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Summary of Ph.D. Thesis

CHILDHOOD MALTREATMENT, EMOTION REGULATION AND SOCIAL STRESS DURING ADOLESCENCE

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CHAPTER I: THEORETICAL BACKGROUND

Childhood maltreatment could be viewed as the greatest failure of the family environment in offering a child the chance of typical development (Cicchetti and Lynch, 1995). Within the context of a relationship based on responsibility and trust, the child is exposed to abuse, neglect or exploitation, which can lead to threat or real damage to their health, development, dignity and survival (Butchard, Putney, Furniss and Kahane, 2006).

The importance of research on childhood maltreatment has risen as its severity and the extent of its negative effects upon individuals are being documented. Childhood maltreatment is associated with a higher probability of developing mental disorders across the lifespan, which, once developed, appear to be more severe and less responsive to treatment. In the last decades, hundreds of studies have analysed the association between exposure to childhood maltreatment and risk of psychopathology (Evans, Li and Whipple, 2013). These studies have highlighted a few highly important aspects. First, exposure to childhood maltreatment is a common phenomenon. The prevalence of childhood maltreatment is estimated at around 50% in developed countries, with a similar percentage estimated in countries with medium and low levels of development (Green et al., 2010; McLaughlin et al., 2012; Kessler et al., 2010). Second, individuals exposed to childhood maltreatment present an increased risk of developing mental disorders during their lifespan, in such a way that the more severe the exposure, the higher the risk of developing psychopathology (Edwards et al., 2003; Green et al., 2010; Kessler et al., 1997). Third, exposure to childhood maltreatment creates a vulnerability to psychopathology that persists across the entire lifespan. Similarly, childhood maltreatment is associated with earlier onset of mental disorders (McLaughlin et al., 2012; Green et al., 2010; Kessler et al., 2010). Fourth, the association between childhood maltreatment and mental disorders appears to be non-specific. It appears that childhood maltreatment imparts a latent vulnerability to issues belonging to the spectrum of internalizing and externalizing disorders (Caspi et al., 2014). Fifth, exposure to childhood maltreatment explains a significant percentage of mental disorders, which is reflective of both the increased prevalence and the strong association between childhood maltreatment and psychopathology (Afifi et al., 2008; Green et al., 2010; McLaughlin et al., 2012).

All of these studies clearly indicate that childhood maltreatment increases the risk of psychopathology. Thus, it is presently necessary to identify mechanisms that explain the association between childhood maltreatment and psychopathology. Although extensive

research has been undergone to identify the mechanisms mediating the link between different types of maltreatment and psychopathology, we only know very little about the complexity of this relationship, which highlights the necessity of probing further into existing knowledge and identifying new mechanisms (McLaughlin, 2016; Tricket, Noll și Putnam, 2011). The relationship between childhood maltreatment and psychopathology is extremely complex, multifactorial and involves numerous biopsychosocial mechanisms (Hoppen and Chalder, 2018). Some mechanisms could be relevant transdiagnostically, while others could be asociated with specific disorders (McLaughlin, 2016).

Constructing on the association between childhood maltreatment and an increased risk of psychopathology, without directly evaluating the psychopathology, this paper aims to examine: (1) the effect of exposure to adverse childhood experiences upon the cortisol response to social stress, in a a meta-analysis; beyond estimating a global effect, the magnitude of the effects of different types of adversities and different age groups – children, adolescents, and adults – upon the cortisol sensitivity to stress has been analysed; (2) the effect of different types of childhood maltreatment – abuse and neglect – and the effect of regular use of specific emotion regulation strategies on the sensitivity to social rejection; (3) whether the aspects of emotion regulation in the daily life of adolescents modulate the relationship between childhood maltreatment and sensitivity to social rejection; (4) the consequences of exposure to childhood maltreatment on emotions and emotion regulation strategies in the daily life of adolescents; more specifically, positive and negative emotions, attempts to use specific emotion regulation strategies and the perceived efficiency of using these strategies have been examined.

In general, the studies included in this paper focus on adolescence, as, during this period, (1) the HPA axis is still undergoing development and it is thought to be extremely susceptible to adverse early experiences (Tarullo and Gunnar, 2006); (2) the mechanisms underlying emotion regulation are still in development (Petchel and Pizzagalli); and (3) sensitivity to rejection is significantly higher compared to other developmental periods (Harper, Dickson and Welsh, 2006).

CHAPTER II: RESEARCH OBJECTIVES AND GENERAL METHODOLOGY

This paper aims to explore the effects of childhood maltreatment at the emotional, social and biological levels. The first study attempts to clarify the association between exposure to childhood maltreatment and reactivity to social stress, through a meta-analysis. The second and third studies address the role of childhood maltreatment on the sensitivity to social rejection at the subjective and physiological levels. The fourth study examines the effect of exposure to different types of childhood maltreatment on emotions and emotion regulation.

The primary objective of this paper was to investigate the effect of early-life adversity over the cortisol reactivity to stress in a meta-analytical study (Study 1). Besides estimating a general effect, we aimed to investigate several moderators such as the type of childhood adversity, the stage of development at the moment of evaluation and the method used to evaluate the adversity. Studies were identified by searching the electronic databases PubMed, PsycINFO and Embase and crossing keywords related to childhood adversity, stress reactivity and the HPA axis. All statistical analyses were done using the Comprehensive Meta-Analysis software, version 2.0 (Biostat, Englewood, NJ, USA). For the main analyses, we used the means from the studies that underwent multiple evaluations. The effect size was based on Hedges' g, corrected for small sample sizes (Hedges and Olkin, 1985) using the *random-effects* model. The size of effects smaller than 0.32 were interpreted as small, the size of effects between 0.33-0.55 were interpreted as moderate, and the size of effects with values over 0.56 were interpreted as large (Lipsey and Wilson, 1993).

The second objective included two phases: first, we aimed to test different types of childhood maltreatment and emotion regulation as predictors of sensitivity to social rejection (Study 2), and secondly, we aimed to investigate whether emotion regulation has a moderating role in the relationship between childhood maltreatment and sensitivity to social rejection (Study 3) in two independent samples of adolescents. In study 2, childhood maltreatment and the habitual use of three emotion regulation strategies (reappraisal, suppression and rumination) have been evaluated using self-report instruments. The subjectively perceived sensitivity to social rejection was evaluated after exposure to the exclusion stage of the game Cyberball, using self-report instruments. Cyberball is an instrument used to evaluate the reaction to social inclusion/exclusion under laboratory conditions and was used in both studies 2 and 3. In study 3, exposure to childhood maltreatment was evaluated with the aid of a semi-structured interview. In addition to the

habitual use of the three emotion regulation strategies, difficulties in emotion regulation were also evaluated by self-report instruments. Sensitivity to social rejection was evaluated both subjectively through self-report, and physiologically, by measuring participants' heart rate variability during exposure to the exclusion stage of Cyberball.

The third objective was to investigate the impact of different types of childhood maltreatment on emotions, emotion regulation attempts and efficiency of emotion regulation in the daily life of adolescents (Study 4). To reach this objective, the adolescents responded to a self-report questionnaire on the history of childhood maltreatment and to questions regarding their daily emotional experiences, through the Day Reconstruction Method, a journal-type method, adapted for this study. Positive and negative emotion scores, attempts to use and the eficiency of using reappraisal, suppresion and distraction were the main variables analysed. In hierarchical multiple regression analyses, the scores of the different types of maltreatment evaluated were used to predict emotional reactivity, attempts to use and the eficiency of using emotion regulation strategies.

CHAPTER III: ORIGINAL CONTRIBUTIONS TO RESEARCH

3.1. Early adversities and the cortisol response to social stress: a meta-analysis (Study 1)

Introduction

Childhood adversities, including maltreatment (e.g. abuse and neglect) and other traumatic events are strongly associated with an increased risk of psychopathology during the lifetime and with chronic health issues (Cicchetti, 2016; McLaughlin, 2016; Nemeroff, 2016). For example, a series of studies have indicated that childhood adversities are associated with an increased risk of all common mental disorders (Green et al., 2010), risk that is maintained during the entire lifetime. Long-term negative effects of childhood adversities are explained by a sensitivity to stress or an increased vulnerability to future stressful events (Hammen, Henry and Daley, 2000; McLaughlin, Conron, Koene and Gilman, 2010). One of the stress response systems which has been intensely analyzed as a potential underlying mechanisms of stress sensitivity is the hypothalamic-pituitary-adrenal axis (HPA axis). The HPA axis undergoes a long period of development, including childhood and adolescence, and is considered to be extremely susceptible to early adversities (Tarullo and Gunnar, 2006). In addition to this, cortisol, which is this system's main hormone and plays an essential role in maintaining the increased metabolic demands of the stress response, can also contribute to allostatic load and health damage when difficulties in regulation are present (McEwen, 1998; Sapolsky, 2000). Difficulties in cortisol regulation can lead, to the same extent, to increased or decreased response levels (Lupien, McEwen, Gunnar and Heim, 2009; McEwen, 1998; Sapolsky, 2000) and a hypothesis is that cortisol blunting could represent a process of adaptation of the HPA axis to long periods of hyper reactivity (Trickett, Noll, Susman, Shenk and Putnam, 2010; Fries, Hesse, Hellhammer and Hellhammer, 2005).

Consequently, this meta-analysis examined the effect of childhood adversities on the cortisol response to social stress. The threat of social evaluation is an efficient activator of the HPA axis (Dickerson and Kemeny, 2004), and this type of social stress can offer a model for studying cortisol sensitivity to stress. Beyond estimating a global effect, this research analyses whether the magnitude of the effect differs between different types of adversities, as well as between children, adolescents, and adults. Moreover, based on previous results that used the Trier Social Stress Test (TSST) (Kudielka, Hellhammer and Kirschbaum, 2007), sex differences and the methodological quality of the studies were evaluated as potential moderators.

Materials and methods

Study identification

Articles were identified through searching electronic databases PubMed, PsycINFO and Embase up to March 2017, by crossing keywords, including truncated terms associated with childhood adversities (e.g. traumatic events or adversities or stressors or maltreatment and early or childhood) with terms associated with stress reactivity (e.g. social or acute stressor) and the HPA axis (e.g. cortisol). Likewise, references of eligible studies, as well as other meta-analyses, were verified.

Statistical analysis

All statistical analyses were done using the Comprehensive Meta-Analysis software, version 2.0 (Biostat, Englewood, NJ, USA). The means and standard deviations of salivary cortisol were extracted from the text of the papers as well as from tables, and also from graphs, using the Web Plot Digitizer software (Rohatgi, 2015). Alternatively, the effect sizes were estimated on the basis of correlations, or unstandardized regression coefficients and sample sizes, as well as based on results from inter-group differences (e.g. ANOVA) using the formulae implemented in Comprehensive Meta-Analysis (Borenstein, Hedges, Higgins and Rothstein, 2009).

Results

Study selection

After evaluating the title and abstract, 9898 studies were excluded as they did not fulfill the inclusion criteria or were duplicates. For the 54 remaining studies, the entire text was analysed, but 22 of these did not fulfill the inclusion criteria and were excluded. The 32 remaining studies fulfilled the inclusion criteria, and 24 reported enough data to calculate the effect size. The authors of the 8 studies where not enough data was available were contacted, and 5 of these offered the necessary information. For 3 of the studies (Elzinga, Spinhoven, Berretty, de Jong and Roelofs, 2010; Rao and Morris, 2015; Wang, Paul, Stanton, Greeson and Smoski, 2013) we could not obtain the necessary data and thus decided to exclude them from the meta-analysis.

Primary effects

The mean of the effect size is -0.39 (95% CI: -0.52, -0.27), suggesting an association between childhood adversities and a blunted cortisol level. Heterogeneity is high (I^2 = 86.63%; p <0.001) which suggests that other factors could interact with childhood adversities during the cortisol response to stress.

The size of the effect was evaluated in at three time points of cortisol analysis: baseline (k = 18), peak (k = 18) and recovery (k = 15). Childhood adversities were associated with blunted cortisol levels at all three time points (all $p < 0.01$), with a moderate effect at baseline (Hedges' g = -0.33; 95% CI -0.58, -0.08) and a large effect at peak (Hedges' g = -0.77; 95% CI -1.09, -0.44) and recovery (Hedges' g = -0.77; 95% CI -1.14, -0.39).

Discussion

This meta-analysis included 30 datasets in which childhood adversities and the salivary cortisol response to stress were evaluated in 4292 participants of different ages. In accordance to the hypothesis of stress sensitivisation of the HPA axis, and to evidence supporting the idea that a lower level of activity represents a manifestation of HPA axis dysregulation, the results obtained in this meta-analysis suggest that the cortisol response to stress is blunted in individuals with a history of childhood maltreatment. A moderate general effect of association was obtained between childhood maltreatment and the cortisol response to stress, yet large effects were observed at the peak and recovery time points, with a moderate effect at baseline. These results suggest that the effects of childhood adversities on the cortisol response to stress can be more obvious in the acute phase of the stressor.

In conclusion, this meta-analysis supports the association between early-life adversities, especially child maltreatment, and a blunted cortisol response to social stress. Thus, we bring the first meta-analytical evidence of long-term effects of childhood adversities on the HPA axis reactivity to social stress, indicating that this effect reaches maximum potential during adulthood. These results may have clinical implications, taking into account the fact that HPA axis sensitivity could represent one of the mechanisms underlying the long-term vulnerability to psychopathology which appears after exposure to childhood maltreatment.

3.2. Childhood maltreatment, emotion regulation and sensitivity to social rejection (Studies 2 and 3)

Introduction

Extreme levels of childhood maltreatment represent a major risk factor for developing mental disorders across the lifetime (Norman, Byambaa, Butchart, Scott and Vos, 2012; Gilbert et al., 2009), and one of the mechanisms that contribute to a vulnerability to developing mental disorders could be represented by difficulties in social functioning. (McCroy, Ogle, Gerin and Viding, 2019; Flynn, Cichetti and Rogosch, 2014). The

association between childhood maltreatment and difficulties in social functioning is supported by numerous transversal and longitudinal studies (Kim and Cichetti, 2010; Bolger and Patterson, 2001; Raby et al., 2019) and could be influenced by multiple and complex dysfunctionalities in domains such as emotion regulation, threat signal processing and reward processing.

We could assume that emotional maltreatment through verbal hostility, rejection and child humiliation behaviors (Egeland, 2009) may contribute to an increased sensitivity to emotional stimuli evaluated as threatening. An increased receptivity to emotional stimuli (Heim et al., 2000; Obradovic, 2012; Voellmin et al., 2015) could be associated with the facilitation of attention towards stimuli perceived as threatening, which, in the context of childhood maltreatment, prepares the child for confrontation with the abuser. Moreover, in environments characterized by abuse and neglect, parents' or caregivers' rejection behaviors are often present (Bolger and Patterson, 2001) and can manifest chronically or acutely (DeWall and Bushman, 2011) through neglect, isolation, emotional coldness, indifference, hostility (Ibrahim, Rohner, Smith and Flannery, 2015). Chronic exposure to rejection during childhood is associated with hypersensitivity to rejection and threat signals (Van Beest and Williams, 2006) both in the familial as well as the extended social environment (van den Berg et al., 2018).

Considering the fact that exposure to maltreatment is a situation which the child does not control, the way in which they respond to stressful situations has the potential to diminish or amplify the long-term negative effects (Compas et al, 2017). However, in an environment characterized by abuse and neglect, the capacity to learn functional emotion regulation strategies is simultaneously confronted with a double challenge, through the lack of functional stress response models and through constant battle to stressors which exceed the individual's level of development (Gruhn and Compas, 2020). In this context, abundant evidence supports the association between childhood maltreatment and emotion regulation, through general emotion regulation difficulties as well as through the regular use of dysfunctional emotion regulation strategies at a more specific level (Miu et al., 2022; Gruhn and Compas, 2020; Lavi, Katz, Ozer and Gross, 2019).

Our research aims to investigate if (study 2) exposure to different types of childhood maltreatment together with the habitual use of emotion regulation strategies predicts sensitivity to social rejection and if (study 3) the characteristics of emotion regulation in the daily life of adolescents – at the specific level, through emotion regulation strategies, as well

as the general level, through emotion regulation difficulties – modulate the relationship between childhood maltreatment and sensitivity to social rejection.

Study 2 – Methods

Participants

The sample contains data from 231 adolescents aged between 10 years and 6 months and 17 years (M = 14.69, SD = 1.57), 60.2% of the sample being female (N = 139).

Evaluation of childhood maltreatment

The *Childhood Trauma Questionnaire, CTQ*, (Bernstein și colaboratorii, 2003) is a questionnaire by which we can evaluate five types of childhood maltreatment (1) physical abyse, (2) emotional abuse, (3) sexual abuse, (4) physical neglect and (5) emotional neglect. This instrument allows us to calculate both a total score and a score for each type of maltreatment.

Evaluation of emotion regulation

The *Emotion Regulation Questionnaire, ERQ* (Gross și John, 2003) is an instrument used to identify interindividual differences in the habitual use of two emotion regulation strategies: reappraisal and supression. Reappraisal implies changing the way in which individuals interpret a situation, with the purpose of changing the emotion they are experiencing. Supression consists in blocking the expression of a felt emotion. Participants answer on a scale of 1 (strongly disagree) to 7 (strongly agree) to what extent each of the 10 items of this instrument evaluates their experience and emotional expression.

The *Ruminative Response Scale,* RRS (Treynor, Gonzalez and Nolen-Hoeksema, 2003) is an instrument which evaluates the extent to which participants have the tendency to think repetitively about the stressful aspects of a situation or its possible consequences. Participants respond on a scale of 1 (almost never) to 4 (almost all of the time) to indicate the extent to which they engage in certain behaviours and thoughts when feeling sad.

Evaluation of sensitivity to social rejection

Cyberball (Williams, Cheung and Choi, 2000) is a digital game which allows us to create interactive scenarios using a simple ball game. In this game, the real participant is playing a ball game with other two players. The participant is told that the other players are real, of similar age and are participating in the same study in different cities. However, these players are fictive. In our study, each participant had to complete two stages of Cyberball. In the first stage (inclusion), all players, real and fictive, received an equal number of ball passes, while in the second stage (exclusion), the real participants only received passes at the

beginning of the game, after which they witnessed the other two participants playing, without receiving the ball themselves. All participants had two fictive partners during each stage of the game.

The *Positive and Negative Affect Scales*, *PANAS*, (Watson and Clark, 1994) consists of a number of words and phrases which describe different sentiments and emotions. Participants respond on a scale of 1 (very slightly or not at all) to 5 (extremely) to what extent each of the 10 items of this instrument correspond to the way they felt during the game. Two scores are calculated: positive affectivity and negative affectivity. This instrument was completed by the participants after each stage of Cyberball.

Evaluation of development during puberty

The *Pubertal Developmental Scale, PDS,* (Pettersen, Crockett, Richards and Boxer, 1988) is an instrument which evaluates development during puberty in a non-intrusive way. The items for evaluating development include increase in height, body hair growth and skin changes. Additionally, the scale includes two more items for evaluating female development, on breast growth and onset of menstruation, and two items for evaluating male development, on changes in voice and facial hair growth. Participants respond on a scale of 1 to 4. Out of the total score, participants are assigned to a developmental stage: pre-puberty, midpubertal, late puberty, post-puberty.

Procedure

Participants were programmed to the study the day before, being informed that they are going to participate to an online game with adolescents from other cities, where this study is taking place in parallel. At the established time, participants started the first stage, the inclusion stage of the Cyberball game. After the first stage (inclusion), participants completed the PANAS questionnaired and continued to the second stage of the game, the exclusion stage. Subsequently, they completed the PANAS questionnaire again. After completing the two stages and the questionnaires, the experimenter discussed with the participant and debriefed them. After completing the task, participants received instructions for completing the ERQ, RRS, PDS and CTQ questionnares online.

Statistical analysis

In the first stage of hierarchical multiple regression, the socio-demographic and developmental characteristics of the participants such as sex, age and puberal stage were tested as predictors of sensitivity to social rejection. In the second stage, the five types of maltreatment evaluated in our study were added as predictors, and in the third stage,

measurements of emotion regulation were added. The statistical software SPSS was used for all analyses (IBM, Armonk, NY, USA).

Results

Emotional and physical abuse were positively associated with the habitual use of rumination (r = .32, $p < .01$; r = .18, $p < .01$) and sensitivity to social rejection (r = .19, $p < .01$; r = .15, $p < .05$), and the habitual use of rumination was positively associated with sensitivity to social rejection (r = .18, $p < .01$). Moreover, physical and sexual abuse were negatively associated with the habitual use of reappraisal (r = -.12, $p < .05$; r = .12, $p < .05$) while the total maltreatment score was negatively asociated with the habitual use of reappraisal (r = -.16, $p < .01$) and positively associated with the habitual use of suppression (r = .13, $p < .01$) and rumination (r = .22, $p < .01$). Of all predictors introduced in the three steps of hierarchical multiple regression, only the exposure to emotional abuse during childhood predicted sensitivity to social rejection F (8, 201) = 2.27, $p < .05$.

Study 3 - Methods

Participants

The sample contains data from 62 adolescents aged between 11 and 16 years (M = 14.26, SD = 1.56), 58% of the sample being female (N = 36).

Evaluation of childhood maltreatment

The *Childhood Trauma Interview* (Fink et al., 1995) is a semi-structured interview which evaluates exposure to maltreatment during childhood and adolescence in six areas: separation/loss of attachment figures, physical neglect, emotional abuse, physical abuse, witnessing of domestic violence, as well as sexual abuse. The *CTI* thus evaluates a wide range of adversities, from the most common to the most extreme. Additionally, the interviewers rate the frequency of apparition of an event using a scale from 1 (less than once per year on average) to 6 (at least daily). The duration (in months) for each event, the abuser, and the age of the participant at the onset and end of each event can also be rated.

Evaluation of emotion regulation

The *Difficulties in Emotion Regulation Scale*, *DERS,* (Gratz și Roemer, 2004) is an instrument which allows the identification of emotion regulation difficulties across multiple dimensions: (1) emotional non-acceptance, i.e. the tendency to display negative emotions towards one's own feelings and the unwillingness to accept them; (2) difficulties that appear when experiencing an unpleasant emotion prevents goal fulfillment; (3) difficulties in controlling impulses when experiencing strong negative emotions; (4) difficulties in

emotional awareness; (5) difficulties in accessing efficient emotion regulation strategies (6) difficulties in understanding the emotion that arise in specific situations and the reason for which they appear. This instrument allows for calculation of a total score. Participants answer on a scale of 0 (almost never) to 5 (almost always) to what extent each of the 36 items of this instrument applies to them. Additionally, in order to evaluate emotion regulation, the *Emotion Regulation Questionnaire*, ERQ, (Gross and John, 2003) and the Ruminative Response Scale, RRS, (Treynor, Gonzalez and Nolen-Hoeksema, 2003) were used, previously described in Study 2.

Evaluation of sensitivity to social rejection

The same task, Cyberball (Williams, Cheung and Choi, 2000) and the same positive and negative emotion rating scale (*Positive and Negative Affect Scales*, PANAS) (Watson and Clark, 1994) were used as in study 2. In addition to these, we used the *Need Threat Scale*, NTS, (Van Beest and William, 2006), which is an instrument that helps identify the extent to which participants' fundamental needs are threatened after each of the two stages of the game. The fundamental needs evaluated are: belonging, self-esteem, control, and purpose. Participants respond on a 1 (disagree) to 7 (agree) scale to what extent each of the 20 items of this instrument expresses the way they felt during the game.To evaluate the sensitivity to social rejection at a physiological level, the electrical activity of the heart was measured by electrocardiogram (EKG). EKG was continuously recorded during the two stages of Cyberball using two pre-gelled disposable Ag/AgCl electrodes placed according to derivation II.

Procedure

Participants were programmed to the study the day before, being informed that they are going to participate in an online game with adolescents from other cities where this study is taking place in parallel, thus punctuality being extremely important. At the established time, after being given the instructions, participants started the first stage of Cyerballl, the inclusion stage. After the first stage of the game (inclusion), participants completed the PANAS and NTS questionnaires and continued to the second stage of the game, the exclusion stage. Subsequently, they completed the two questionnaires again. Then, after a short break, each student participated in the CTI interview in a different room, together with the experimenter. The duration of the interview varied between 15 and 50 minutes, depending on the number and complexity of the traumatic events each of the participants had been exposed to. After completing the interview, participants received instructions to complete the

DERS, ERQ and RRS at home, alone and undisturbed, until the following day when the questionnaires were returned to the experimenter.

Statistical analysis

Moderator analyses were done using the PROCESS app for SPSS (Hayes, 2013). Each of the four measures of emotion regulation (reappraisal, suppression, difficulties in regulation and *brooding*) were tested separately, as a moderator in the relationship between childhood maltreatment as a predictor, and sensitivity to social stress. The latter was evaluated using two indicators: negative emotions (PANAS) and the NTS score after exclusion in Cyberball. As a predictor, the general maltreatment severity score was tested separately. Significant effects were reported at the $p < 0.05$ significance treshold. The statistical software SPSS (IBM, Armonk, NY, USA) was used for all analyses.

Rezultate

The severity of childhood maltreatment was significantly correlated with rumination ($r = .29$, $p < .05$), difficulties in accepting emotions ($r = .39$, $p < .01$), impulse control ($r = .27$, $p < .05$) and access to strategies ($r = .31$, $p < .05$). Similarly, the severity of childhood maltreatment was significantly correlated with the RR intervals ($r = .34$, $p < .05$) in the exclusion stage of Cyberball. The habitual use of rumination was positively correlated with negative emotions ($r = .33$, $p < .05$) and negatively correlated with the need for belonging ($r = -.30$, $p < .05$), self-esteem ($r = -.43$, $p < .01$) and the total score of the fundamental needs scale ($r = -.34$, $p < .01$) after the exclusion stage of Cyberball. Scores for the ERQ revaluation, ERQ suppression, RRS *brooding* and DERS difficulties in emotion regulation scales were tested as moderators in the relationship between the severity of childhood maltreatment and sensitivity to social rejection, via the negative emotions that emerged after the exclusion stage of Cyberball.

Discussion

These results suggest that only exposure to emotional abuse during childhood is a significat predictor of sensitivity to social rejection in adolescence. Emotion regulation was associated to both the severity of childhood maltreatment and the sensitivity to social stress. These associations held for different measurements of emotion regulation, such as those evaluating difficulties in emotion regulation and the habitual use of suppression, rumination and reappraisal. Through different methods (e.g. evaluation of childhood maltreatment by self-report questionnaire and interview), the results of our study support previously published findings (McCroy, Ogle, Gerin and Viding, 2019; Kim and Cichetti, 2010; Iffland and

Nruner, 2020; Pollak et al., 2000) and suggest a mechanism which could contribute to psychopathological vulnerability after exposure to childhood maltreatment.

3.3. Childhood maltreatment, positive emotions, negative emotions and emotion regulation strategies: a journal type study (Study 4)

Introduction

Recent studies have shown that emotion regulation is a multi-process mechanism which can occur at all stages of emotion generation, focused on both antecedents (e.g. situation, attention, evaluation) and the emotional response (Bonanno and Burton, 2013; Gross, 2014; Webb et al., 2012). The process model of emotion regulation (Gross, 2014) maintains that the stage at which emotion regulation strategies are applied is an important factor in the success of emotion regulation. Emotion regulation strategies used on the antecedents of an emotion (e.g. situation, attention, evaluation) could be more efficient than strategies focused on emotional responses (e.g expressive behaviour), as the strategies belonging to the first category aim at stages prior to generating emotional responses or target these responses in incipient stages. Studies in which cognitive reappraisal (e.g. reinterpretation of a potentially threatening stimulus) was compared to expressive suppression (e.g. the reduction of emotional expression) have indicated that reappraisal allows for a higher level of emotional and behavioural control as compared to suppression (Gross, 2002). For example, subsequent studies compared the use of reappraisal with distraction (e.g. diverting attention from the emotional situation to a neutral stimulus) (Sheppes and Meiran, 2008) and identified other factors, such as the intensity of the emotion, which influence the success of emotion regulation.

With regard to emotions and emotion regulation, individuals exposed to childhood maltreatment might have to invest more effort in emotion regulation by developing a heightened sensitivity to negative emotions, compared to individuals without a childhood maltreatment history. For example, the results of a study (Liu, Schulz and Waldinger, 2015) in which the researchers investigated the association between exposure to different types of childhood maltreatment and intention of emotional control during conflictual discussions with partners show that individuals exposed to several types of childhood maltreatment report a stronger intention to control their emotions during discussions with their partner. The authors of the study highlight the importance of identifying factors which could explain the association between childhood maltreatment and an increased motivation for emotional

control, and suggest that a history of maltreatment might countribute to higher engagement levels in emotion regulation processes with the purpose of reducing emotional intensity, even when this is not so high. This could be explained by increased emotional non-acceptance, as suggested by another study conducted in our lab (Cărnuță și colaboratorii, 2014). Another example comes from a functional neuroimaging study (McLaughlin, Peverill, Gold, Alves and Sheridan, 2015), in which adolescents were exposed to positive and negative emotional stimuli, with instructions to either passively view the stimuli, or to regulate their emotional responses. In the case of participants with a childhood maltreatment history, a higher level of activation was observed in cerebral structures involved in emotional control.

The present study aims to offer a new and extended perspective on the consequences of exposure to childhood maltreatment on emotions and emotion regulation strategies in the daily life of adolescents. More specifically, positive and negative emotions, the attempt to use reappraisal, suppression and distraction, and the efficiency of implementing these strategies were evaluated in each episode identified by the adolescents with the use of the DRM. Based on previously published results (McLaughlin, Peverill, Gold, Alves and Sheridan, 2015; Liu, Schulz and Waldinger, 2015), we would expect that childhood maltreatment associates with higher levels of negative emotions, lower levels of positive emotions and attempts to use emotion regulation strategies of generally lower efficiency and higher cognitive costs. With regard to the efficiency of using emotion regulation strategies, we expected negative association to childhood maltreatment.

Methods

Participants

The sample contains data from 364 adolescents aged between 11-17 years (M = 14.73, SD = 1.70), 65.9% of the sample being female (N = 240).

Evaluation of childhood maltreatment

Childhood maltreatment was evaluated using the *Childhood Trauma Questionnaire, CTQ, (*Bernstein et al., 2003), described in study 2.

Evaluation of emotions and emotion regulation

The DRM, addapted form Kahneman, Krueger, Schkade, Schwarz and Stone (2004) is a method by which, in the first stage, participants are asked to reconstruct the previous day as a series of events, using a structured questionnaire. In the second stage, participants are asked to answer to a series of online questions addressing each of the events previously identified in the structured questionnaire. These questions target the important elements of each episode, including the felt emotion and the use of specific emotion regulation strategies.

Development during puberty

In evaluating the stage of pubertal development we used the *Pubertal Developmental Scale*, PDS, (Pettersen, Crockett, Richards and Boxer, 1988), described in study 2.

Procedure

Participants were recruited and evaluated in their schools and received written instructions for the DRM. For the online questionnaires, they received codes so they could complete them anonymously.

Statistical analysis

In the first step of the hierarchical multiple regression, the socio-demographic and developmental characteristics of the participants such as sex, age and pubertal stage were tested as predictors of positive and negative emotions, the attempt to use and the efficiency of the three emotion regulation strategies: reeevaluation, suppresion and distraction. In the second step of hierarchical multiple regression, the five types of childhood maltreatment that we evaluated: emotional, physical and sexual abuse, physical and emotional neglect, were added as predictors. The statistical software SPSS (IBM, Armonk, NY, USA) was used for all analyses.

Results

The total childhood maltreatment score was positively correlated to the attempt to reappraise (r = .19, $p < .01$), as well as the attempt (r = .27, $p < .01$) and efficiency of suppression (r = .25, $p < .01$). Moreover, the total score of childhood maltreatment was negatoively associated to positive emotions (r = -.17, $p < .01$) and positively associated to negative emotions (r = .18, $p < .01$) and the attempt to use distraction (r = .12, $p < .05$). Emotional neglect was negatively associated to positive emotions (r = -.19, $p < .01$) and positively associated to negative emotions (r = .18, $p < .01$). With regards to the attempt to use the three emotion regulation strategies, exposure to childhood maltreatment predicted 6% of reappraisal attempts, $R^2 = .06$, $F(8, 361) = 2.96$, $p = .003$, with emotional abuse and physical neglect being significant predictors, 12% of suppression attempts, $R^2 = .12$, $F(8, 361) = 6.17$, $p < .001$, with emotional abuse and physical neglect being significant predictors, and 5% of distraction attempts, $R^2 = .05$, $F(8, 361) = 2.43$, $p = .014$, with emotional abuse being a significant predictor. Regarding the efficiency of using emotion regulation strategies, participants' age and their exposure to emotional neglect during childhood significantly predicted 11% of the reappraisal efficiency, $R^2 = .11$, $F(8, 181) = 2.72$, $p = .007$.

Discussion

In agreement with multiple theoretical models and with evidence that supports the development of hyperreactivity to negative emotions such as sadness and anger, and of hiporeactivity to positive emotions such as happiness and joy in the context of childhood maltreatment, the results obtained in this study support the idea that a dysfunctional relationship to parents or caregivers in early environments characterised by maltreatment represents an important factor in learning maladaptive emotional reactions (Bowlby, 1988; Cicchetti and Lynch, 1995; Eisenberg et al., 2001). Thus, these results are in agreement with the results of a recent meta-analysis (Lavi, Katz, Ozer and Gross, 2019) which included 58 studies of child and adolescent participants and pointed towards the existence of a significant association between exposure to childhood maltreatment and heightened levels of negative emotions, as well as lower levels of positive emotions.

All five types of maltreatment evaluated in our study were positively associated with the attempt to reappraise and, at the same time, suppress emotional experiences. These results suggerts that exposure to higher levels of childhood maltreatment associates with increased effort in the attempt to identify and use emotion regulation strategies. Along with the results of two previously published studies (McLaughlin, Peverill, Gold, Alves and Sheridan, 2015; Liu, Schulz and Waldinger, 2015) these result highlight the importance of investigating emotion regulation in order to identify the specific difficulties associated with exposure to childhood maltreatment. As it can be seen further, of all the five types of maltreatment evaluated in our study, only emotional abuse predicted the attempt to use all three emotion regulation strategies.

Through the viewpoint of clinical implications, the results of this study come, on the one hand, as a guide to developing intervention programs for reducing the risk of psychopathology in individuals exposed to childhood maltreatment and, on the other hand, as an aid in developing psychotherapeutic interventions through focusing on a complex evaluation of the different aspects of emotion regulation in patients with a history of childhood maltreatment.

CHAPTER IV: GENERAL CONCLUSIONS AND IMPLICATIONS

4.1. General conclusions

The first meta-analytical study investigated the effect of early adversities on the cortisol response to social stress. The subsequent two studies investigated the impact of childhood maltreatment and emotion regulation on the sensitivity to social rejection in adolescence, and the last study aimed to grasp the association between different types of childhood maltreatment and potential difficulties with emotional reactivity and emotion regulation strategies in the daily life of adolescents.

The results of our meta-analysis (Study 1) support for the first time the idea that the cortisol stress response is blunted in individuals with a history of early-life adversities compared to individuals without a history of early-life adversities, at the same time suggesting that out of several types of adversities, childhood maltreatment can have a stronger effect on the cortisol reactivity to social stress. Similarly, our results point to blunted cortisol levels during adulthood, in comparison to childhood and adolescence.

With regards to the role of childhood maltreatment and emotion regulation in the sensitivity to social rejection (Studies 2 and 3), our results support the idea that exposure to emotional abuse during childhood contributes to sensitivity to social rejection during adolescence, and that childhood maltreatment is linked to emotion regulation and emotion regulation is linked to sensitivity to social rejection.

In the last study included in this work (Study 4), we evaluated emotions and emotion regulation in the daily life of adolescents, in order to test whether the exposure to different types of maltreatment during childhood predicts reactivity, the attempt to use and the efficiency of three emotion regulation strategies. Our results indicate that exposure to emotional abuse and neglect negatively predicts positive emotional reactivity during adolescence. Moreover, emotional abuse also predicts the attempt to use different strategies of emotion regulation.

In the following sections, we will outline some theoretical, methodological and practical implications emerging from our work. In the last section, we will summarize the main limitations of the research included and suggest future directions which could contribute to understanding the association between exposure to childhood maltreatment and psychopathology.

4.2. Theoretical implications

The results obtained in our meta-analysis confirm what is supported by recent studies, which is that exposure to childhood maltreatment is associated with diminished activity of the HPA axis, and at the same time indicate that the experience of childhood maltreatment can have a stronger effect than other types of adversities on the cortisol reactivity to social stress.

In addition to this, exposure to emotional abuse during childhood, through rejection behaviours from parents or caregivers, was associated to a heightened sensitivity to social rejection during adolescence, suggesting that specific types of childhood maltreatment can have different effects on typical development.

At the same time, childhood maltreatment associated with emotion regulation, and emotion regulation associated with sensitivity to social rejection, but the relationship between childhood maltreatment and sensitivity to social rejection was not moderated by emotion regulation. The absence of moderation could suggest that, during development in a constantly aversive environment, hyperreactivity to rejection signals may appear earlier than the emotion regulation issues.

With regards to emotion regulation in the context of childhood maltreatment, our study calls attention, on the one hand, to the increased effort of adolescents in the attempt to use the different emotion regulation strategies available out of the need to regulate their emotions, and, on the other hand, to the perceived efficiency of maladaptive emotion regulation strategies by adolescents, yet not of more adaptive emotion regulation strategies. Moreover, with regards to emotions on the context of childhood maltreatment, our results come to confirm what previous models and studies supported, which is that adolescents with a childhood maltreatment history experience more negative emotions and less positive emotions, in comparison to adolescents without a maltreatment history

The results obtained in all studies included in this work suggest that adolescence could represent an opportune period for implementing intervention programs focused on the reactivity to social stress, learning adaptive emotion regulation strategies and improving the flexibility of reactions to social rejection.

4.3. Practical implications

The results of our meta-analysis suggest a stronger effect of childhood maltreatment on the cortisol response to social stress, compared to other types of adversities. These results

agree with previous results which support the idea that childhood maltreatment is associated with a higher risk of psychopathology (Green et al., 2010; McLaughlin et al., 2010) in comparison to other childhood adversities, and may have clinical implications in the context of HPA axis sensitivity as a potential mechanism of vulnerability to psychopathology. What is more, the results of our meta-analysis indicate that the effect of childhood adversities on the cortisol response to social stress is larger in adults and smaller in adolescents and children. The small effect obtained in adolescents and children could reflect an earlier stage of HPA axis dysregulation and could represent a period in which, through developing specific interventions, the negative effects could be diminished.

Evaluation of the attempt to use emotion regulation strategies and their efficiency in the daily life of adolescents showed that exposure to emotional abuse during childhood predicts the attempt to use both adaptive and maladaptive emotion regulation strategies, but only the use of maladaptive regulation strategies is evaluated as effficient by the adolescents. These results suggest that adolescents with a history of emotional abuse during childhood put more effort into the attempt to regulate their emotions, and highlights the importance of interventions targetting the development of emotion regulation skills during childhood and adolescence. The perceived efficiency of emotion regulation strategies is associated with psychopathology, and learning to use adaptive strategies could contribute to diminishing the risk of psychopathology.

Our results draw attention to the relationship between exposure to emotional abuse during childhood and the sensitivity to social rejection, sugesting that exposure to different types of maltreatment could have different effects on social and emotional development. Thus, evaluation of different types of childhood maltreatment in the psychotherapeutic context could guide specialists towards selecting the most effective psychotherapeutical interventions.

4.4. Methodological implications

The studies included in this work bring important contributions to the study of emotions, emotion regulation and sensitivity to social rejection. One of our major objectives was to evaluate emotions and emotion regulation in the daily life of adolescents, without being limited to self-report instruments. Thus, we chose to adapt the Day Reconstruction Method for evaluating experienced emotions and emotion regulation strategies used by adolescents during multiple events in a regular day of life. This method, by relating to events

that took place during the previous day, allowed for reduction of memory distortions and, at the same time, for investigating the attempt to use and the efficiency of using several emotion regulation strategies.

Sensitivity to social rejection was evaluated both at the subjective and physiological levels. Previous studies support subjective reactions to social rejection, however, the studies evaluating physiological reactions were ambiguous. By recording heart rate variability during Cyberball, our results indicate that social rejection triggers immediate physiological reactions, characterized by behavioural activation.

4.5. Limitations and future directions

It is possible that the sample in study 3 was too small for some of the analyses we used, such as moderating analyses. Future studies are necessary to investigate the complex relationship between different types of childhood maltreatment and sensitivity to social rejection evaluated at both the subjective and physiological levels, in order to clarify the results which suggest that different types of maltreatment are associated with difficulties in various emotional, social and attentional processes.

The use of the Cyberball game in investigating sensitivity to social rejection could have been too low an emotional activator for individuals with a history of childhood maltreatment, being considered a moderate social injury task. Thus, the use of either a stronger activating task, or of more ambiguous tasks could have contributed more to understanding the relationship between sensitivity to rejection and different types of childhood maltreatment. Similarly, future studies could investigate sensitivity to rejection outside the laboratory environment, by studying daily reactions to social rejection in adolescents, in their interactions with real friends and not virtual players.

The studies included in this work are transversal. Without this necessarily being a limitation, we suggest longitudinal follow-up of the children and and adolescents in future studies aiming to investigate emotion regulation and sensitivity to social rejection in relationship to childhood maltreatment, in order to capture the emergence of difficulties in different developmental stages.

REFERENCES

Afifi, T. O., Enns, M. W., Cox, B. J., Asmundson, G. J., Stein, M. B., & Sareen, J. (2008). Population attributable fractions of psychiatric disorders and suicide ideation and attempts associated with adverse childhood experiences. *American journal of public health*, *98*(5), 946-952.

Bolger, K. E., & Patterson, C. J. (2001). Developmental pathways from child maltreatment to peer rejection. *Child development*, *72*(2), 549-568.

Bonanno, G. A., & Burton, C. L. (2013). Regulatory flexibility: An individual differences perspective on coping and emotion regulation. *Perspectives on psychological science*, *8*(6), 591-612.

Borenstein, M., Hedges, L. V., Higgins, J. P., & Rothstein, H. R. (2009). *Introduction to meta- analysis*. John Wiley & Sons.

Bowlby, J. (1988). A secure base: Parent-child attachment and healthy human development. Basic Books.

Butchart, A., Putney, H., Furniss, T. and Kahane, T. (2006) Preventing child maltreatment: A guide to taking action and generating evidence. Geneva: World Health Organisation.

Cărnuţă, M., Crişan, L. G., Vulturar, R., Opre, A., & Miu, A. C. (2015). Emotional non-acceptance links early life stress and blunted cortisol reactivity to social threat. *Psychoneuroendocrinology*, *51*, 176-187.

Cicchetti, D. (2016). Socioemotional, personality, and biological development: Illustrations from a multilevel developmental psychopathology perspective on child maltreatment. Annual review of psychology, 67, 187-211.

Cicchetti, D., & Lynch, M. (1995). *Failures in the expectable environment and their impact on individual development: The case of child maltreatment*. John Wiley & Sons.

Compas, B. E., Jaser, S. S., Bettis, A. H., Watson, K. H., Gruhn, M. A., Dunbar, J. P., ... & Thigpen, J. C. (2017). Coping, emotion regulation, and psychopathology in childhood and adolescence: A meta-analysis and narrative review. *Psychological bulletin*, *143*(9), 939.

DeWall, C. N., & Bushman, B. J. (2011). Social acceptance and rejection: The sweet and the bitter. *Current Directions in Psychological Science*, *20*(4), 256-260.

Dickerson, S. S., & Kemeny, M. E. (2004). Acute stressors and cortisol responses: a theoretical integration and synthesis of laboratory research. *Psychological bulletin*, *130*(3), 355.

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. (2009). Taking stock: childhood emotional maltreatment and developmental psychopathology.

Eisenberg, N., Cumberland, A., Spinrad, T. L., Fabes, R. A., Shepard, S. A., Reiser, M., ... & Guthrie, I. K. (2001). The relations of regulation and emotionality to children's externalizing and internalizing problem behavior. *Child development*, *72*(4), 1112-1134.

Elzinga, B. M., Roelofs, K., Tollenaar, M. S., Bakvis, P., van Pelt, J., & Spinhoven, P. (2008). Diminished cortisol responses to psychosocial stress associated with lifetime adverse events: a study among healthy young subjects. *Psychoneuroendocrinology*, *33*(2), 227-237.

Evans, G. W., Li, D., & Whipple, S. S. (2013). Cumulative risk and child development *Psychological bulletin*, *139*(6), 1342.

Flynn, M., Cicchetti, D., & Rogosch, F. (2014). The prospective contribution of childhood maltreatment to low self-worth, low relationship quality, and symptomatology across adolescence: A developmental-organizational perspective. *Developmental psychology*, *50*(9), 2165.

Fries, E., Hesse, J., Hellhammer, J., & Hellhammer, D. H. (2005). A new view on hypocortisolism. *Psychoneuroendocrinology*, *30*(10), 1010-1016.

Gilbert, R., Widom, C. S., Browne, K., Fergusson, D., Webb, E., & Janson, S. (2009). Burden and consequences of child maltreatment in high-income countries. *The lancet*, *373*(9657), 68-81.

Green, J. G., McLaughlin, K. A., Berglund, P. A., Gruber, M. J., Sampson, N. A., Zaslavsky, A. M., & Kessler, R. C. (2010). Childhood adversities and adult psychiatric disorders in the national comorbidity survey replication I: associations with first onset of DSM-IV disorders. *Archives of general psychiatry*, *67*(2), 113-123.

Gross, J. J. (2002). Emotion regulation: Affective, cognitive, and social consequences. *Psychophysiology*, *39*(3), 281-291.

Gross, J. J. (2014). Emotion regulation: conceptual and empirical foundations.

Gruhn, M. A., & Compas, B. E. (2020). Effects of maltreatment on coping and emotion regulation in childhood and adolescence: A meta-analytic review. *Child abuse & neglect*, *103*, 104446.

Hammen, C., Henry, R., & Daley, S. E. (2000). Depression and sensitization to stressors among young women as a function of childhood adversity. *Journal of consulting and clinical psychology*, *68*(5), 782.

Harper, M. S., Dickson, J. W., & Welsh, D. P. (2006). Self-silencing and rejection sensitivity in adolescent romantic relationships. *Journal of Youth and Adolescence*, *35*(3), 435-443.

Hedges, L. V., & Olkin, I. (1985). *Statistical methods for meta-analysis*. Academic press: Orlando, FL, USA

Heim, C., Newport, D. J., Heit, S., Graham, Y. P., Wilcox, M., Bonsall, R., & *et al.*(2000). Pituitary-adrenal and autonomic responses to stress in women after sexual and physical abuse in childhood. *Jama*, *284*(5), 592-597.

Hoppen, T. H., & Chalder, T. (2018). Childhood adversity as a transdiagnostic risk factor for affective disorders in adulthood: a systematic review focusing on biopsychosocial moderating and mediating variables. *Clinical Psychology Review*, *65*, 81-151.

Ibrahim, D. M., Rohner, R. P., Smith, R. L., & Flannery, K. M. (2015). Adults' remembrances of parental acceptance–rejection in childhood predict current rejection sensitivity in adulthood. *Family and Consumer Sciences Research Journal*, *44*(1), 51-62.

Kessler, R. C., McLaughlin, K. A., Green, J. G., Gruber, M. J., Sampson, N. A., Zaslavsky, A. M., ... & Williams, D. R. (2010). Childhood adversities and adult psychopathology in the WHO World Mental Health Surveys. *The British journal of psychiatry*, *197*(5), 378-385.

Kim, J., & Cicchetti, D. (2010). Longitudinal pathways linking child maltreatment, emotion regulation, peer relations, and psychopathology. *Journal of child psychology and psychiatry*, *51*(6), 706-716.

Kudielka, B. M., Hellhammer, D. H., & Kirschbaum, C. (2007). Ten Years of Research with the Trier Social Stress Test--Revisited. In: Harmon-Jones E, Winkielman P (eds). *Social neuroscience: Integrating biological and psychological explanations of social behavior*. Guilford Press: New York, NY, US, 2007, pp 56-83.

Lavi, I., Katz, L. F., Ozer, E. J., & Gross, J. J. (2019). Emotion reactivity and regulation in maltreated children: A meta-analysis. *Child development*, *90*(5), 1503-1524.

Lipsey, M. W., & Wilson, D. B. (1993). The efficacy of psychological, educational, and behavioral treatment: Confirmation from meta-analysis. *American psychologist*, *48*(12), 1181.

Liu, S. R., Schulz, M. S., & Waldinger, R. J. (2015). Cumulative contribution of child maltreatment to emotional experience and regulatory intent in intimate adult interactions. *Journal of Aggression, Maltreatment & Trauma*, *24*(6), 636-655.

Lupien, S. J., McEwen, B. S., Gunnar, M. R., & Heim, C. (2009). Effects of stress throughout the lifespan on the brain, behaviour and cognition. *Nature reviews neuroscience*, *10*(6), 434-445.

McCrory, E., Ogle, J. R., Gerin, M. I., & Viding, E. (2019). Neurocognitive adaptation and mental health vulnerability following maltreatment: The role of social functioning. *Child maltreatment*, *24*(4), 435-451.

McEwen, B. S. (1998). Stress, adaptation, and disease: Allostasis and allostatic load. *Annals of the New York academy of sciences*, *840*(1), 33-44.

McLaughlin, K. A. (2016). Future directions in childhood adversity and youth psychopathology. *Journal of Clinical Child & Adolescent Psychology*, *45*(3), 361-382.

McLaughlin, K. A., Conron, K. J., Koenen, K. C., & Gilman, S. E. (2010). Childhood adversity, adult stressful life events, and risk of past-year psychiatric disorder: a test of the stress sensitization hypothesis in a population-based sample of adults. *Psychological medicine*, *40*(10), 1647-1658.

McLaughlin, K. A., Green, J. G., Gruber, M. J., Sampson, N. A., Zaslavsky, A. M., & Kessler, R. C. (2012). Childhood adversities and first onset of psychiatric disorders in a national sample of US adolescents. *Archives of general psychiatry*, *69*(11), 1151-1160.

McLaughlin, K. A., Peverill, M., Gold, A. L., Alves, S., & Sheridan, M. A. (2015). Child maltreatment and neural systems underlying emotion regulation. *Journal of the American Academy of Child & Adolescent Psychiatry*, *54*(9), 753-762.

Miu, A. C., Szentágotai-Tătar, A., Balazsi, R., Nechita, D., Bunea, I., & Pollak, S. D. (2022). Emotion regulation as mediator between childhood adversity and psychopathology: a meta-analysis. *Clinical psychology review*, 102141.

Nemeroff, C. B. (2016). Paradise lost: the neurobiological and clinical consequences of child abuse and neglect. *Neuron*, *89*(5), 892-909.

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.

Obradović, J. (2012). How can the study of physiological reactivity contribute to our understanding of adversity and resilience processes in development?. *Development and psychopathology*, *24*(2), 371-387.

Raby, K. L., Roisman, G. I., Labella, M. H., Martin, J., Fraley, R. C., & Simpson, J. A. (2019). The legacy of early abuse and neglect for social and academic competence from childhood to adulthood. *Child development*, *90*(5), 1684-1701.

Rao, U., & Morris, M. C. (2015). Cortisol responses to psychosocial stress: The role of childhood maltreatment and depression. *International journal of public mental health and neurosciences*, *2*(1).

Rohatgi A (2015). WebPlotDigitizer: User manual version 3.9. Available at http://arohatgi.info/WebPlotDigitizer/.

Sapolsky, R. M., Romero, L. M., & Munck, A. U. (2000). How do glucocorticoids influence stress responses? Integrating permissive, suppressive, stimulatory, and preparative actions. *Endocrine reviews*, *21*(1), 55-89.

Sheppes, G., & Meiran, N. (2008). Divergent cognitive costs for online forms of reappraisal and distraction. *Emotion*, *8*(6), 870.

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

Trickett, P. K., Noll, J. G., & Putnam, F. W. (2011). The impact of sexual abuse on female development: Lessons from a multigenerational, longitudinal research study. *Development and psychopathology*, *23*(2), 453-476.

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*(1), 165-175.

Van Beest, I., & Williams, K. D. (2006). When inclusion costs and ostracism pays, ostracism still hurts. *Journal of personality and social psychology*, *91*(5), 918.

Van den Berg, L. J., Tollenaar, M. S., Pittner, K., Compier-de Block, L. H., Buisman, R. S., Van Ijzendoorn, M. H., & Elzinga, B. M. (2018). Pass it on? The neural responses to rejection in the context of a family study on maltreatment. *Social cognitive and affective neuroscience*, *13*(6), 616-627.

Voellmin, A., Winzeler, K., Hug, E., Wilhelm, F. H., Schaefer, V., Gaab, J., ... & Bader, K. (2015). Blunted endocrine and cardiovascular reactivity in young healthy women reporting a history of childhood adversity. *Psychoneuroendocrinology*, *51*, 58-67.

Wang, L., Paul, N., Stanton, S. J., Greeson, J. M., & Smoski, M. (2013). Loss of sustained activity in the ventromedial prefrontal cortex in response to repeated stress in individuals with early-life emotional abuse: implications for depression vulnerability. *Frontiers in Psychology*, *4*, 320.

Webb, T. L., Miles, E., & Sheeran, P. (2012). Dealing with feeling: a meta-analysis of the effectiveness of strategies derived from the process model of emotion regulation. *Psychological bulletin*, *138*(4), 775.