .01
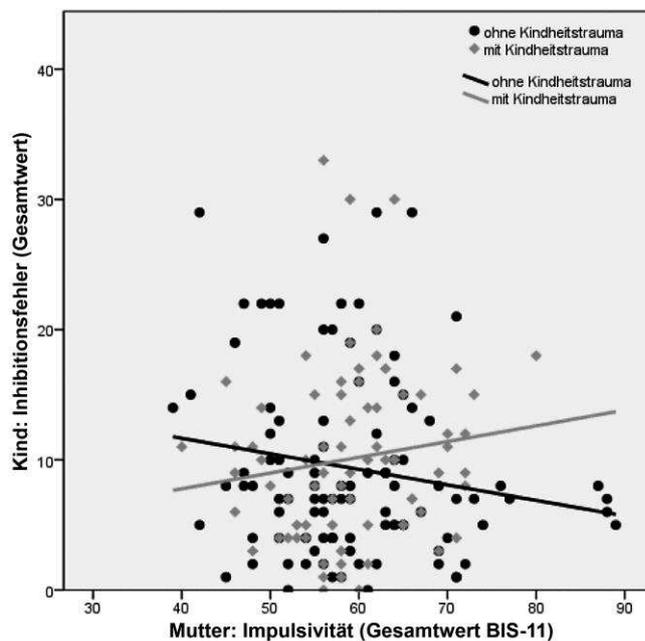
Abbildung 2: Interaktion von mütterlicher Impulsivität und traumatischen Kindheitserfahrungen für die Inhibitionsleistungen des Kindes. Abgebildet sind die standardisierten Residualwerte der kindlichen Inhibitionsfehler nach Kontrolle für Alter des Kindes, Intelligenz des Kindes, psychiatrische Vorbehandlung des Kindes und Ausbildungsjahre der Mutter.

Diskussion

In der vorliegenden Arbeit wurden an einer Stichprobe von 194 Müttern erstmals Zusammenhänge zwischen mütterlichen traumatischen Kindheitserlebnissen, Depressivität sowie mütterlicher Impulsivität und der Inhibitionsleistung ihrer fünf bis zwölf Jahre alten

Kinder untersucht. Entgegen den Hypothesen zeigten die Analysen keine Unterschiede in der Anzahl der kindlichen Inhibitionsfehler in Abhängigkeit von der Gruppenzugehörigkeit ihrer Mütter. Die Berechnungen ergaben, dass sich die Gruppe der depressiven Mütter signifikant impulsiver einschätzte als die Mütter der anderen Gruppen. Die mütterliche Impulsivität per se erwies sich zunächst nicht als signifikanter Prädiktor der kindlichen Inhibitionsfähigkeit, in Interaktion mit der Gruppenzugehörigkeit jedoch zeigte sie einen bedeutsamen Einfluss: Bei Vorliegen eines mütterlichen Traumas und hoher Impulsivität zeigten die Kinder schwächere, bei Vorliegen eines mütterlichen Traumas und niedriger Impulsivität stärkere Inhibitionsleistungen.

In unserer Stichprobe konnten wir keinen direkten Effekt mütterlicher Misshandlungserfahrungen oder mütterlicher remittierter Depression auf die Inhibitionsleistung des Kindes feststellen. Einzig das Alter des Kindes erwies sich als signifikanter Prädiktor im Haupteffekte-Modell – ein Ergebnis, welches den in der Literatur gut dokumentierten Kompetenzzuwachs in dieser Altersgruppe abbildet (Anderson, 2002; Diamond, 2013). Unsere Ergebnisse stützen die von anderen Forschergruppen berichteten Befunde eines fehlenden Zusammenhangs zwischen depressiver Erkrankung der Mutter und inhibitorischer Kontrolle des Kindes (Klimes-Dougan, Ronsaville, Wiggs, & Martinez, 2006; Micco et al., 2009; Wagner, Alloy, & Abramson, 2015). Sie erweitern die Befundlage nun um eine Stichprobe von Kindern in präpubertärem Alter. Zusammenfassend scheinen die Studien darauf hinzudeuten, dass eine depressive Erkrankung der Mutter auch bei erhöhter mütterlicher Impulsivität keine beeinträchtigende Wirkung auf die Entwicklung der inhibitorischen Fähigkeiten ihrer Kinder hat – zumindest, wenn diese im Rahmen affekt-neutraler Situationen, wie in der vorliegenden Studie, untersucht werden.

Im Hinblick auf die Zusammenhänge zwischen mütterlichen Misshandlungserfahrungen in der Kindheit und kindlicher Inhibitionsleistung stehen die Ergebnisse im Einklang mit denen der Studie von Henschel et al. (2013), welche keine direkten Auswirkungen der mütterlichen Misshandlungs-Historie auf die kindliche Selbstkontrollfähigkeit im Vorschulalter identifizieren konnten. Diese Ergebnisse geben möglicherweise einen Hinweis darauf, dass der Zusammenhang zwischen den Variablen ein wesentlich komplexerer ist, als er durch die Analyse direkter Beziehungen abgebildet werden könnte. Es ist demnach umso bedeutsamer, potentielle moderierende Faktoren zu identifizieren.

Dies wird auch dadurch bekräftigt, dass unsere Hypothese eines signifikanten Einflusses der Interaktion zwischen mütterlichen Misshandlungserfahrungen in der Kindheit und mütterlicher Impulsivität bestätigt wurde. Kinder, deren Mütter sowohl traumatische Kindheitserfahrungen als auch höhere Impulsivität berichteten, machten in den Inhibitionsaufgaben mehr Fehler als die Kinder, deren Mütter traumatische Erfahrungen und

niedrigere Impulsivität berichteten. Die Fehleranzahl der Kinder depressiver Mütter hingegen zeigte sich unabhängig von der Impulsivität ihrer Mütter. Ein transgenerationaler Prozess scheint sich also unter der Bedingung zu zeigen, dass nicht nur eine Misshandlungserfahrung in der Kindheit der Mütter vorliegt, sondern diese zudem impulsiver sind. Mütterliche Impulsivität wurde bereits in früheren Studien als Risikofaktor für die kindliche Entwicklung identifiziert, beispielsweise im Kontext transgenerationaler Weitergabe von Misshandlungs- und Missbrauchserfahrungen. So fanden Henschel et al. (2013), dass geringe Selbstkontrollwerte der Mütter einher gingen mit einem höheren Missbrauchsrisiko ihrer Kinder, und umgekehrt zeigten Mütter, deren Kinder ein niedrigeres Missbrauchsrisiko aufwiesen, eine bessere Emotionsregulation (Fontaine & Nolin, 2012).

Entgegen unserer Hypothesen zeigte sich kein direkter Zusammenhang zwischen kindlicher Inhibition und der mütterlichen Impulsivität, was jedoch auch durch methodische oder inhaltliche Faktoren bedingt sein könnte. Die Erfassung der beiden Variablen war nicht einheitlich (Behaviorales Maß und Selbstbericht), und Inhibition und Impulsivität stellen trotz hoher theoretischer Überlappung letztlich unterschiedliche Konstrukte dar. Eine zusätzliche behaviorale Erfassung der mütterlichen Inhibitionsfähigkeit war im Rahmen der vorliegende Studie aufgrund des insgesamt bereits sehr hohen diagnostischen Aufwandes nicht umsetzbar, könnte aber in weiterführenden Studien mit einbezogen werden.

Zusammenfassend deuten unsere Ergebnisse darauf hin, dass sich die transgenerationalen Einflüsse mütterlicher Misshandlungserfahrungen in der Kindheit und mütterlicher Depression auf die kindliche Inhibition nicht in einfachen Zusammenhängen abbilden lassen, sondern von weiteren Faktoren abhängig zu sein scheinen, welche noch weiterführend zu identifizieren wären. Eine dieser Einflussvariablen scheint die mütterliche Impulsivität darzustellen, die in Interaktion mit mütterlicher Misshandlungserfahrung einen Risikofaktor für die kindliche Inhibitionsleistung bildet.

Stärken

Eine deutliche Stärke der Studie liegt im Einsatz umfangreicher klinischer Interviews zur Identifikation mütterlicher Depression sowie mütterlicher traumatischer Kindheitserfahrungen, wodurch ein potentieller Beurteiler-*Bias* ausgeschlossen werden kann. Um die differenziellen Effekte von Misshandlungs- und Missbrauchserfahrungen der Mütter in der Kindheit und Depression getrennt untersuchen zu können, verwendeten wir ein 2-faktorielles Design mit einem entsprechend hohen Rekrutierungsaufwand. Zudem führten wir die Studie in zwei Zentren in Deutschland durch und konnten auf diese Weise regionsübergreifende Ergebnisse präsentieren. Die Inhibitionskontrolle des Kindes wurde anhand verschiedener Aufgaben gemessen, so dass wir verschiedene Facetten dieser EF erfassen konnten.

Grenzen

Die Inhibitionsleistung eines Kindes setzt sich aus komplexen Komponentenprozessen zusammen, beispielsweise aus automatischer Inhibition der Aufmerksamkeit, exekutiver Inhibition oder motivationaler Inhibition (Nigg, 2000). Ihre Erfassung zeichnet sich dementsprechend durch hohe Fehleranfälligkeit aus. Um eine Reduktion der Fehlerwahrscheinlichkeit zu erreichen, wurden die Berechnungen dieser Studie auf der Grundlage mehrerer Inhibitionsaufgaben und eines entsprechend zusammengefassten Gesamtwertes ausgeführt. Zur Sicherstellung der reliablen Durchführung und Auswertung der klinisch-diagnostischen Interviews (MINI, CECA) wurden umfassende Schulungen und engmaschiger Supervision der Diagnostiker durchgeführt. Aufgrund dieser intensiven Bemühungen wurde auf ein doppeltes Kodieren der Antworten verzichtet. Eine Quantifizierung der Interrater-Reliabilität konnte deshalb nicht bestimmt werden und muss als mögliche Einschränkung genannt werden. Eine Einschränkung der Interpretierbarkeit der Ergebnisse könnte sich zudem durch die kleinen Stichprobengrößen der Trauma- und der Depression+Trauma-Gruppe sowie das querschnittliche Design ergeben. Das weite Altersspektrum der hier untersuchten Kinder kann einerseits als eine Schwäche der Studie bewertet werden. Die Inhibitionsleistungen verändern sich mit dem Entwicklungsstand der Kinder stark. Zudem variiert die Messgenauigkeit der einzelnen Untertests altersabhängig, was beides für den Vergleich altershomogener Stichproben spricht. In unsere Studie wurde deshalb sowohl eine multimethodale Erfassung der Inhibitionsleistungen zur Erhöhung der Reliabilität verfolgt als auch das Alter der Kinder in den statistisch Analysen kontrolliert, so dass sich auch generalisierbarere Aussagen für diesen etwas größeren Altersrange treffen lassen.

Implikationen für Theorie und Praxis

Die Identifikation der mütterlichen Impulsivität als bedeutsamen Faktor in transgenerationalen Prozessen hat konkrete klinische Implikationen. Behandler sollten bei Müttern mit Misshandlungs- und Missbrauchserfahrungen in der Kindheit einen explorativen Fokus auf deren impulsives Verhalten legen. Aus Studien ist bekannt, dass Defizite im Bereich der Selbstkontrolle durch Trainings verbessert werden können. Crandall et al. (2015) betonen hier insbesondere die Wirksamkeit von Ansätzen wie der Dialektisch Behavioralen Therapie (DBT; siehe z.B. Davenport, Bore, & Campbell, 2010) oder Achtsamkeitsinterventionen (Friese, Messner, & Schaffner, 2012).

Literaturverzeichnis

Anderson, P. (2002). Assessment and development of executive function (EF) during childhood.

Child neuropsychology, 8(2), 71–82.

Barkley, R. A. (1997). Behavioral inhibition, sustained attention, and executive functions:

constructing a unifying theory of ADHD. Psychological bulletin, 121(1), 65.

Baron, R. M., & Kenny, D. A. (1986). The moderator–mediator variable distinction in social

psychological research: Conceptual, strategic, and statistical considerations. Journal of

personality and social psychology, 51(6), 1173.

Baune, B. T., Czira, M. E., Smith, A. L., Mitchell, D., & Sinnamon, G. (2012). Neuropsychological

performance in a sample of 13–25year olds with a history of non-psychotic major depressive

disorder. Journal of affective disorders, 141(2), 441–448.

Bifulco, A., Brown, G. W., & Harris, T. O. (1994). Childhood Experience of Care and Abuse

(CECA): a retrospective interview measure. Journal of Child Psychology and Psychiatry,

35(8), 1419–1435.

Blair, C., Granger, D. A., Willoughby, M., Mills-Koonce, R., Cox, M., Greenberg, M. T… Fortunato,

C. K. (2011). Salivary cortisol mediates effects of poverty and parenting on executive

functions in early childhood. Child development, 82(6), 1970–1984.

Boutwell, B. B., & Beaver, K. M. (2010). The intergenerational transmission of low self-control.

Journal of Research in Crime and Delinquency, 47(2), 174–209.

Bridgett, D. J., Burt, N. M., Edwards, E. S., & Deater-Deckard, K. (2015). Intergenerational

transmission of self-regulation: A multidisciplinary review and integrative conceptual

framework. Psychological bulletin, 141(3), 602.

Brodsky, B. S., Oquendo, M., Ellis, S. P., Haas, G. L., Malone, K. M., & Mann, J. J. (2001). The

relationship of childhood abuse to impulsivity and suicidal behavior in adults with major

depression. American Journal of Psychiatry, 158(11), 1871–1877.

Comas, M., Valentino, K., & Borkowski, J. G. (2014). Maternal depressive symptoms and child

temperament: Longitudinal associations with executive functioning. Journal of Applied

Developmental Psychology, 35(3), 156–167.

Corstorphine, E., Waller, G., Lawson, R., & Ganis, C. (2007). Trauma and multi-impulsivity in the eating disorders. Eating behaviors, 8(1), 23–30.

Crandall, A., Deater-Deckard, K., & Riley, A. W. (2015). Maternal emotion and cognitive control capacities and parenting: A conceptual framework. Developmental Review, 36, 105–126.

Davenport, J., Bore, M., & Campbell, J. (2010). Changes in personality in pre-and post-dialectical behaviour therapy borderline personality disorder groups: A question of self-control. Australian Psychologist, 45(1), 59–66.

DePrince, A. P., Weinzierl, K. M., & Combs, M. D. (2009). Executive function performance and trauma exposure in a community sample of children. Child abuse & neglect, 33(6), 353–361.

Diamond, A. (2013). Executive functions. Annual review of psychology, 64, 135.

Dixon, L., Browne, K., & Hamilton-Giachritsis, C. (2005). Risk factors of parents abused as children: a mediational analysis of the intergenerational continuity of child maltreatment (Part I). Journal of Child Psychology and Psychiatry, 46(1), 47–57.

Dumas, J. E., Nissley, J., Nordstrom, A., Smith, E. P., Prinz, R. J., & Levine, D. W. (2005). Home chaos: Sociodemographic, parenting, interactional, and child correlates. Journal of Clinical Child and Adolescent Psychology, 34(1), 93–104.

Fontaine, D., & Nolin, P. (2012). Study of "hot" executive functions in a sample of parents who have been accused of physical abuse or neglect. Journal of Aggression, Maltreatment & Trauma, 21(1), 1–18.

Friese, M., Messner, C., & Schaffner, Y. (2012). Mindfulness meditation counteracts self-control depletion. Consciousness and cognition, 21(2), 1016–1022.

Gaher, R. M., Arens, A. M., & Shishido, H. (2013). Alexithymia as a mediator between childhood maltreatment and impulsivity. Stress and Health, 31 (4), 274–280

Gohier, B., Ferracci, L., Surguladze, S. A., Lawrence, E., El Hage, W., Kefi, M. Z., … Le Gall, D. (2009). Cognitive inhibition and working memory in unipolar depression. Journal of affective disorders, 116(1), 100–105.

Goodman, S. H., & Gotlib, I. H. (1999). Risk for psychopathology in the children of depressed mothers: a developmental model for understanding mechanisms of transmission. Psychological review, 106(3), 458.

Gould, F., Clarke, J., Heim, C., Harvey, P. D., Majer, M., & Nemeroff, C. B. (2012). The effects of child abuse and neglect on cognitive functioning in adulthood. Journal of psychiatric research, 46(4), 500–506.

Halse, M. K. (2014). Stability and predictors of change in executive functions from the age of 6 to 8. Master's thesis in Psychology, Norwegian University of Science and Technology.

Hamilton, M., & Guy, W. (1976). Hamilton depression scale. ECDEU assessment manual for psychopharmacology, 179–192.

Henschel, S., de Bruin, M., & Möhler, E. (2013). Self-control and child abuse potential in mothers with an abuse history and their preschool children. Journal of Child and Family Studies, 23(5), 824–836.

Holmes, C. J., Kim-Spoon, J., & Deater-Deckard, K. (2015). Linking Executive Function and Peer Problems from Early Childhood Through Middle Adolescence. Journal of abnormal child psychology, 1–12.

Joormann, J., & Gotlib, I. H. (2010). Emotion regulation in depression: relation to cognitive inhibition. Cognition and Emotion, 24(2), 281–298.

Kaess, M., Parzer, P., Mattern, M., Resch, F., Bifulco, A., & Brunner, R. (2015). Childhood Experiences of Care and Abuse (CECA). Validierung der deutschen Version von Fragebogen und korrespondierendem Interview sowie Ergebnisse einer Untersuchung von Zusammenhängen belastender Kindheitserlebnissemit suizidaler Verhaltensweisen. Zeitschrift für Kinder- und Jugendpsychiatrie und Psychotherapie, 39, 243 – 252

Klimes-Dougan, B., Ronsaville, D., Wiggs, E. A., & Martinez, P. E. (2006). Neuropsychological functioning in adolescent children of mothers with a history of bipolar or major depressive disorders. Biological psychiatry, 60(9), 957–965.

Kochanska, G., & Knaack, A. (2003). Effortful control as a personality characteristic of young children: Antecedents, correlates, and consequences. Journal of personality, 71(6), 1087–1112.

Korkman, M., Kirk, U., & Kemp, S. (2007). NEPSY-II. Pearson San Antonio, TX.

Kraybill, J. H., & Bell, M. A. (2013). Infancy predictors of preschool and post-kindergarten executive function. Developmental psychobiology, 55(5), 530–538.

Lecrubier, Y., Sheehan, D. V., Weiller, E., Amorim, P., Bonora, I., Sheehan, K. H., … Dunbar, G. C. (1997). The Mini International Neuropsychiatric Interview (MINI). A short diagnostic structured interview: reliability and validity according to the CIDI. European psychiatry, 12(5), 224–231.

Maier, W., Buller, R., Philipp, M., & Heuser, I. (1988). The Hamilton Anxiety Scale: reliability, validity and sensitivity to change in anxiety and depressive disorders. Journal of affective disorders, 14(1), 61–68.

Micco, J. A., Henin, A., Biederman, J., Rosenbaum, J. F., Petty, C., Rindlaub, L. A., … Hirshfeld-Becker, D. R. (2009). Executive functioning in offspring at risk for depression and anxiety. Depression and anxiety, 26(9), 780–790.

Moffitt, T. E., Arseneault, L., Belsky, D., Dickson, N., Hancox, R. J., Harrington, H., … others. (2011). A gradient of childhood self-control predicts health, wealth, and public safety. Proceedings of the National Academy of Sciences, 108(7), 2693–2698.

Möhler, E., Matheis, V., Poustka, L., Marysko, M., Finke, P., Kaufmann, C., … Resch, F. (2009). Mothers with a history of abuse tend to show more impulsiveness. Child abuse & neglect, 33(3), 123–126.

Nigg, J. T. (2000). On inhibition/disinhibition in developmental psychopathology: views from cognitive and personality psychology and a working inhibition taxonomy. Psychological bulletin, 126(2), 220.

Nikulina, V., & Widom, C. S. (2013). Child maltreatment and executive functioning in middle adulthood: a prospective examination. Neuropsychology, 27(4), 417.

Patton, J. H., Stanford, M. S., & others. (1995). Factor structure of the Barratt impulsiveness scale. Journal of clinical psychology, 51(6), 768–774.

Preuss, U. W., Rujescu, D., Giegling, I., Watzke, S., Koller, G., Zetzsche, T., ... & Möller, H. J. (2008). Psychometrische Evaluation der deutschsprachigen Version der Barratt-Impulsiveness-Skala. *Der Nervenarzt*, 79(3), 305-319.

Pechtel, P., & Pizzagalli, D. A. (2011). Effects of early life stress on cognitive and affective function: an integrated review of human literature. Psychopharmacology, 214(1), 55–70.

Roskam, I., Stievenart, M., Meunier, J.-C., & Noël, M.-P. (2014). The development of children's inhibition: Does parenting matter? Journal of experimental child psychology, 122, 166–182.

Saddichha, S., & Schuetz, C. (2014). Is impulsivity in remitted bipolar disorder a stable trait? A meta-analytic review. Comprehensive psychiatry, 55(7), 1479–1484.

Sarsour, K., Sheridan, M., Jutte, D., Nuru-Jeter, A., Hinshaw, S., & Boyce, W. T. (2011). Family socioeconomic status and child executive functions: the roles of language, home environment, and single parenthood. Journal of the International Neuropsychological Society, 17(01), 120–132.

Schoemaker, K., Mulder, H., Deković, M., & Matthys, W. (2013). Executive functions in preschool children with externalizing behavior problems: A meta-analysis. *Journal of abnormal child psychology, 41*(3), 457-471.

Sheehan, D. V., Lecrubier, Y., Sheehan, K. H., Amorim, P., Janavs, J., Weiller, E., … others. (1998). The Mini-International Neuropsychiatric Interview (MINI): the development and validation of a structured diagnostic psychiatric interview for DSM-IV and ICD-10. Journal of clinical psychiatry, 59, 22–33.

Sjöwall, D., Bohlin, G., Rydell, A.-M., & Thorell, L. B. (2015). Neuropsychological deficits in preschool as predictors of ADHD symptoms and academic achievement in late adolescence. Child Neuropsychology, 1–18.

Wagner, C. A., Alloy, L. B., & Abramson, L. Y. (2015). Trait rumination, depression, and executive functions in early adolescence. Journal of youth and adolescence, 44(1), 18–36.

Weiß, R. H. (2006). Grundintelligenztest Skala 2 (CFT 20-R) mit Wortschatz-test (WS) und

Zahlenfolgentest (ZF). Intellektuelle Hochbegabung, 80.

Weiß, R. H., & Osterland, J. (2013). CFT 1-R: Grundintelligenztest, Skala 1-Revision; Manual.

Hogrefe.

Weyandt, L. L., Willis, W. G., Swentosky, A., Wilson, K., Janusis, G. M., Chung, H. J., … Marshall,

S. (2014). A review of the use of executive function tasks in externalizing and internalizing

disorders. In Handbook of executive functioning (S. 69–87). Springer.

Zajecka, J., & Beeler, M. (2003). Improving long-term adherence to treatment in major depression.

Handbook of Chronic Depression: Diagnosis and Therapeutic Management, 403.

Acknowledgements

Erklärung gemäß § 8 Abs. (1) c) und d) der Promotionsordnung der Fakultät für Verhaltens- und Empirische Kulturwissenschaften

Promotionsausschuss der Fakultät für Verhaltens- und Empirische Kulturwissenschaften der Ruprecht-Karls-Universität Heidelberg

Erklärung gemäß § 8 (1) c) der Promotionsordnung der Universität Heidelberg für die Fakultät für Verhaltens- und Empirische Kulturwissenschaften

Ich erkläre, dass ich die vorgelegte Dissertation selbstständig angefertigt, nur die angegebenen Hilfsmittel benutzt und die Zitate gekennzeichnet habe.

Erklärung gemäß § 8 (1) d) der Promotionsordnung der Universität Heidelberg für die Fakultät für Verhaltens- und Empirische Kulturwissenschaften

Ich erkläre, dass ich die vorgelegte Dissertation in dieser oder einer anderen Form nicht anderweitig als Prüfungsarbeit verwendet oder einer anderen Fakultät als Dissertation vorgelegt habe.

Vorname Nachname   _____

Datum, Unterschrift   _____