Psychobiological adaptation to childhood adversity

The role of contextual and individual factors

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References

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JASP Team (2022). JASP (Version 0.16.3)[Computer software].


References


**K**


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References


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References


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References


References


References


References


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Supplementary materials
Appendix A

Protocol for the systematic search strategy

APA PsycINFO (Ovid, 1806-..)

- authoritarian parenting/ OR bullying/ OR child abuse/ OR child neglect/ OR child welfare/ OR emotional abuse/ OR exposure to violence/ OR foster care/ OR foster children/ OR parental death/ OR parenting style/ OR physical abuse/ OR protective services/ OR school violence/ OR sexual abuse/ OR verbal abuse/ OR domestic violence/ OR dysfunctional family/ OR family conflict/ OR family socioeconomic level/ OR intimate partner violence/ OR lower income level/ OR marital conflict/ OR poverty/ OR socioeconomic status/ OR (abandonment OR adverse childhood experience* OR authoritarian parenting OR bullied OR bully* OR ((child* OR early) ADJ2 (advers* OR stress OR trauma)) OR ((child* OR emotional* OR physical* OR sexual*) ADJ2 abuse*) OR child welfare OR early bereavement OR (expos* ADJ2 violen*) OR foster care OR foster children OR harsh parenting OR maltreat* OR neglect* OR parental aggression OR parental death* OR parental loss OR parental violence OR parenting style* OR peer victim* OR protective service* OR school violence OR ((domestic OR families OR family OR household OR interparental OR interpersonal OR intimate partner OR marital OR parental) ADJ2 (aggress* OR chaos OR conflict* OR divorce* OR dysfunction* OR hostil* OR separation OR violen*)) OR family-related adversit* OR harsh family environment OR lower income* OR (neighbo*rhood ADJ3 (crime* OR stress OR violen*)) OR ((parent* OR maternal OR mother* OR paternal OR father*) ADJ2 (alcohol* OR anxiety OR bipolar OR borderline personality OR depress* OR mania OR mental disorder* OR mental health problem* OR mental illness* OR mood disorder* OR psychopathology OR psychosis OR schizophrenia OR substance)) OR poverty OR risky family environment OR socioeconomic level* OR socioeconomic status).ti,ab,id.

- autonomic nervous system/ OR cardiovascular reactivity/ OR heart rate variability/ OR parasympathetic nervous system/ OR (((autonom* OR parasympathetic) ADJ2 (nervous OR function* OR reactivity OR responsivity)) OR cardiovascular reactivity OR cardio-vascular reactivity OR heart rate variability OR HRV OR respiratory sinus arrhythmia OR RSA OR (vagal ADJ1 (control OR flexibility OR regulation OR tone))).ti,ab,id.

- 1 AND 2

Key concepts: 1) childhood adversity, 2) vagally-mediated HRV

Key: / = subject heading, ti = title, ab = abstract, id = key concepts (other keywords added by PsycINFO indexers to supplement the subject headings), ADJn = word distance of maximum n words
Medline (Ovid MEDLINE and Epub Ahead of Print, In-Process & Other Non-Indexed Citations and Daily 1946-..)

1. bullying/ OR child abuse, sexual/ OR child abuse/ OR child protective services/ OR child welfare/ OR child, foster/ OR exposure to violence/ OR foster home care/ OR parental death/ OR physical abuse/ OR domestic violence/ OR family conflict/ OR intimate partner violence/ OR poverty/ OR socioeconomic factors/ OR spouse abuse/ OR (abandonment OR adverse childhood experience* OR authoritarian parenting OR bullied OR bully* OR ((child* OR early) ADJ2 (advers* OR stress OR trauma)) OR ((child* OR emotional* OR physical* OR sexual*) ADJ2 abuse*)) OR child welfare OR early bereavement OR (expos* ADJ2 violen*) OR foster care OR foster children OR harsh parenting OR maltreat* OR neglect* OR parental aggression OR parental death* OR parental loss OR parental violence OR parenting style* OR peer victim* OR protective service* OR school violence OR ((domestic OR families OR family OR household OR interparental OR interpersonal OR intimate partner OR marital OR parental) ADJ2 (aggress* OR chaos OR conflict* OR divorce* OR dysfunction* OR hostil* OR separation OR violen*)) OR family-related adversit* OR harsh family environment OR lower income* OR (neighborhood ADJ3 (crime* OR stress OR violen*)) OR ((parent* OR maternal OR mother* OR paternal OR father*) ADJ2 (alcohol* OR anxiety OR bipolar OR borderline personality OR depress* OR mania OR mental disorder* OR mental health problem* OR mental illness* OR mood disorder* OR psychopathology OR psychosis OR schizophrenia OR substance)) OR poverty OR risky family environment OR socioeconomic level* OR socioeconomic status).ti,ab,kf.

2. autonomic nervous system/ OR parasympathetic nervous system/ OR respiratory sinus arrhythmia/ OR (((autonom* OR parasympathetic) ADJ2 (nervous OR function* OR reactivity OR responsivity)) OR cardiovascular reactivity OR cardiovascular reactivity OR heart rate variability OR HRV OR respiratory sinus arrhythmia OR RSA OR (vagal ADJ1 (control OR flexibility OR regulation OR tone))).ti,ab,kf.

3. 1 AND 2

Key concepts: 1) childhood adversity, 2) vagally-mediated HRV
Key: / = medical subject heading (MeSH), ti = title, ab = abstract, kf = author supplied keywords, ADJn = word distance of maximum n words
Web of Science Core Collection (Web of Science Core Collection Editions: Science Citation Index Expanded (SCI-EXPANDED), 1975 - present, Social Sciences Citation Index (SSCI), 1975 - present, Arts & Humanities Citation Index (A&HCI), 1975 - present, Emerging Sources Citation Index (ESCI), 2015 - present))

1. TS=("abandonment" OR "adverse childhood experience*" OR "authoritarian parenting" OR "bullied" OR "bully*" OR (("child*" OR "early") NEAR/1 ("advers*" OR "stress" OR "trauma")) OR ("child*" OR "emotional*" OR "physical*" OR "sexual*") NEAR/1 "abuse*") OR "child welfare" OR "early bereavement" OR ("expos*" NEAR/1 "viol*") OR "foster care" OR "foster children" OR "harsh parenting" OR "maltreat*" OR "neglect*" OR "parental aggression" OR "parental death*" OR "parental loss" OR "parental violence" OR "parenting style*" OR "peer victim*" OR "protective service*" OR "school violence" OR ("domestic" OR "families" OR "family" OR "household" OR "interparental" OR "interpersonal" OR "intimate partner" OR "marital" OR "parental") NEAR/1 ("aggress*" OR "chaos" OR "conflict*" OR "divorce*" OR "dysfunction*" OR "hostil*" OR "separation" OR "viol*") OR "family-related adversit*" OR "harsh family environment" OR "lower income*" OR ("neighborhood" NEAR/2 ("crime*" OR "stress" OR "viol*")) OR (("parent*" OR "paternal") NEAR/1 ("alcohol*" OR "anxiety" OR "bipolar" OR "borderline personality" OR "depress*" OR "mania" OR "mental disorder*" OR "mental health problem*" OR "mental illness*" OR "mood disorder*" OR "psychopathology" OR "psychosis" OR "schizophrenia" OR "substance") OR "poverty" OR "risky family environment" OR "socioeconomic level*" OR "socioeconomic status")

2. TS=(("autonom*" OR "parasympathetic") NEAR/1 ("nervous" OR "function*" OR "reactivity" OR "responsivity") OR "cardiovascular reactivity" OR "cardiovascularreactivity" OR "heart rate variability" OR "HRV" OR "respiratory sinus arrhythmia" OR "RSA OR ("vagal" NEAR/0 ("control" OR "flexibility" OR "regulation" OR "tone").

3. #1 AND #2

Key concepts: 1) childhood adversity, 2) vagally-mediated HRV

Key: TS = topic, which includes title, abstract, author keywords and Web of Science Keywords Plus, NEAR/n = word distance of maximum n words
Appendix B

**Figure B1.** Average seed-based functional connectivity for the centromedial and basolateral amygdala across all participants (uncorrected, but arbitrarily thresholded at $t > 15$), overlaid on the MNI standard brain. Brains are displayed in radiological convention (i.e., left hemisphere is on the right side of the image and vice versa)
### Appendix C

**Table C1. Full correlation matrix of untransformed cortisol levels**

<table>
<thead>
<tr>
<th>Sample</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Day 1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 (Noon)</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 (Afternoon)</td>
<td>.59**</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 (Bedtime)</td>
<td>.68**</td>
<td>.90**</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Day 2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 (Wake-up)</td>
<td>.01</td>
<td>.33</td>
<td>.44</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 (Morning)</td>
<td>.02</td>
<td>.88**</td>
<td>.84**</td>
<td>.40</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 (Noon)</td>
<td>.31</td>
<td>.83**</td>
<td>.59*</td>
<td>.25</td>
<td>.80**</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 (Afternoon)</td>
<td>.29</td>
<td>.82**</td>
<td>.64**</td>
<td>.33</td>
<td>.79**</td>
<td>.84**</td>
<td>--</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 (Bedtime)</td>
<td>.47*</td>
<td>.95**</td>
<td>.80**</td>
<td>.33</td>
<td>.84**</td>
<td>.89**</td>
<td>.83**</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td><strong>Day 3</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 (Wake-up)</td>
<td>.08</td>
<td>.56*</td>
<td>.37</td>
<td>.43</td>
<td>.68*</td>
<td>.61*</td>
<td>.76**</td>
<td>.58*</td>
<td>--</td>
</tr>
<tr>
<td>10 (Morning)</td>
<td>.12</td>
<td>.82**</td>
<td>.56</td>
<td>.30</td>
<td>.96**</td>
<td>.81**</td>
<td>.84**</td>
<td>.86**</td>
<td>.80**</td>
</tr>
</tbody>
</table>

*Note. * p < .05; ** p < .01.*
### Table C2. Estimates for multi-level models of log-transformed cortisol data of 14-months-old toddlers

<table>
<thead>
<tr>
<th></th>
<th>Wake-up</th>
<th>Morning</th>
<th>Noon</th>
<th>Afternoon</th>
<th>Bedtime</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Samples</td>
<td>22</td>
<td>21</td>
<td>30</td>
<td>30</td>
<td>31</td>
</tr>
<tr>
<td>Fixed effects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \gamma_{00} ) = intercept</td>
<td>1.1028</td>
<td>0.0731</td>
<td>0.9024</td>
<td>0.0836</td>
<td>0.6294</td>
</tr>
<tr>
<td>Random effects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between-individual variance: ( \tau^2 )</td>
<td>0.0474</td>
<td>0.2177</td>
<td>0.0741</td>
<td>0.2721</td>
<td>0.0491</td>
</tr>
<tr>
<td>Within-individual variance: ( \sigma^2 )</td>
<td>0.0352</td>
<td>0.1875</td>
<td>0.0160</td>
<td>0.1265</td>
<td>0.0941</td>
</tr>
<tr>
<td>ICCs</td>
<td>0.57</td>
<td>0.82</td>
<td>0.34</td>
<td>0.59</td>
<td>0.69</td>
</tr>
</tbody>
</table>

**Note.** The intra-class correlation coefficient (ICC) represents the ratio of between-individual variance (\( \tau^2 \)) to total variance (between-individual variance \( \tau^2 \) plus within-individual variance \( \sigma^2 \)) estimated from multi-level models of log-transformed cortisol data.
### Table C3. Estimates for two multi-level models of wake-up cortisol levels

<table>
<thead>
<tr>
<th></th>
<th>Model 1: Intercept-only Model</th>
<th>Model 2 including “Delay”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Samples</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>Fixed effects</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\gamma_0 = \text{intercept}$</td>
<td>1.0610, 0.0717</td>
<td>0.8907, 0.091</td>
</tr>
<tr>
<td>$\gamma_{10} = \text{delay}$</td>
<td>0.0139, 0.0054</td>
<td></td>
</tr>
<tr>
<td>Random effects</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between-individual variance: $t^2$</td>
<td>0.0565, 0.2376</td>
<td>0.0404, 0.2010</td>
</tr>
<tr>
<td>Within-individual variance: $\sigma^2$</td>
<td>0.0322, 0.1793</td>
<td>0.0276, 0.1662</td>
</tr>
<tr>
<td>-2 log-likelihood</td>
<td>-2.577</td>
<td>0.306</td>
</tr>
<tr>
<td>ICC</td>
<td>0.64</td>
<td>0.59</td>
</tr>
</tbody>
</table>

*Note.* Model 1 differs from the empty (intercept-only) model for wake-up cortisol levels described in Table 2 in that only cases with reported wake-up times ($N = 25$) were included to enable comparability with Model 2.
### Appendix D

**Table D1.** Comparison of different outcomes between participants tested online and participants tested at home

<table>
<thead>
<tr>
<th></th>
<th>Participants tested online</th>
<th>Participants tested at home</th>
<th>t-test</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Parenting stress</td>
<td>18.00</td>
<td>4.64</td>
<td>17.08</td>
<td>3.97</td>
</tr>
<tr>
<td>Effortful control</td>
<td>3.89</td>
<td>0.79</td>
<td>4.33</td>
<td>0.65</td>
</tr>
<tr>
<td>Morning cortisol</td>
<td>0.96</td>
<td>0.22</td>
<td>0.95</td>
<td>0.27</td>
</tr>
<tr>
<td>Evening cortisol</td>
<td>0.03</td>
<td>0.32</td>
<td>0.09</td>
<td>0.39</td>
</tr>
</tbody>
</table>

*Note.* Cortisol levels were log-transformed to achieve normal distribution.
Table D2. Regression models for evening cortisol including age as a covariate

<table>
<thead>
<tr>
<th>Step</th>
<th>$b$ (SE)</th>
<th>$\beta$</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>1.88 (0.76)</td>
<td>-</td>
<td>.021*</td>
</tr>
<tr>
<td>Child age</td>
<td>-1.12 (0.05)</td>
<td>- .43</td>
<td>.024*</td>
</tr>
<tr>
<td>Parenting stress</td>
<td>-0.01 (0.01)</td>
<td>- .17</td>
<td>.353</td>
</tr>
<tr>
<td>Step 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>1.79 (0.75)</td>
<td>-</td>
<td>.025*</td>
</tr>
<tr>
<td>Child age</td>
<td>-1.11 (0.05)</td>
<td>- .40</td>
<td>.029*</td>
</tr>
<tr>
<td>Parenting stress</td>
<td>-0.00 (0.02)</td>
<td>- .04</td>
<td>.854</td>
</tr>
<tr>
<td>Effortful control</td>
<td>0.14 (0.09)</td>
<td>.30</td>
<td>.137</td>
</tr>
<tr>
<td>Step 3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>1.76 (0.75)</td>
<td>-</td>
<td>.028*</td>
</tr>
<tr>
<td>Child age</td>
<td>-0.11 (0.05)</td>
<td>- .40</td>
<td>.031*</td>
</tr>
<tr>
<td>Parenting stress</td>
<td>-0.01 (0.02)</td>
<td>- .10</td>
<td>.626</td>
</tr>
<tr>
<td>Effortful control</td>
<td>0.14 (0.09)</td>
<td>.31</td>
<td>.123</td>
</tr>
<tr>
<td>Parenting stress x Effortful control</td>
<td>-0.01 (0.02)</td>
<td>- .17</td>
<td>.393</td>
</tr>
</tbody>
</table>

*Note. Log-transformed cortisol levels are included in correlation analyses. $b$ = unstandardized regression weights. SE = standard error. $\beta$ (beta) = standardized regression weights. $R^2 = 0.21$ for Step 1 ($p = .051$), $\Delta R^2 = 0.07$ for Step 2 ($p = .044*$), $\Delta R^2 = 0.03$ for Step 3 ($p = .068$). *$p < .05$
**Table D3.** Robustness of the results of Bayesian multiple regression analyses against the choice of prior

<table>
<thead>
<tr>
<th></th>
<th><strong>$BF_{10}$ for model on morning cortisol</strong></th>
<th><strong>$BF_{10}$ for model on evening cortisol</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>JZS r scale 1/4</strong></td>
<td><strong>JZS r scale 1/2</strong></td>
</tr>
<tr>
<td>Step 1 (including Parenting stress)</td>
<td>1.35</td>
<td>1.10</td>
</tr>
<tr>
<td>Step 2 (adding effortful control)</td>
<td>0.77</td>
<td>0.45</td>
</tr>
<tr>
<td>Step 3 (adding interaction between parenting stress and effortful control)</td>
<td>0.47</td>
<td>0.20</td>
</tr>
</tbody>
</table>

*Note.* For all Bayesian regressions, a beta binomial model prior is chosen with varying prior widths of the Jeffreys-Zellner-Siow (JZS) prior.
Appendix E

**Appendix E**

**Glossary and definitions of major terms that appear in the review**

All terms are underlined in the results section. Terms that are marked with a star represent self-regulatory capacities.

*Alerting system.* The brain’s attention network for achievement and maintenance of an alert state to facilitate task performance (Zani & Proverbio, 2017). See also *Attention.*

*Affective attunement.* An extrinsic mode of emotion regulation typically observed during interactive contexts such as face-to-face play, in which caregivers provide an emotionally resonant response to the child’s emotional expressions in order to enhance or dampen the child’s emotional reaction (R. A. Thompson, 1991).

*Appearance goals.* Performance goals in which the predominant theme is to appear talented (VandeWalle & Cummings, 1997).

*Approach goals.* Goals that strive towards acquiring success (Dweck, 1986; Nicholls, 1984).

*Arousal regulation*.* Within cognitive psychology, concept describing the production and maintenance of vigilance for task performance (S. E. Petersen & Posner, 2012). See *Alerting system* and *Attention*.

*Attachment.* Describes the lasting affectional bonds that develop between young children and their primary caregivers (Bowlby, 1982). The work of Ainsworth (1979) and Main & Solomon (1990) identified four types of mother-infant attachment: Secure (type B), insecure avoidant (type A), insecure ambivalent/resistant (type C), and disorganized (type D).

*Attention*.* The attention system encompasses a set of information gathering mechanisms that can be subsumed under the three neurologically-based functional systems of the alerting, orienting, and executive network, and the interactions among them (S. E. Petersen & Posner, 2012; Posner, 2012; Posner & Petersen, 1990). *Alerting attention* involves attaining and maintaining a state of high sensitivity to incoming stimuli; *orienting attention* pertains to the selection of information from sensory input; *executive attention* involves a set of mechanisms for monitoring and resolving conflict among cognitive, emotional, and behavioral responses (Rueda & Posner, 2013).

*Authoritarian parenting.* Parenting style characterized by low support, the demand of unquestioning obedience and rigid control without warm communication (Baumrind, 1971; Kiss et al., 2014).
Authoritative parenting. Parenting style in which parents involve the child in decision making while reserving the final judgement. Further characterized by high support and warmth of parents (Baumrind, 1971; Kiss et al., 2014).

Autonomy support. Behavior that encourages an individual to take personal initiative and that supports the individual’s competence in a climate of relatedness (Deci et al., 2001; Gagné, 2003).

Avoidance goals. Goals that strive towards avoiding failure (Elliot, 1999).

Behavioral control. Parental control of children’s behavior through provision of regulation, structure, or guidance (Bean et al., 2006).

Cognitive control*. A set of superordinate functions involved in resource allocation, information representation, and executive attention in the context of dynamically changing goals and task demands (Botvinick & Braver, 2015; Carter & Krug, 2012; Nigg, 2017). Closely related to, but narrower than executive functions. Basic top-down operations that enable complex executive functions (Nigg, 2017).

Cognitive flexibility*. Umbrella term used to describe the broad combination of updating, shifting, and conflict-resolving in tasks (Hendry et al., 2016). Although cognitive flexibility may be closely linked to working memory, working memory tasks more purely refer to updating tasks (e.g., Garon et al., 2014), while cognitive flexibility tasks require broader updating/shifting/conflict-resolving skills.

Compliance*. Term used in early childhood to describe children’s ability to comply with external (mostly caregivers’) requests. Can be differentiated in two motivationally distinct forms of compliance, situational and committed compliance. Situational compliance involves the acceptance and following of caregivers’ rules under close monitoring, whereas committed compliance involves the full endorsement of caregivers’ rules and the willingly adherence to these without supervision (Kochanska & Aksan, 1995).

Coping*. Cognitive and behavioral efforts employed by a person to manage stress (Lazarus & Folkman, 1984). Generally categorized as emotion-focused and problem-focused coping (Garcia, 2010).

Co-regulation. An interactive process of regulatory support and guidance that can occur within the context of caring relationships (e.g., between the child and parents/teachers/peers) across the lifespan (Kopp, 1982; Rosanbalm & Murray, 2017).

Delay of Gratification*. The ability to postpone an immediate gain or to persist in an undesirable activity in favour of greater and later reward (Mischel & Ebbesen, 1970).
Appendix E

Demonstration goals. Goals that are aimed towards proving one’s skills (Dweck & Leggett, 1988; Molden & Dweck, 2006). This terminology is mostly used in the social context.

Effortful control*. The regulatory dimension of temperament that serves to modulate the two reactive dimensions of temperament—negative affectivity and extraversion/surgency (Rothbart et al., 2004). Further defined as “the efficiency of executive attention, including the ability to inhibit a dominant response and/or to activate a subdominant response, to plan, and to detect errors” (Rothbart & Bates, 2006, p. 129). Also used later in development to identify top-down self-regulatory processes related to executive functioning (Pallini et al., 2018).

Emotion dysregulation. Emotion dysregulation refers to the instance when strategies employed to manage emotions are unsuccessful in the long-term, or successful in the short-term but with consequences for long-term well-being (Cole et al. 2017).

Emotion regulation*. “Processes used to manage and change if, when, and how (e.g., how intensely) one experiences emotions and emotion-related motivational and physiological states, as well as how emotions are expressed behaviorally.” (Eisenberg et al., 2007, p. 288)

Endogenous attention*. The voluntary, strategic allocation of attention resources (Hunnius, 2007).

Executive attention (system)*. Top-down form of attention that involves overcoming attention to a certain stimulus in order to relocate attention to a goal-relevant stimulus (Nigg, 2017). See also Attention.

Executive functions*. A set of higher-order top-down cognitive processes that are essential for the control of behavior, emotion, and cognition. Consists of working memory, inhibitory control, and shifting (Miyake et al., 2000), with on-going debates whether there is a unitary ‘core’ to all executive functions (Nigg, 2017).

Future time perspective. The present anticipation of future goals (J. Simons et al., 2004).

Goal setting. Retrieving information from memory about how strategies could help to achieve a goal and then develop a strategic plan based on this metacognitive knowledge and the understanding of the task (Pintrich, 2000; Winne, 2001). Often described as part of planning.

Growth mindset. The belief that one’s current ability can be improved with enough effort (Dweck, 2007).
Higher-order goals. Abstract goals that are on top in the hierarchical goal structure and that are related to ‘being something’ (Powers, 1973).

Identified motivation. Amount of invested effort is based on the utility of that behavior for personally valued goals (Ryan & Deci, 2000).

Information processing. Selecting, encoding, and remembering incoming information (Bornstein, 1998).

Inhibition*. See Response inhibition.

Inhibitory control*. See Response inhibition.

Integrated motivation. Amount of invested effort is based on the perception that the behavior is consistent with other endorsed values and aspects of the self (Ryan & Deci, 2000).

Intentional pre-verbal communication*. The use of non-verbal communicative signals such as gestures and vocalizations to direct and maintain another person’s attention to a particular object or referent (Bretherton & Bates, 1979).

Metacognition*. A thinking skill, also called ‘thinking about thinking’ or cognition about cognition to enable monitoring and controlling cognition (Muis, 2007; R. Lavi et al., 2019; Ohtani & Hisasaka, 2018). It can be divided into two broad categories, namely “metacognitive knowledge” and “metacognitive activities”, which involve goal setting, planning, monitoring, evaluation, and strategy selection and use (R. Martini & Shore, 2008).

Mind-mindedness. Caregivers’ capacity to understand and verbalize the internal state of their child during interaction (Meins, 2013).

Modeling. A learning process in which children take over similar patterns of behavior as observed from their parents (Rosenthal & Zimmerman, 2014; Tibbs et al., 2001).

Monitoring*. Monitoring one’s thinking, a metacognitive activity (R. Lavi et al., 2019).

Normative goals. Performance goals in which the predominant theme is to outperform others (VandeWalle & Cummings, 1997).

Oculomotor control. The rapid, stable, and coordinated manner in which eye movements need to be controlled in order to accurately fixate targets in the visual field (Hung, 2006).

Ostensive gestures. Gestures in which an object is used to communicate something about that object itself, for instance when showing an object or demonstrating its use (Kuvalja et al., 2013).
Appendix E

*Parental responsiveness.* A component of parental sensitivity encompassing parents’ prompt and contingent reactions to their child’s exploratory and communicative actions (Bornstein et al., 2008).

*Parental scaffolding.* The provision of supporting strategies, including instruction and demonstration (C. Lewis & Carpendale, 2009).

*Parental sensitivity.* Parenting behaviors characterized by an accurate interpretation of a child’s signals, and a prompt and appropriate response to these (DePasquale & Gunnar, 2020). Involves positive affect, warmth, and the absence of hostility and rejection (Fay-Stammbach et al., 2014). Closely related to the construct of *parental responsiveness.*

*Parental stimulation.* Parenting style that involves enriched interactions such as reading to the child with the aim of providing children with opportunities to develop cognitive skills (Bradley et al., 2011).

*Planning*.* Metacognitive activity involving the construction of mental representations of personal goals, as well as the organization and management of strategies for achieving them (Eilam & Aharon, 2003; R. Lavi et al., 2019).

*Reappraisal*.* Altering one’s view of a given situation before the emotion occurs (Tyson et al., 2009). A cognitive form of emotion regulation (Ziv et al., 2017).

*Response inhibition*.* Intentional or effortful suppression of behavior in order to sustain goal-directed behavior. Top-down ability involved in executive functions and effortful control (Logan & Cowan, 1984; Nigg, 2017). A differentiation can be made between *simple response inhibition* (i.e., delaying a proponent response with minimal demands on working memory), and *complex inhibitory control* (i.e., delaying the proponent response while responding to a salient, conflicting response option involving greater working memory demand; S. M. Carlson & Moses, 2001; Garon et al., 2008).

*Selective reinforcement.* Selectively rewarding/punishing an emotional reaction in order to encourage/devalue the frequency at which it occurs (R. A. Thompson, 1991).

*Self-control*.* Umbrella construct that includes concepts from different disciplines such as delay of gratification, impulse control, willpower, and executive functions (Moffitt et al., 2011). In the developmental literature, self-control more specifically refers to the capacity to inhibit a dominant response and activate a subdominant response (Diamond, 2013).

*Self-directed language*.* Language directed to the self that typically involves on-task commentary that aims to support the problem solving process (Kuvalja et al., 2013).
Self-efficacy (beliefs). Beliefs about one’s capabilities to complete actions (Bandura, 1977).

Self-prohibition*. A form of egocentric symbol use in which the child approaches a previously forbidden object or initiates an activity which has been previously prohibited and then expresses negation, verbally or through gestures (Pea, 1980).

Set-shifting*. A complex executive function involving the ability to alternate between different response sets (Miyake et al., 2000).

Simple inhibition*. See Response inhibition.

Social referencing. When the child seeks information from the parent’s social cues to interpret or respond to an ambiguous situation (Walden & Ogan, 1988).

Simple inhibition*. See Response inhibition.

Strategy selection/use*. Selecting or using a cognitive strategy, a metacognitive activity (Muis, 2007).

Spatial orienting*. Orienting attention resources toward and away from objects, people, or visual cues at a specific spatial location (Hendry et al., 2019; see Attention).

Sustained attention*. Effortful attentional engagement with a stimulus for the purpose of active information processing (Hendry et al., 2019).

Working memory*. Executive function representing the ability to hold multiple contents in mind at once while actively manipulating one or more of them (Baddeley, 2012).
### Table E1. Number of references per database from the original and updated search systematic search

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*Note.* The search was performed in July 2019 and updated on 29 September 2022. All records from the updated search that were also retrieved in the original search were removed based on accession numbers following the procedure described in [https://osf.io/e9z76](https://osf.io/e9z76).
Table E2. Number of references included in results section grouped by review topic and type

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<td>Meta-analyses</td>
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<td>Teachers</td>
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(continued on next page)
Appendix E

**Table E2.** (continued)

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<td>Total</td>
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<td>Total all periods without duplicates within and across developmental periods</td>
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<td>18</td>
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*Note.* G & M = goals and motivation.
Summary

A large number of children grows up under conditions of adversity, experiencing abuse, neglect, separation from caregivers, chronic poverty, or neighborhood violence. While childhood adversities markedly increase the risk for psychopathology, not all individuals exposed to adversity develop negative mental health outcomes. In this doctoral thesis, we aimed to address two main questions: How do childhood adversities become biologically embedded to affect mental health outcomes? And what explains the individual variability in psychobiological adaptation after childhood adversity?

In Section 1, we summarized former findings on adversity-related alterations in the functioning of the stress systems. Focusing on the hypothalamic-pituitary-adrenal (HPA) axis, we demonstrated in a narrative review in Chapter 2 that both heightened and lowered levels of diurnal cortisol have previously been found in children younger than age 5 who were exposed to adversity. In former studies, both patterns of HPA axis dysregulation have been associated with impairments in executive functions, which are important for self-regulation. Given these lines of evidence, we proposed one possible pathway through which childhood adversity may affect mental health outcomes. Specifically, we suggested that experiences of adversity may shape the functioning of the child’s developing HPA axis throughout the first years of life, leading to cortisol alterations that may over time impair the development and functioning of brain structures which are important for self-regulation. Impairments in self-regulation, in turn, may increase the risk for psychopathology in the long term. Reviewing the intervention literature, we further found promising evidence that interventions targeting parenting behavior have the potential to remediate adversity-related biological and behavioural alterations in the context of adversity.

In two meta-analyses reported in Chapter 3, we aggregated findings on adversity-related alterations in vagal regulation, a specific aspect of autonomic nervous system functioning indexed by vagally-mediated heart rate variability (vmHRV). Specifically, we tested for associations of childhood adversity with baseline vagal activity and vagal reactivity to challenges. Given the lack of an overall association between childhood adversity and vmHRV in both meta-analyses, we concluded that the vagal system generally maintains its functional integrity in the broad context of childhood adversity. However, we observed that under specific circumstances (e.g., in the presence of severe adversity or psychopathology), very small reductions in vagal activity and vagal reactivity to challenge can be found in adversity-exposed individuals. As both lower vagal activity and reactivity have been
shown indicative of less effective self-regulation, our findings support a part of the pathway that we proposed in Chapter 2, in which childhood adversity increases risk for psychopathology through affecting an individual’s self-regulatory abilities.

In Section 2, we examined whether characteristics of childhood adversity explain different patterns of psychobiological adaptation. In our narrative review in Chapter 2, we concluded that specific adversity types cannot be clearly linked to HPA axis hyper- or hypoactivity based on evidence from former early childhood studies. We further did not find distinct associations of deprivation and threat (two different dimensions of adversity) with cortisol and vagal alterations (Chapters 2 and 3). However, it needs to be acknowledged that the methodology employed in both of our works—reviewing former studies—may have concealed differential associations that might be observable in studies specifically designed to disentangle experiences of threat from those of deprivation. Overall, our findings rather suggested that the severity of adversity influences psychobiological adaptation. While severe adversity was mostly related to decreased cortisol production and reduced levels of vagal activity, less severe adversity was rather related to increased cortisol production and normal vagal functioning (Chapters 2 and 3).

In Section 3, we investigated whether individual characteristics are associated with differences in psychobiological adaptation in the context of childhood adversity. In our first meta-analysis in Chapter 3, we found that childhood adversity was associated with lower baseline vagal activity in samples in which part of the participants were diagnosed with a psychiatric disorder. Integrating the broader literature, we suggested that individuals with lower resting vagal activity at the time of adversity exposure may be the ones who more likely develop further reductions in vagal activity over time. In our second meta-analysis, we found that childhood adversity was related to lower vagal reactivity to challenge in older individuals who had experienced adversity less recently. This finding indicates that childhood adversity can set in motion a detrimental developmental cascade in which alterations in stress system functioning become more apparent in the long run.

In addition, we conducted two empirical studies to broaden knowledge on specific individual moderators at the genotypical and phenotypical level that were outside the scope of our meta-analysis. In Chapter 4, we tested whether different allelic variants of rs1360780 of the *FKBP5* gene would influence the extent to which individuals demonstrate alterations in resting-state functional connectivity in the salience network in the context of adversity. Data stemmed from 774 young European adults from the general population who took part in the IMAGEN study.
Summary

We found that carriers of the TT (‘risk’) allele with a history of abuse demonstrated stronger amygdala-insula resting-state functional connectivity as compared to TT allele carriers without a history of abuse, and CT/CC allele carriers with and without abuse. This finding suggests that the TT genotype of rs1360780 may render individuals with a history of abuse more vulnerable to functional changes in the communication between brain areas processing emotions and bodily sensations, which could underlie or increase the risk for psychopathology.

In Chapter 6, we examined whether effortful control (a dimension of temperament) would render toddlers more or less vulnerable to develop cortisol alterations in the context of parenting stress. Data stemmed from 31 families who took part in the baseline wave of an intervention study. In contrast to our expectations, parenting stress was not associated with toddlers’ morning or evening cortisol levels, and toddlers’ effortful control did not moderate these hypothesized associations. While parenting stress may have not sufficiently reflected experiences that are perceived as stressful by the child, it is also possible that our cortisol measure was not sensitive enough to capture parenting stress-related HPA axis alterations. Likewise, given the lack of a moderation effect, we could only speculate that individual differences in effortful control at 15 months of age were not yet meaningful to influence child outcomes. An interesting finding was that higher levels of parenting stress were related to lower levels of toddlers’ effortful control, which might reflect a bidirectional association. A toddler’s low levels of effortful control could give rise to or exacerbate parenting stress, thereby impeding the parent’s competence in engaging in sensitive and responsive parenting to meet the child’s needs. In turn, dysfunctional parenting practices may undermine the development of toddlers’ effortful control. Longitudinal studies are needed to examine at what age an assessment of effortful control may be useful in pediatric practice to identify those children who are at heightened risk to develop psychobiological alterations and problem behavior in the context of adversity.

In Section 4, we addressed two secondary aims of this dissertation. The first one is described in Chapter 5, in which we investigated what times of day would be most reliable in revealing between-individual differences in young children’s cortisol levels. To this end, we instructed 19 parents to take ten saliva samples from their toddler over two days, yielding five samples per day. Comparing intra-class correlation coefficients of each sampling time, we found that saliva samples taken by parents in the morning between 30 and 80 min after wake-up and bedtime samples were more reliable in revealing between-individual differences in toddlers’ basal
Summary

cortisol levels as compared to samples taken within the first 30 min after wake-up, in the noon or in the afternoon. This study provided the base for the cortisol sampling protocol employed in the intervention study described in Chapter 6. Further, it may inform researchers in choosing reliable sampling times to measure young children’s cortisol levels, if they are restricted to a few samples only.

Another secondary aim is presented in Chapter 7, in which we provided a meta-review on the development and socialization of self-regulation from infancy to adolescence. Based on narrative reviews, systematic reviews and meta-analyses, we disentangled developmental and socialization processes of self-regulatory capacities from those of goals and motivation that underlie the willingness to self-regulate. We found that the development in complex capacities (e.g., planning) is preceded and paralleled by development in simpler capacities (e.g., working memory). Over time, coordination between these capacities improves, and goals and motivation shift from exploring the immediate environment to thriving in multiple domains. Focusing on socialization processes, we further observed that parents, peers, and teachers all have a major impact on the development of self-regulation, with self-regulation transitioning from being a co-regulated process to an increasingly internally regulated process. Given these findings, we emphasized that self-regulation development should be studied in light of the social environment with specific attention to the distinction between self-regulatory capacities, goals and motivation. These findings also bear important methodological implications by demonstrating that what is considered as adaptive self-regulation is relative to the broader context. A toddler growing up under conditions of adversity may be less motivated to delay gratification if asked to do so. However, if this toddler does not resist the immediate temptation of a reward in an experimental task, this would not necessarily indicate low self-regulatory capacities. Further work is required to develop experimental paradigms that enable valid assessment of children’s self-regulatory capacities by taking the child’s goals into consideration, particularly in the context of childhood adversity.

The present dissertation summarizes a broad literature on alterations in HPA axis and vagal functioning that have been observed in the context of adversity. Overall, our findings point to the complexity of predicting psychobiological adaptation, which is not only influenced by adversity characteristics, but also by individual characteristics such as genetic constitution. To trace diverse pathways from childhood adversity to psychopathology, more longitudinal studies are needed that incorporate multiple measures of stress system functioning next to various
Summary

protective factors. These studies should begin their first assessment(s) in early childhood to enable a better understanding of the biological embedding of adversity early in life.
Nederlandse samenvatting

Een groot aantal kinderen groeit op onder omstandigheden van tegenspoed, waarin ze te maken krijgen met bijvoorbeeld misbruik, verwaarlozing, chronische armoede of geweld in de buurt. Hoewel tegenslagen in de kindertijd het risico op psychopathologie aanzienlijk verhogen, ontwikkelt niet iedereen die aan tegenslag is blootgesteld problemen met de geestelijke gezondheid. In dit proefschrift wilden we twee hoofdvragen beantwoorden: Wat voor psychobiologische veranderingen zijn er aanwezig bij mensen met een geschiedenis met tegenspoed? En wat verklaart de individuele variabiliteit in psychobiologische adaptatie na tegenslagen in de kindertijd?

In sectie 1 hebben we eerdere bevindingen samengevat over de aan tegenslag gerelateerde veranderingen in het functioneren van stresssystemen. Wat betreft de hypothalamus-hypofyse-bijnier (HHB)-as, lieten we zien dat er zowel verhoogde als verlaagde dagelijkse cortisolniveaus zijn gevonden bij kinderen jonger dan 5 jaar die waren blootgesteld aan tegenspoed (hoofdstuk 2). Beide patronen van ontregeling van de HHB-as zijn in eerdere studies gerelateerd aan stoornissen in executieve functies, die belangrijk zijn voor zelfregulatie. Op basis van deze evidentie stelden we een manier voor van hoe tegenspoed in de kindertijd de geestelijke gezondheid mogelijk kan beïnvloeden. Om precies te zijn, stelden we voor dat tegenspoed tijdens de eerste levensjaren van het kind het functioneren van de HHB-as beïnvloedt, die nog in ontwikkeling is. Dit leidt tot veranderingen in de cortisolniveaus, wat na verloop van tijd zowel de ontwikkeling als het functioneren van hersenstructuren die belangrijk zijn voor zelfregulatie kunnen belemmeren. Zelfregulatieproblemen kunnen op hun beurt het risico op psychopathologie op de lange termijn vergroten. In de literatuur over interventies vonden we dat interventies gericht op het opvoeden door de ouders mogelijk de aan tegenslag gerelateerde biologische en gedragsmatige veranderingen kunnen herstellen.

De twee meta-analyses in hoofdstuk 3 vatten de bevindingen samen over aan tegenslag gerelateerde veranderingen in vagale regulatie. Vagale regulatie is een specifiek aspect van het functioneren van het autonome zenuwstelsel, wat vaak wordt gemeten door vagaal gemedieerde hartslagvariabiliteit (vgHSV). Om precies te zijn, hebben we het verband onderzocht tussen tegenspoed in de kindertijd en vagale activiteit bij rust, en vagale reactiviteit op uitdagingen. Omdat in beide meta-analyses deze verbanden niet werden gevonden tussen tegenspoed in de kindertijd en vgHSV, concludeerden we dat het vagale systeem over het algemeen functioneel lijkt binnen de brede context van tegenspoed in de kindertijd. Onder bepaalde omstandigheden, zoals bij ernstige tegenspoed of psychopathologie, vonden we
verminderingen van vagale activiteit en -reactiviteit op situaties waarin bijvoorbeeld stress werd geïnduceerd.

In sectie 2 onderzochten we of bepaalde ongunstige omstandigheden in de kindertijd verschillende patronen van psychobiologische aanpassing kunnen verklaren. In hoofdstuk 2 concludeerden we op basis van bewijs uit eerdere studies dat in de vroege kinderjaren specifieke tegenslagen niet duidelijk gelinkt kunnen worden aan hyper- of hypoactiviteit van de HHB-as. Verder waren deprivatie (“deprivation”) en bedreiging (“threat”)—twee verschillende dimensies van tegenspoed—niet gerelateerd aan veranderingen in cortisol en het vagale systeem (hoofdstukken 2 en 3). Een kanttekening bij deze bevindingen is dat onze aangepaste methodologie ten opzichte van eerdere studies mogelijk bestaande verbanden verhulde heeft. Mogelijk zijn dergelijke verbanden wel waarneembaar in studies die zich specifiek richten op verschillen tussen ervaringen van deprivatie en van bedreiging. Op basis van onze bevindingen kan in het algemeen worden gesteld dat de ernst van tegenspoed de psychobiologische aanpassing beïnvloedt. Ernstige tegenslag in de kindertijd ging voornamelijk samen met verminderde cortisolproductie en verminderde vagale activiteit, terwijl minder ernstige tegenslag eerder gerelateerd was aan verhoogde cortisolproductie en normaal vagaal functioneren (hoofdstuk 2 en 3).

In sectie 3 hebben we individuele verschillen in psychobiologische aanpassing aan tegenspoed in de kindertijd onderzocht. In onze eerste meta-analyse in hoofdstuk 3 ontdekten we dat tegenspoed was gerelateerd aan een lagere baseline vagale activiteit in steekproeven met deels ook deelnemers met een psychiatrische stoornis. Gezien de overige literatuur, suggereerden we dat mensen die op het moment van blootstelling aan tegenspoed een lagere vagale activiteit in rust hebben, mogelijk degenen zijn die een hogere kans hebben om later verdere vermindering van vagale activiteit te ontwikkelen. In onze tweede meta-analyse ontdekten we dat degenen voor wie de tegenspoed in de kindertijd minder recent was, een lagere vagale reactiviteit op uitdaging hadden. Deze bevinding geeft aan dat tegenspoed in de kindertijd een nadelige ontwikkeling in gang kan zetten waarbij veranderingen in het functioneren van het stresssysteem zichtbaarder worden op de langere termijn.

Ook voerden we twee empirische studies uit om de kennis te verbreden over specifieke individuele moderatoren op genotypisch en fenotypisch niveau die niet meegenomen konden worden in onze meta-analyses. In hoofdstuk 4 hebben we getest of verschillende allelvarianten van rs1360780 van het FKBP5-gen invloed hebben op de mate waarin individuen met en zonder tegenslag in de kindertijd
veranderingen vertonen in functionele connectiviteit van het brein in rust. De data was afkomstig van 774 jonge Europese volwassenen uit de algemene bevolking die deelnamen aan het IMAGEN-onderzoek. We ontdekten dat dragers van het TT (‘risico-’) allel met een geschiedenis van misbruik, een sterkere functionele connectiviteit tussen de amygdala en insula in rusttoestand vertoonden dan dragers van de TT-allelvariant zonder een geschiedenis van misbruik en dan CT/CC-alleldragers met en zonder misbruik. Deze bevinding suggereert dat mensen die het TT-genotype van rs1360780 dragen en misbruik hebben meegemaakt, kwetsbaarder zijn voor functionele veranderingen in de communicatie tussen hersengebieden die emoties en lichamelijke gewaarwordingen verwerken. Dit kan ten grondslag liggen aan het ontstaan van psychopathologie.

In hoofdstuk 6 onderzochten we of “effortful control” (een dimensie van temperament) peuters meer of minder kwetsbaar maakt voor het ontwikkelen van cortisolveranderingen bij opvoedingsstress. De data was afkomstig van 31 gezinnen die deelnamen aan de baselinemetingen van een interventiestudie. Tegen onze verwachtingen was opvoedingsstress niet geassocieerd met de cortisoolniveaus van peuters in de ochtend of avond. Ook modereerde effortful control van de peuter deze veronderstelde associaties niet. Een verklaring voor deze bevinding zou kunnen zijn dat opvoedingsstress mogelijk een onvoldoende weergave is voor de stress die ervaren wordt door het kind. Een alternatieve verklaring is dat onze cortisolmeting niet gevoelig genoeg was om aan opvoedingsstress gerelateerde HHB-as veranderingen vast te stellen. Omdat wij geen moderatie-effecten vonden, is het evenwel mogelijk dat individuele verschillen in effortful control op de leeftijd van 15 maanden nog niet genoeg van betekenis zijn om psychobiologische aanpassingen aan tegenspoed te bevloeden. Een interessante bevinding was dat meer opvoedingsstress verband hield met minder effortful control bij de peuters. Dit zou kunnen duiden op een wederkerig verband tussen effortful control en opvoedingsstress. Een peuter met minder effortful control kan opvoedingsstress bij ouders veroorzaken of verergeren, waardoor ouders meer moeite hebben om sensitief en responsief op te voeden. Op hun beurt kunnen deze disfunctionele opvoedingspraktijken de ontwikkeling van effortful control van peuters ondermijnen. Longitudinale studies zijn nodig om te onderzoeken op welke leeftijd een beoordeling van effortful control nuttig kan zijn om in de praktijk kinderen te kunnen identificeren die een verhoogd risico lopen om psychobiologische veranderingen en probleemgedrag te ontwikkelen bij tegenspoed.
Sectie 4 gaat over twee secundaire doelen van dit proefschrift. Het eerste doel was om te onderzoeken welke tijdstippen van de dag het meest betrouwbaar zouden zijn om individuele verschillen in de cortisolniveau’s van jonge kinderen te meten: dit wordt beschreven in hoofdstuk 5. Hiervoor hebben we 19 ouders gevraagd om gedurende twee dagen tien speekselmonsters bij hun peuter af te nemen, wat neerkomt op vijf monsters per dag. Door de correlaties tussen de tijdstippen te vergelijken, ontdekten we dat speekselmonsters die ‘s ochtends afgenomen werden tussen 30 en 80 minuten na het ontwaken en monsters voor het slapengaan betrouwbare waren om individuele verschillen in basale cortisolspiegels van peuters aan te tonen dan monsters van de eerste 30 minuten na het ontwaken, rond 12 uur of in de (na)middag. Deze bevinding vormde de basis voor het cortisolafnameprotocol dat werd gebruikt in de interventiestudie beschreven in hoofdstuk 6. Deze informatie kan onderzoekers helpen bij het kiezen van betrouwbare afnamemomenten om de cortisolspiegels van jonge kinderen te meten, zeker als slechts enkele monsters kunnen worden afgenomen.

Het tweede secundaire doel was een overzicht te geven over de ontwikkeling en socialisatie van zelfregulatie vanaf de kindertijd tot de adolescentie, zoals beschreven in de meta-review in hoofdstuk 7. Op basis van narratieve reviews, systematische reviews en meta-analyses hebben we de ontwikkelings- en socialisatieprocessen van zelfregulatie capaciteiten losgekoppeld van doelen en motivatie die ten grondslag liggen aan de bereidheid tot zelfregulatie. We ontdekten dat de ontwikkeling in complexe capaciteiten (bijvoorbeeld planning) zowel wordt voorafgegaan door—als parallel loopt aan—de ontwikkeling in eenvoudigere capaciteiten (bijvoorbeeld werkgeheugen). Gedurende de ontwikkeling verbetert de coördinatie tussen deze capaciteiten en verschuiven doelen en motivatie van het verkennen van de directe omgeving naar functioneren in meerdere domeinen. Met betrekking tot socialisatieprocessen vonden we dat ouders, leeftijdsgenoten en leraren allemaal een grote invloed hebben op de ontwikkeling van zelfregulatie, waarbij zelfregulatie overgaat van een gezamenlijk gereguleerd proces naar een steeds meer intern gereguleerd proces. Op basis van deze bevindingen benadrukten we dat de ontwikkeling van zelfregulatie bestudeerd moet worden in het licht van de sociale omgeving met specifieke aandacht voor het onderscheid tussen capaciteiten, doelen en motivatie. Voor het onderwerp van dit proefschrift hebben deze bevindingen ook belangrijke methodologische implicaties. Wat wordt beschouwd als adaptieve zelfregulatie blijkt relatief en wordt bepaald door de bredere context. Een peuter die opgroeit in tegenspoed kan minder gemotiveerd zijn om de onmiddellijke verleiding van een beloning bij een experimentele taak te weerstaan.
Nederlandse samenvatting

Dit kan echter een aanpassing zijn op zijn omstandigheden en hoeft niet noodzakelijkerwijs te wijzen op een laag zelfregulerend vermogen. Toekomstig onderzoek is nodig om experimentele paradigma’s te ontwikkelen om zelfregulatie van kinderen te meten waarbij rekening wordt gehouden met de doelen van het kind die mogelijk zijn ontstaan door ongunstige omstandigheden in de kindertijd.

Dit proefschrift geeft een samenvatting van de brede literatuur over veranderingen in de HHB-as en vagaal functioneren die zijn waargenomen in de context van tegenspoed. In algemene zin, laten onze bevindingen zien dat het voorspellen van psychobiologische adaptatie complex is. Dit komt omdat adaptatie wordt beïnvloed door zowel kenmerken van de ongunstige omstandigheden, als door individuele verschillen, zoals genetische opmaak. Om verschillende ontwikkelingstrajecten van tegenspoed in de kindertijd tot psychopathologie in kaart te brengen, zijn meer longitudinale studies nodig die naast beschermende factoren ook meerdere meetpunten en maten van het functioneren van het stresssysteem kunnen meenemen. Dergelijk onderzoek zou moeten starten in de vroege kinderjaren om te kunnen leiden tot een beter begrip van de psychobiologische gevolgen van ongunstige omstandigheden in de kindertijd.
Nederlandse samenvatting
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