IDENTIFYING PHYSICALLY AND INTERPERSONALLY ADAPTIVE INTRINSIC AND EXTRINSIC STRATEGIES FOR EMOTION REGULATION IN THE PARENT-CHILD RELATIONSHIP

by

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A DISSERTATION

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DISSERTATION ABSTRACT

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Title: Identifying Physically and Interpersonally Adaptive Strategies for Intrinsic and Extrinsic Emotion Regulation in the Parent-Child Relationship

The ability to effectively regulate emotions is fundamental to interpersonal and physical functioning. Emotion regulation strategies are not equal, however, with some positively and others negatively impacting physical health. Specifically, previous literature has demonstrated that distinct intrinsic emotion regulation strategies differentially predict chronic inflammation, as measured by C-Reactive Protein (CRP), but little is known about the association between extrinsic emotion regulation strategies and chronic inflammation. Furthermore, the extrinsic emotion regulation strategies employed by parents are facilitative of the developing emotion regulation skills of children, and inflammation has been identified as a key biological factor that could impact the intergenerational transmission of emotion dysregulation, either by explaining it or by modifying the strength of the intergenerational association. This study seeks to replicate previous findings demonstrating a link between intrinsic emotion regulation strategies and chronic inflammation in a community sample of mothers with preschool-aged children. Additionally, this study aims to extend those findings and interrogate the association between extrinsic emotion regulation strategies and chronic inflammation. Last, this study proposes to examine the associations between intrinsic and extrinsic

emotion regulation strategies in mothers and the socioemotional health of their preschool-aged children, predicting that the relationships between maternal intrinsic and extrinsic emotion regulation strategies and child socioemotional health will be significantly impacted by maternal chronic inflammation. Both moderation and mediation models will be evaluated.

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For my children. Know that you are capable of achieving great things as long as you have faith in yourself, welcome the support of others, and work to benefit the greater good.

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CHAPTER I

INTRODUCTION

Emotions[1] are associated with action tendencies that guide behavioral responding necessary to support human functioning (Gross, 2002). For example, emotions can propel us to successfully rise to challenges or connect meaningfully with others (Gross, 2013; Lazarus, 1991). Conversely, emotions can lead to acts of self-injury or other behaviors that can be harmful in the long-term such as over-eating (Laye-Gindhu & Schonert-Reichl, 2005; Ricca et al., 2009; Whiteside et al., 2007). Importantly, from the perspective of prevention and intervention, the automatic action tendencies associated with emotions can be overridden by strategies that change the occurrence, intensity, or duration of an emotional response, commonly referred to as *emotion regulation* (Gross, 2013; Thompson, 1994). However, not all emotion regulation strategies are equal. As noted by Gross (2002), "[h]ow we regulate our emotions matters" (p. 281) and can have pronounced impacts on physical, cognitive, and social health (Appleton et al., 2013; John & Gross, 2004; Richards & Gross, 2000; Sapolsky, 2007).

Understanding how emotion regulation relates to health first requires understanding different approaches to emotion regulation. Emotion regulation strategies can be either *intrinsic*—used to regulate one's own emotions—or *extrinsic*—used to regulate the emotions of another, such as a parent attempting to soothe their child (Gross, 2013). Intrinsic emotion regulation strategies are putatively either *adaptive* or *maladaptive* based on their cognitive, affective, and behavioral consequences including

[1] There is no universally-accepted definition of *emotion* within the scientific community, though emotions are generally considered to be episodic (having a beginning and end), directed toward an internal or external object, to be triggered and influenced by a cognitive appraisal of that object, and to produce bodily changes, including outward expression (Mulligan & Scherer, 2012).

their associations with the incidence and maintenance of psychopathology (Aldao & Nolen-Hoeksema, 2012). Adaptive strategies tend to benefit the individual whereas maladaptive strategies generally exact a toll in these domains, though it is possible that the most adaptive choice in a given situation could be biologically costly. Similarly, extrinsic emotion regulation strategies can either be *supportive* or *unsupportive* based on their functional impact on emotional distress, physiological arousal, and goal-directed behavior in the target individual (Butler et al., 2014; Dixon-Gordon et al., 2015; Rozanski & Kubzansky, 2005). Supportive strategies generally decrease distress and arousal while increasing goal-directed behavior, whereas the reverse is true for unsupportive strategies.

The process model of emotion regulation (see Figure 1) organizes strategies temporally as either *antecedent-focused* or *response-focused* (Gross, 1998, 2002). Antecedent-focused emotion regulation strategies are implemented proactively, prior to the activation of physiological and behavioral response tendencies, and are thought to contribute to more effective use of cognitive and biological resources than response-focused strategies, which are applied reactively to the experience of an undesired emotion (Gross & John, 2003).

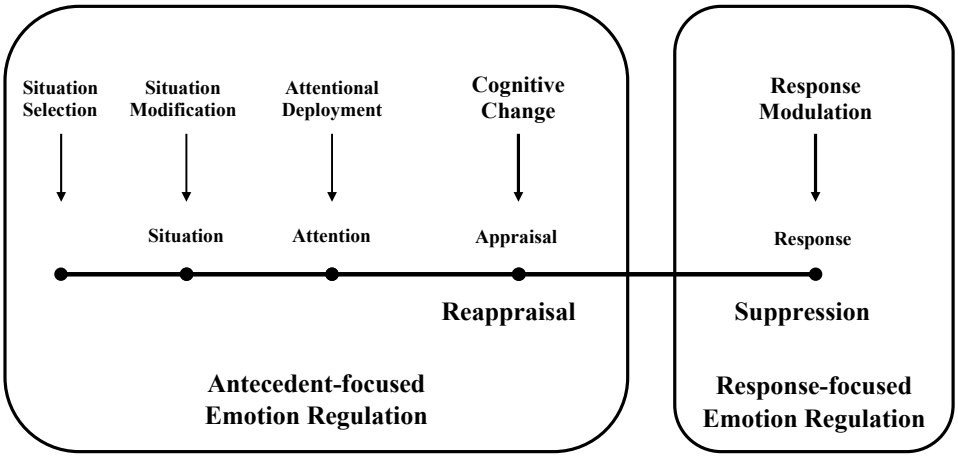

Figure 1. The Process Model of Emotion Regulation by Gross (1998)

Emotion Regulation Strategies

Reappraisal (i.e., altering one's thoughts about an emotion-eliciting situation in order to modify its emotional impact; Lazarus & Alfert, 1964) is a commonly-used antecedent-focused emotion regulation strategy that is considered to be adaptive, or protective of physical health, because it alters the course of one's emotional experience, effectively initiating improved biological, psychological, and social responses (Gross & John, 2003). For example, a researcher could view an upcoming conference presentation as an opportunity to gain valuable feedback from other scientists with the purpose of advancing her field rather than as a stressful event to be feared because her work could be harshly scrutinized. According to the process model of emotion, the researcher's use of reappraisal should improve her experience of, and her behavioral responding to, the conference presentation (Gross, 1998, 2002).

Research indicates that reappraisal is indeed linked to positive outcomes in multiple domains (for a meta-analysis, see Augustine & Hemenover, 2009). For example, individuals who habitually use reappraisal tend to experience and express more positive emotions and fewer negative emotions, report fewer depressive symptoms, and endorse increased optimism (Gross & John, 2003; Troy et al., 2010). Reappraisal has also been shown to be related to improved ability to respond psychologically to negative emotion-arousing situations compared to other emotion regulation strategies. In a laboratory study conducted to compare subjective and physiological arousal associated with the use of different emotion regulation strategies in response to anxiety, Hofmann et al. (2009) asked participants to give an impromptu 10-minute speech about three controversial topics (i.e., the mandatory seat belt law, the war in Iraq, and the death penalty) in front of

a video camera. In order to maximize their anxiety, participants were told that researchers might evaluate the quality of their speech. Participants were divided into one of three groups: a reappraisal group, a suppression group, and an acceptance group. All groups were told "It is quite normal that an impromptu speech creates some level of discomfort or even fear" (Hofmann et al., 2009, pp. 390). Participants in the reappraisal group were instructed to regulate their emotions by reevaluating the situation:

> Please try to take a realistic perspective on this task, by recognizing that there is no reason to feel anxious. Please realize that this situation does not present a threat to you. Regardless of what occurs during this task or how anxious you appear, it is just an experiment, and there are no negative consequences to be concerned with (Hofmann et al., 2009, pp. 390-391).

In the suppression group, participants were instructed to inhibit their emotions during the task: "Please try not to let your feelings show as you give your speech. Please behave in such a way, that a person watching you would not know you were feeling anything" (Hofmann et al., 2009, p. 391). Acceptance group participants were instructed to allow their emotional responses to emerge naturally throughout the task:

> Please try to experience your feelings fully and do not try to control or change them in any way. Please let your feelings run their natural course and allow yourself to stay with your emotions, as fully as possible, without trying to control your feelings in any way (Hofmann et al., 2009, p. 391).

Participant change in heart rate from baseline, to task, to recovery was measured to assess physiological arousal and participant self-report measures were used to assess subjective

arousal at baseline, after task, and after recovery. The suppression group had a significantly greater change in heart rate from baseline to task than both the reappraisal and acceptance groups, and reappraisal was shown to be the most effective emotion regulation strategy for diminishing the subjective feeling of anxiety from baseline, to task, to recovery compared to both acceptance and suppression.

Relatedly, Gross (1998) presented participants in a laboratory task with a video showing an arm amputation to elicit disgust. Prior to being shown the video, participants were assigned to (a) a control condition and were told to simply view the video without accompanying instructions, (b) an antecedent-focused reappraisal condition, in which participants were told to view the film objectively, focusing on the technical aspects of the procedure in such a way that would not prompt disgust, or (c) a suppression emotion regulation condition, in which participants were instructed to hide their emotional reactions. Participants in both the reappraisal and control conditions showed significantly lower cardiovascular sympathetic (i.e. "fight-or-flight" stress response system) activation during the task than participants in the suppression condition, suggesting that use of reappraisal resulted in a diminished physiological stress response relative to participants in the suppression condition.

As demonstrated in the study by Gross (1998), affective *suppression* (i.e., inhibiting emotional expression in response to an emotion-eliciting event) is a response-focused emotion regulation strategy because it attempts to inhibit an emotion response while it is occurring. Suppression is considered a maladaptive emotion regulation strategy because it does not alter the psychological or physiological experience of emotion, it only restrains the *behavioral* response to an emotion, a task that is cognitively and biologically

costly (Gross, 2003). This is because suppression requires ongoing self-monitoring and self-correction, expending additional cognitive resources that could otherwise be used to enhance social performance and contribute to overall wellbeing (Richards & Gross, 2000).

Research has indicated that use of suppression is linked to negative outcomes. For example, use of suppression has been linked to increased sympathetic nervous system activation (i.e., "fight or flight"; Gross & Levenson, 1993, 1997), higher endorsement of depressive symptoms, and decreased social sharing (Gross & John, 2003). It has also been suggested that suppression could lead to feelings of inauthenticity due to incongruence between inner experience and outward expression in those who use it habitually, making it more challenging to connect meaningfully in important social relationships (John & Gross, 2004). Roos and colleagues (2018) showed that use of suppression also exacerbates the relationship between stressful life experiences and levels of cortisol (i.e., a glucocorticoid that is released by the hypothalamic-pituitary-adrenal [HPA] axis, the body's stress response system; Stephens & Wand, 2012), such that use of suppression increased cortisol response to an acute stressor after experiencing recent stressful life events, particularly if the stressful events were relational in nature. Cortisol reactivity is a reliable marker of HPA axis activity, and greater HPA axis activity over time is considered detrimental to health (McEwan, 2006). Specifically, dysregulated corticosteroid activity, which includes chronically elevated cortisol, can inhibit a "normal" immune response, resulting in chronic inflammation (Karatsoreos & McEwen, 2011).

Emotion Regulation and Chronic Inflammation

Chronic inflammation has been correlated with multiple adverse health outcomes, including coronary artery disease (Wensley et al., 2011; Miller et al., 2009), myocardial infarction, and death (Libby & Theroux, 2005). While inflammation is a bodily reaction to physical stressors such as illness, chronic inflammation has also been robustly associated with factors related to psychosocial health, including depression (Howren et al., 2009), job stress and burnout (Toker et al., 2005), poverty status (Alley et al., 2006), childhood adversity (Danese et al., 2007), and loneliness (Ford et al., 2006). There is evidence for three causal pathways in the association between psychosocial factors and chronic inflammation: (a) psychosocial factors can contribute to chronic inflammation; (b) chronic inflammation can impact psychosocial outcomes; and (c) the association between psychosocial factors and chronic inflammation can be bidirectional (Howren et al., 2009). Multiple studies have indicated that emotion regulation strategies can predict chronic inflammation and other biological stress indices (Appleton et al., 2013; Gross & Levenson, 1993, 1997; Lam et al., 2009); however, the impact of specific emotion regulation strategies on biological stress indices, and inflammation specifically, is less straightforward.

Appleton and colleagues (2013) found that higher use of suppression was significantly linked to higher levels of C-Reactive Protein (CRP) – an acute phase serum protein and biomarker of chronic inflammation in the body (Howren et al., 2009) – and that higher use of reappraisal was significantly linked to lower CRP. Though ostensibly separate from inflammatory processes, evidence on HPA axis reactivity and recovery is also relevant to our understanding of how emotional regulation relates to inflammation. Specifically, inflammation is a consequence of sympathetic nervous system (SNS)

activation (Karakas et al., 2018). Acute stress activates the SNS as well as the HPA, and the HPA "may compensate, enhance, or suppress the SNS effects" (Chen et al., 2017, p. 168). HPA axis reactivity has also been linked to reappraisal and suppression. Lewis and colleagues (2018) found that use of reappraisal significantly predicted improved HPA axis recovery after a social stressor task. However, another study demonstrated that both reappraisal and suppression predict greater HPA axis reactivity to an acute stressor (Lam et al., 2009), suggesting that comparing the impact of using reappraisal or suppression on chronic inflammation warrants further investigation.

Moreover, though there is a growing understanding of how intrinsic emotion regulation strategies (e.g., reappraisal and suppression) are related to chronic stress indices such as CRP, the association between extrinsic emotion regulation strategies (i.e. supportive and unsupportive) and chronic inflammation has yet to be explored. This could have particularly important implications in the parent-child relationship, as the quality of parent responses to child emotions could impact parent physical health and has also been strongly linked to socioemotional health in their children as well (Repetti et al., 2002; Tan & Smith, 2019).

Parent Influence on Socioemotional Health in Early Childhood

Socioemotional health in early childhood can be defined as the absence or minimal presence of internalizing and externalizing behaviors. Frequent use of internalizing and externalizing behaviors reflect an inability to adaptively respond to emotions and social demands, which can inhibit a preschool-aged child's ability to perform crucial developmental tasks such as making friends or acclimating to the daycare- or school-setting (Mesman et al., 2001). Internalizing behaviors are those that

direct emotional distress inward toward the individual, such as symptoms of depression and anxiety, social withdrawal, and somatic experiences (Bolger & Patterson, 2001). Conversely, externalizing behaviors are those that direct emotional distress outward toward others and include aggressive, hostile, destructive, or defiant behaviors (Keil & Price, 2006). It has been suggested that internalizing behaviors reflect constrained or over-controlled emotion regulation and externalizing behaviors suggest inadequate or under-controlled emotion regulation (Eisenberg et al., 2001; Eisenberg & Fabes, 1992; Olson et al., 1999).

Though multiple factors contribute to a child's tendency to demonstrate (or not demonstrate) internalizing and/or externalizing behaviors, parents play an important role through the process of emotional socialization. Emotional socialization of a child involves modeling by parents of their own intrinsic emotion regulation strategies (Morris et al., 2007) and parents' use of extrinsic emotion regulation strategies. Supportive extrinsic emotion regulation strategies used by parents convey awareness and acceptance of children's emotional experiences while facilitating learning of adaptive intrinsic emotion regulation strategies such as reappraisal (Gottman et al., 1996). Conversely, unsupportive extrinsic emotion regulation strategies tend to minimize, invalidate, show disapproval of, or punish children's emotional expressions (Morelen & Suveg, 2012) and contribute to heightened distress and use of maladaptive intrinsic emotion regulation strategies (i.e., suppression) in the target individual (Dixon-Gordon et al., 2015). Unsupportive emotion regulation strategies are similar to suppression in that they attempt to avoid distress and conflict (Butler et al., 2014).

Parents' emotional socialization practices are directly associated with child outcomes. For example, the quality of mothers' intrinsic emotion regulation has been shown to predict their child's emotion regulation skills (Tan & Smith, 2019). Likewise, use of supportive extrinsic emotion regulation strategies (e.g., encouraging expression of emotion) are correlated with children's greater use of adaptive intrinsic emotion regulation strategies, lower levels of externalizing behaviors, and improved social functioning (Eisenberg et al., 1999; Morelen & Suveg, 2012; Ramsden & Hubbard, 2002). By comparison, use of unsupportive extrinsic emotion regulation strategies are associated with child emotion dysregulation, low emotion knowledge, as well as both parent- and teacher-reported child internalizing and externalizing behaviors (Lunkenheimer et al., 2007; Perlman et al., 2008).

Importantly, the quality of children's emotional functioning during early childhood has been demonstrated to be relatively stable into adulthood (Repetti et al., 2002), and internalizing and externalizing behaviors in early childhood have been shown to predict chronic inflammation in later childhood (Slopen et al., 2013). Thus, learning to effectively regulate emotions is a critical developmental task (National Research Council and Institute of Medicine, 2000), and identifying specific behavioral and biological parent factors that are associated with socioemotional health in early childhood could have important implications for both emotion regulation and physical health across individuals' lifespan as well as across generations (Repetti et al., 2002).

Role of Chronic Inflammation in the Association Between Parental Emotion Regulation and Child Socioemotional Health

Intrinsic emotion regulation strategies impact individuals' level of chronic inflammation, and the development of emotion regulation skills in early childhood is largely facilitated by emotional socialization by caregivers and important others (including modeling of their intrinsic emotion regulation strategies and use of extrinsic emotion regulation strategies). The quality of emotional socialization can increase or decrease the likelihood of internalizing and externalizing behaviors, suggesting that inflammation may be a key biological factor contributing to intergenerational associations among parent and child stress and emotion dysregulation (Manczak et al., 2017; Plant et al., 2014). However, the nature of this association is still unclear. It is possible that parents' inflammation either influences the extent to which parent emotion regulation impacts child socioemotional health (i.e., acts as a moderator of this association) or explains the association between parent emotional regulation and child socioemotional health (i.e., acts as a mediator of this association). Moreover, research to date has not fully explored the connection between parents' inflammation and their emotional socialization practices (i.e., supportive and unsupportive extrinsic emotion regulation).

Chronic Inflammation as a Potential Moderator

Maternal biological expression of stress could add to a family's risk for maladaptive emotional functioning, thereby moderating the impact of parent emotion regulation on child socioemotional health. Maternal stress has been shown to moderate the association between mother's emotion socialization practices and child emotionality, such that low levels of maternal support of child negative emotions predicted more child sadness among moderately and highly stressed mothers but not among mothers

experiencing low stress (Wu et al., 2019). Additionally, high maternal parenting stress was found to strengthen the association between low maternal expression of positive emotion and increased socioemotional problems among preschoolers (Hooper et al., 2015). Chronic inflammation is indicative of chronic stress and could similarly act as a moderator in the association between parent emotion regulation and child socioemotional problems, such that adaptive maternal intrinsic and supportive extrinsic emotion regulation strategies would be associated with greater child socioemotional health (i.e., protective) in the context of high maternal inflammation.

Chronic Inflammation as a Potential Mediator

As outlined previously, emotion regulation strategies have been shown to predict biological health indices (Lam et al., 2009; Lewis et al., 2018) including chronic inflammation (Appleton et al., 2013; Sin et al., 2015). Antecedent- and response-focused strategies (i.e., reappraisal and suppression) have been shown to predict long-term cardiovascular health in disparate ways. For example, researchers found that a one standard deviation increase in reappraisal was associated with a 5.9% *lower* risk of developing cardiovascular disease within 10 years and a one standard deviation increase in suppression was associated with a 10% *higher* risk for developing cardiovascular disease in 10 years (Appleton et al., 2014).

There is also evidence to suggest that adult biological stress indices predict child socioemotional health outcomes (Gustafsson et al., 2018; Perlman et al., 2008), and one study (Gustafsson et al., 2018) has shown that maternal inflammation could explain the association between parent emotional health and child emotional outcomes. Specifically, Gustafsson and colleagues (2018) found that maternal inflammation mediated the

positive association between maternal prenatal depression and infant negative affect, which is a risk factor for child internalizing problems. This is the only study to date that has established the potential mediating role of inflammation in the association between parental and child socioemotional health, suggesting more research is needed to fully understand this association.

Research Questions

This study aims to interrogate the following four research questions: (a) How are mothers' use of adaptive and maladaptive intrinsic emotion regulation skills and their use of supportive and unsupportive extrinsic emotion regulation strategies with their preschool-aged children associated with mothers' level of chronic inflammation? (b) What is the nature of the association between mothers' use of adaptive and maladaptive intrinsic emotion regulation strategies and supportive and unsupportive extrinsic emotion regulation strategies and the socioemotional health of their preschool-aged children? (c) Is the association between mothers' use of adaptive and maladaptive intrinsic emotion regulation strategies and supportive and unsupportive extrinsic emotion regulation strategies and the socioemotional health of their children moderated by mothers' level of chronic inflammation? (d) Is the association between mothers' use of adaptive and maladaptive intrinsic emotion regulation strategies and supportive and unsupportive extrinsic emotion regulation strategies and the socioemotional health of their children mediated by mothers' level of chronic inflammation?

Hypotheses

Related to the first research question, it is predicted that this study will replicate the findings of Appleton and colleagues (2013) regarding the association between

intrinsic emotion regulation strategies and CRP. Specifically, it is predicted that mothers' use of reappraisal (an adaptive intrinsic emotion regulation strategy) will be negatively correlated with mothers' CRP (see path *a* in Figure 2), and mothers' use of suppression (a maladaptive intrinsic emotion regulation strategy) will be positively correlated with mothers' CRP (see path *a* in Figure 3). Extending the findings by Appleton and colleagues (2013), it is predicted that mothers' use of supportive extrinsic emotion regulation strategies with children will be negatively correlated with mothers' CRP (see path *a* in Figure 4), and mothers' use of unsupportive extrinsic emotion regulation strategies will be positively correlated with mothers' CRP (see path *a* in Figure 5).

Related to the second research question, it is hypothesized that mothers' use of adaptive intrinsic emotion regulation strategies will be positively associated with their children's socioemotional health (see path *c* in Figure 2), such that greater use of reappraisal by mothers will be associated with better socioemotional health in their child.[2] Conversely, it is predicated that mothers' use of maladaptive intrinsic emotion regulation strategies will be negatively associated with their children's socioemotional health (see path *c* in Figure 3), such that greater use of suppression by mothers will be associated with poorer socioemotional health in their child. Similarly, it is predicted that mothers' use of supportive extrinsic emotion regulation strategies will be positively correlated with the socioemotional health of their preschool-aged children (see path *c* in Figure 4), and mothers' use of unsupportive extrinsic emotion regulation strategies will

[2] Note, for all hypotheses that reference *child socioemotional health* as the outcome, this construct is operationalized in this study as *lower* scores on a measure of internalizing and externalizing behavior; thus, the predicted conceptual association (e.g., greater reported maternal use of reappraisal will be associated with *better* child socioemotional health) is opposite to the expected *statistical* association (e.g., maternal adaptive intrinsic emotion regulation should be *negatively* associated with the measure of child socioemotional health, as lower scores are equivalent to better health). Conceptual associations are depicted in all figures.

be negatively correlated with the socioemotional health of their preschool-aged children (see path *c* in Figure 5).

Related to the third research question, it is predicted that the association between mothers' use of (a) adaptive intrinsic emotion regulation strategies, (b) maladaptive intrinsic emotion regulation strategies, (c) supportive extrinsic emotion regulation strategies, and (d) unsupportive extrinsic emotion regulation strategies and their child's socioemotional health will be moderated by mothers' CRP, such that mother's use of a specific strategy and their children's socioemotional health will be different across all levels of maternal CRP (see Figure 6).

Related to the fourth research question, it is predicted that the association between mothers' use of adaptive intrinsic emotion regulation strategies and child's socioemotional health will be mediated by mothers' CRP (see Figure 2), such that adaptive maternal intrinsic emotion regulation will be associated with lower maternal CRP, which in turn will be associated with greater child socioemotional health (i.e., see path *b* in Figure 2). It is also predicted that the relationship between mothers' use of maladaptive intrinsic emotion regulation strategies and their child's socioemotional health will be mediated by maternal CRP (see Figure 3), such that maladaptive maternal intrinsic emotion regulation will be associated with higher maternal CRP, which in turn will be associated with poorer socioemotional health in their child (see path *b* in Figure 3). It is further predicted that the association between mothers' use of supportive extrinsic emotion regulation skills and their child's socioemotional health will be mediated by mothers' CRP (see Figure 4), such that supportive maternal extrinsic emotion regulation will be associated with lower maternal CRP, which in turn will be associated with greater

child socioemotional health (see path *b* in Figure 4). It is also predicted that the relationship between mothers' use of unsupportive extrinsic emotion regulation skills and their child's socioemotional health will be mediated by mothers' CRP (See Figure 5), such that unsupportive maternal extrinsic emotion regulation will be associated with higher CRP, which in turn will be associated with poorer socioemotional health in their child (see path *b* in Figure 5).

Our study seeks to test whether maternal inflammation acts as a mediator in the association between parent emotion regulation strategies and child socioemotional problems.

The potential moderating role of maternal chronic inflammation in the association between maternal emotion regulation strategies and child socioemotional health will also be examined in this study. The nature of such associations has yet to be demonstrated in the literature, and the findings will have important implications for promotion of emotional well-being and prevention of inflammation-related disease. If the predicted outcomes are found, this research could further establish the link between emotion regulation and physical health, as well as identify which intrinsic and extrinsic emotion regulation strategies should be further investigated as potential targets for interventions aimed at improving emotional and related physical health outcomes for parents and their young children. If parent emotion regulation strategies were taken into account in such interventions, it is possible that it could aid in preventing children from developing difficulties with emotion dysregulation and related immune dysfunction as they develop, improving their health and well-being over their lifespan.

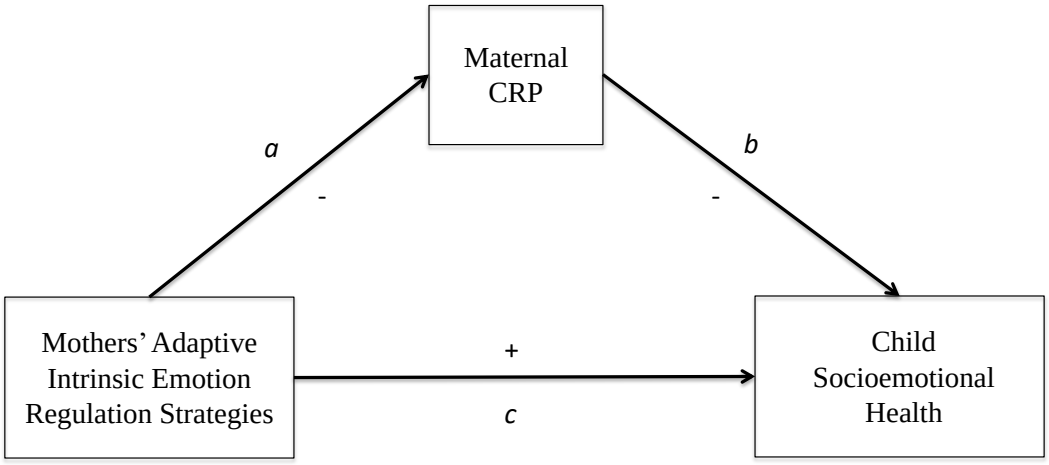

Figure 2. The association between parent use of adaptive intrinsic emotion regulation strategies and child socioemotional health mediated by maternal CRP.

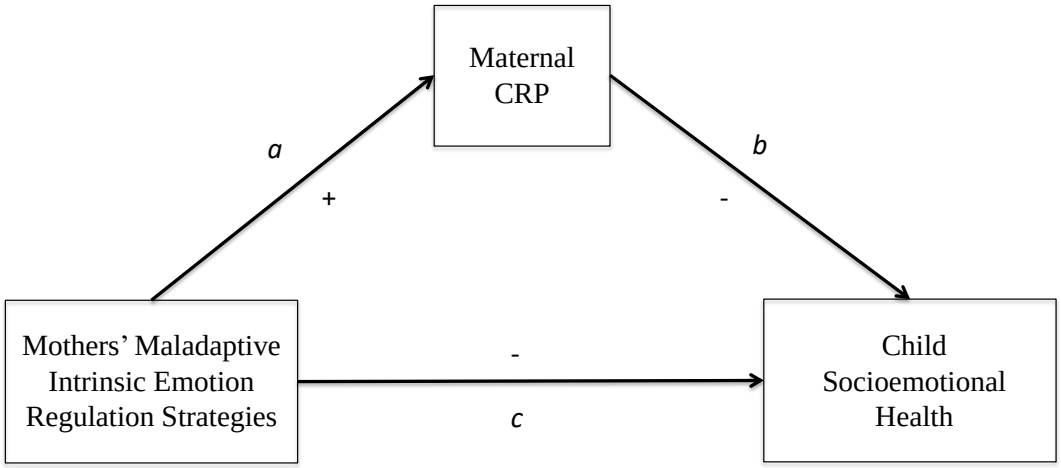

Figure 3. The association between parent use of maladaptive intrinsic emotion regulation strategies and child socioemotional health mediated by maternal CRP.

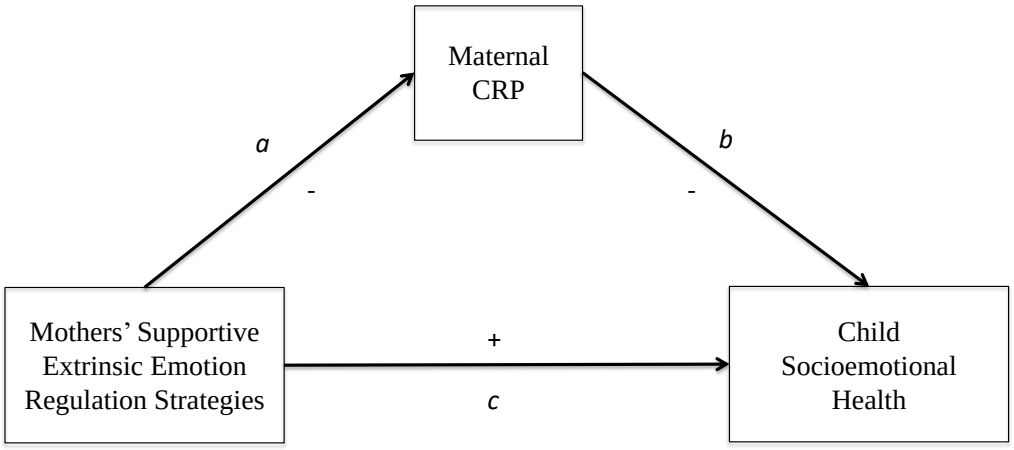

Figure 4. The association between parent use of supportive extrinsic emotion regulation strategies and child socioemotional health mediated by maternal CRP.

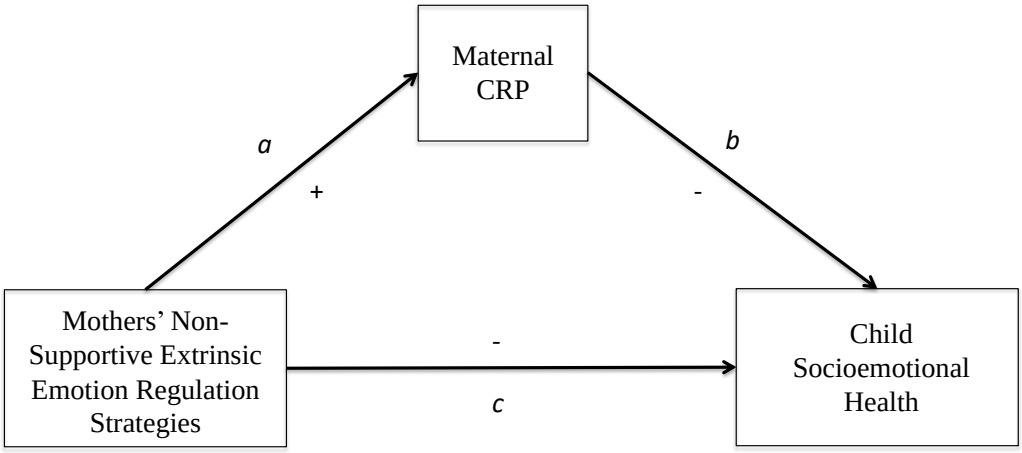

Figure 5. The association between parent use of non-supportive extrinsic emotion regulation strategies and child socioemotional health mediated by maternal CRP.

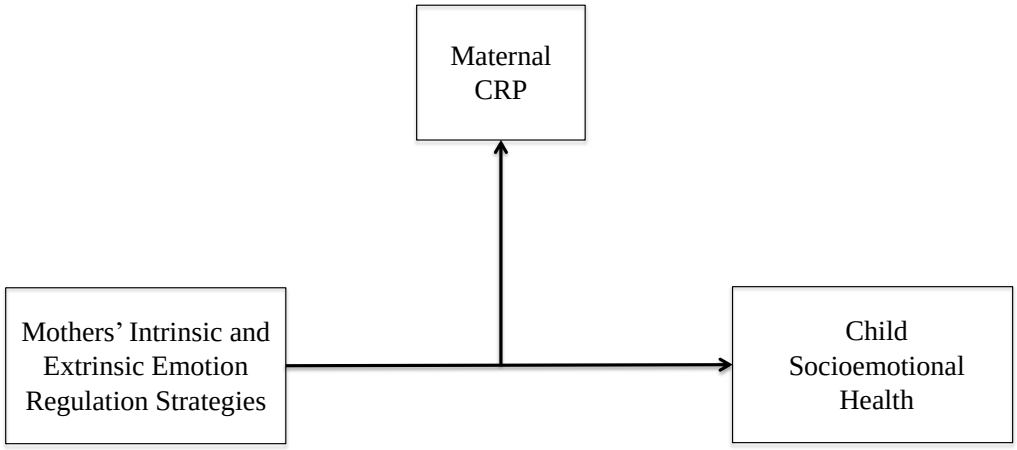

Figure 6. The association between parent use of adaptive and maladaptive intrinsic emotion regulation strategies, and between parent use of supportive and unsupportive extrinsic emotion regulation strategies and child socioemotional health moderated by maternal CRP.

CHAPTER II

METHOD

Participants

Participants in the original sample were 81 biological mothers and their children aged 3-5 years living in Oregon. Data from five families were excluded from the current study due to mothers' report of having ever been diagnosed with periodontitis or gingivitis (i.e., inflammatory diseases of the mouth), invalidating their saliva samples (Ouellet-Morin et al., 2011) and leaving a final sample of n = 76 mother-child dyads. To be eligible, biological mothers must have had primary custody of their child for at least 1 year (most mothers had primary custody since birth), could not have been currently involved in the child welfare system, identified English as their first language, and denied experiencing significant neurological or psychological disorders. Children were required to be aged 3-5 years at the start of the study and be free from developmental delay, sensory impairments, or other conditions that could significantly impact their functioning. If mothers had more than one child in the age range, they were asked to report on their youngest child. Mother participants were 90.7% White and ranged from 20 to 43 years of age with a mean age of 33 years (SD = 5.14). Approximately one-third (30.7%) of mothers had completed 4 years of undergraduate education (i.e., 17 years total) with years of education ranging from 8-22, and household income ranging from $0-260,000 per year, with approximately half of participants reporting an annual income of $60,000 per year or less. Children were 80.7% White, 52.3% male, and were skewed younger across the 3-to-5-year-old age range, with 85.2% of children 4 years of age or younger. See Table 1 for complete demographic information.

Table 1

Demographic Characteristics

Variable	Frequency (N)	Percentage
Mother Age		
20-29	24	27.9
30-39	53	61.6
40-43	9	10.5
Mother Race/Ethnicity		
White	78	90.7
Mixed	6	7
Hispanic /Latino/Spanish Origin	1	1.2
Asian	1	1.2
Child Age		
3	42	47.7
4	33	37.5
5	13	14.8
Child Race/Ethnicity		
White	71	80.7
Mixed	11	12.5
Hispanic/Latino/Spanish Origin	4	4.5
Asian	1	1.1
Native American	1	1.1
Annual Income (USD)		
0-33,000	19	20.7
33,000-60,999	25	27
61,000-99,999	31	33.7
100,000-215,000	17	18.5
Years of Education		
8-12	2	2.2
12-17	48	72.9
18-22	22	24.9

Note. USD = United States Dollars.

Procedures

Participants were recruited from an Oregon community through posting of recruitment flyers in designated areas, advertisements listed in the classified ads in a local newspaper and on online forums (e.g., Facebook, Craigslist), and through in-person and snowball techniques (i.e., asking participants to give study contact information to any

families they thought might be interested). Potential participants were screened for inclusion by telephone by study personnel, and, if criteria were met, participants were scheduled to attend the first of two laboratory visits. Participants were asked to give informed consent when they arrived at the laboratory for the first visit and were compensated $20/hour for participation. If parents completed both laboratory visits, they received a total of $120 and were paid an additional $40 if they attended a follow-up session. All procedures were approved by the University of Oregon institutional review board.

Measures

Demographics. Demographic information was collected for each mother-child dyad and included questions about maternal age, race/ethnicity, socioeconomic status, and child age, race/ethnicity, and sex.

Parent Intrinsic Emotion Regulation. The 10-item Emotion Regulation Questionnaire (ERQ; Gross & John, 2003) assesses individual differences in habitual use of two intrinsic emotion regulation strategies, cognitive reappraisal (6 items) and expressive suppression (4 items). Example items include, "I control my emotions by changing the way I think about them" (reappraisal) and "When I am feeling negative emotions, I make sure not to express them" (suppression). Items are rated on a scale from 1 (*Strongly Disagree*) to 7 (*Strongly Agree*). Items within subscales are averaged, and higher scores indicate greater use of each emotion regulation strategy. Melka and colleagues (2011) report that the ERQ shows good estimated internal consistency reliability (reappraisal, $\alpha = 0.73$; suppression, $\alpha = 0.79$). The ERQ showed fair to good

estimated internal consistency reliability in the current sample (reappraisal, $\alpha = 0.78$; suppression, $\alpha = 0.64$).

Parent Extrinsic Emotion Regulation. The Coping with Children's Negative Emotions Scale (CCNES; Fabes et al., 2002) comprises six 12-item subscales and measures parent responses to their child's negative emotions (Dixon-Gordon et al., 2015). Parents read 12 hypothetical scenarios in which their child experiences a developmentally-typical negative emotion (i.e., "If my child is panicky and can't go to sleep after watching a scary TV show, I would…"). Parents are asked about their likelihood of responding to their child's negative emotion in six possible ways: minimizing (i.e., "tell my child that he/she is overreacting"), punishing (i.e., "tell him/her to go to bed or he/she won't get to watch any more TV"), distress (i.e., "get upset with him/her for being silly"), problem-focused (i.e., "help my child think of something to do so that he/she can get to sleep [e.g., take a toy to bed, leave the lights on"]), emotion-focused (i.e., "do something fun with my child to help him/her forget about what scared him/her"), or expressive encouragement (i.e., "encourage my child to talk about what scared him/her"). Responses are rated on a scale from 1 (*Very Unlikely*) to 7 (*Highly Likely*), and the six subscales are divided into supportive (e.g., problem-focused reactions, emotion-focused reactions, or expressive encouragement) and unsupportive (e.g., minimizing reactions, punitive reactions, distress reactions) strategies. Research indicates that the supportive and unsupportive subscales capture distinct factors and therefore can be treated as singular subscales (Fabes et al., 2002). Fabes et al. (2002) report that the CCNES supportive and unsupportive composite subscales show good estimated internal consistency reliability (supportive, $\alpha = 0.78$-0.85; unsupportive, $\alpha =$

0.69-0.78) and 4-month test-retest reliability (supportive, r = 0.56-0.77, p < .01; unsupportive, r = 0.62-0.83, p < .01). In the current sample, internal consistency reliability was fair to good (supportive, α = 0.77-0.91; unsupportive, α = 0.59-0.77). Mean scores were calculated from the items across the three subscales within each of the two composite subscales to create a mean score for both supportive and unsupportive extrinsic emotion regulation strategies. Higher scores indicate greater use of the emotion-regulation strategy.

Mothers' Chronic Inflammation. We collected 2.5 mL of whole, unstimulated saliva into a polystyrene transport tube via the passive drool method during the day (range approximately 8:00 am – 6:00 pm). We timed the number of seconds taken to fill 2.5 mL to calculate flow rate. We froze samples in a -80°C freezer until they were shipped (overnight with dry ice) to the Stress Physiology Investigative Team (SPIT) lab at Iowa State University. Samples, therefore, had only one freeze/thaw cycle. We recorded body temperature on the forehead with an Exergen temporal artery digital thermometer; all participants measured under 100.4°F/38°C, permitting inclusion (Ouellet-Morin et al., 2011).

The SPIT lab conducted immunological assays for CRP using Salimetrics enzyme-immunoassay (ELISA) kits (www.salimetrics.com). The inter-assay coefficient of variation (CV) was calculated from optical density and was 8.45% for CRP. The intra-assay CV was 5.04% for CRP. We winsorized assay values that were out of range (either too high [right-censored] or too low [left-censored] for the assay to detect). There were three CRP and five right-censored CRP values. CRP skew was 1.27 and kurtosis was

0.20, so this variable was not transformed. CRP values in our sample ranged from 3.39 pg/mL to 2874.09 pg/mL, with a mean value of 747.29 pg/mL (*SD* = 930.56 pg/mL).

Salivary CRP concentrations obtained with this assay have been shown to be correlated with plasma CRP concentrations (Ouellet-Morin et al., 2011). Higher concentrations of CRP in saliva indicate greater chronic inflammation. CRP was examined continuously.

Child Socioemotional Health. The Behavior Assessment System for Children, Third Edition, Behavioral and Emotional Screening System, Parent Rating Scale-Preschool (BASC-3 BESS Parent-P; Reynolds & Kamphaus, 2015) is a parent-report measure designed to assess three broad dimensions of behavior: internalizing, externalizing, and adaptive skills of children aged 2-5 years. Items are rated on a scale from 0 (*Never*) to 3 (*Almost Always*). The Internalizing Problems and Externalizing Problems subscales ask parents to rate their perspectives of observable behavior related to emotional functioning of their children in the aforementioned domains. The Internalizing Problems subscale assesses for the presence of depression, anxiety, and somatization symptoms (e.g., "Worries about things that cannot be changed."). The Externalizing Problems subscale assesses for hyperactivity, aggression, and conduct problems (e.g., "Hurts others on purpose."). Prior research examining the latent factor structure of the BASC-3 BESS Parent-P in a very large sample (N = 799) has supported the distinct nature of the internalizing and externalizing subscales (Dowdy et al., 2019); however, other research (Edyburn et al., 2020; N = 351) has found these subscales to be highly correlated (r = .92), with items loading onto a single factor in the best fitting model, suggesting they likely capture a single construct of socioemotional health. Based on

Edyburn and colleagues (2020), and the high correlation between these two subscales found in the current study (r = .94), we formed a composite scale of severity of internalizing and externalizing problems, treated continuously, with higher scores indicating higher endorsement of symptoms (i.e., poorer socioemotional health). However, as extant evidence is mixed on whether these subscales represent unique constructs or a single construct, data were subjected to a confirmatory factor analysis (CFA) to ensure our choice to combine the internalizing and externalizing subscales and omit the adaptive skills subscale was empirically justified. Reynolds and Kamphaus (2015) report that the BASC-3 BESS Parent-P shows good composite internal consistency reliability for the internalizing subscale ($\alpha = 0.85$), externalizing subscale ($\alpha = 0.88$), and for the subscales combined ($\alpha = 0.95$). In the current sample, both internalizing ($\alpha = 0.75$) and externalizing ($\alpha = 0.83$) subscales showed good estimated internal consistency reliability.

Potential Covariates. Maternal income, years of education, age, body mass index (BMI), and child age were examined as potential covariates in this study based on prior studies (Appleton et al., 2013; Ouellet-Morin et al., 2011; Perlman et al., 2008; Rexrode et al., 2003).

Data Analytic Plan

Power analysis. An a priori power analysis was performed using GPower (Buchner et al., 2006) to determine the necessary sample size to achieve adequate power ($\geq .80$) to detect effects for the proposed analyses. Relevant research studies examining effects of emotion-related parenting behaviors on child emotion-related outcomes, and moderation or mediation of the associations between emotion-related parenting behaviors

and child emotion-related outcomes by parenting stress or chronic inflammation have yielded small to large effects (f^2 = 0.02 – 0.35; Chang et al., 2003; Dunsmore et al., 2013; Eisenberg et al., 2001; Fabes et al., 2001; Gustafsson et al., 2018; Wu et al., 2019). In such cases, it is recommended to use the mean, or typical effect, found in relevant research in *a priori* power analyses (Schäfer & Schwarz, 2019). Accordingly, we anticipated that medium effect sizes (f^2 =.15) might be expected. Based on these considerations, a sample size of 68 mother-child dyads was deemed necessary to adequately power research questions one and two. To adequately power research question 3, a linear regression model with three tested predictor variables (the specific form of emotion regulation and CRP) and five total predictor variables (inclusive of the interaction and two covariates), 77 participants would be necessary. Thus, the sample size of the current study (n = 76) is slightly underpowered to test for moderation effects once cases were excluded. To sufficiently power research question 4 to detect an indirect effect of maternal emotion regulation on child socioemotional health via maternal inflammation, assuming a large direct effect of maternal emotion regulation on maternal inflammation and a large direct effect of maternal inflammation on child socioemotional health (based on Gustafsson et al., 2018), Fritz and Mackinnon (2007) suggest a sample size of n = 36 would be necessary using bootstrapping procedures. If more medium effects were expected, a sample size of 78 would be required, which is still close to the current sample size.

Preliminary analyses. CFA were conducted on data from the BASC-3 BESS Parent-P to determine whether the rationale for combining two theory-based subscales—internalizing and externalizing—and omitting a third subscale—adaptive skills—emerged

quantitatively. Decisions regarding the dependent variable (i.e., child socioemotional health) in all analyses were informed by the outcome of these CFA. The CFA were performed using Amos version 22.0 (Arbuckle, 2013).

Bivariate correlations among emotion regulation strategies, maternal CRP, maternal BMI, maternal income, maternal age, child age, maternal years of education, and child socioemotional health were examined to detect potential covariates. Preliminary analyses revealed no significant correlations between potential covariates (i.e., maternal BMI, maternal income, maternal years of education, maternal age, child age) and the independent and dependent variables, but maternal BMI and child age were still entered as covariates in all analyses based on strong theoretical rationale for a potential confounding effect (Ouellet-Morin et al., 2011; Perlman et al., 2008; Rexrode et al., 2003). Other potential covariates were not included due to low risk for confounding effects represented in our sample (e.g., the mothers in this sample had relatively high income and years of education, making it unlikely that stress related to socioeconomic status would have a confounding effect). See Table 2 for correlations among measures.

Table 2

Correlations Among Measures

Variable	1	2	3	4	5	6	7	8
1. IER – Adaptive								
2. IER – Maladaptive	-.07							
3. EER – Supportive	.28**	-.19						
4. EER – Unsupportive	.00	.36**	-.11					
5. CRP	-.15	-.16	.14	-.03				
6. Maternal BMI	-.06	.02	.11	.09	.12			
7. Child Age	-.16	.02	-.14	-.05	.12	-.03		
8. Child SEH	-.03	.06	.06	.35**	-.06	.17	.08	

Note. IER = Intrinsic Emotion Regulation; EER = Extrinsic Emotion Regulation; CRP = Maternal CRP, BMI = Body Mass Index; SEH = Socioemotional Health. *Lower* scores on the measure of Child SEH are indicative of *better* Child SEH.
**$p < .01$.

Primary analyses. This study tested the linear relationships among maternal intrinsic and extrinsic emotion regulation and maternal CRP (research question 1) and among maternal intrinsic and extrinsic emotion regulation strategies and child socioemotional health (research question 2). This study also evaluated the hypothesized moderating and mediating function of maternal CRP in the associations between maternal internal and extrinsic emotion regulation strategies and child socioemotional health (research questions 3 and 4). Prior to primary analyses, the independent variables were examined for missing cases, outliers, and normal distribution. Additionally, data were tested for adherence to the six assumptions inherent to linear regression—linearity, absence of multicollinearity, multivariate independence, multivariate normality, absence of influential cases biasing the model, and homoscedasticity.

Analyses addressing the primary research questions were performed using SPSS 26.0 (SPSS, Chicago, IL) using the SPSS PROCESS macro. PROCESS is a conditional process modeling program developed by Preacher and Hayes (2008) using an ordinary least squares-based path analytical framework to test for both direct and indirect effects (Hayes, 2013). All variables were mean-centered by the PROCESS software prior to analyses to improve interpretability and to reduce multicollinearity.

Examination of regression pathways between maternal intrinsic and extrinsic emotion regulation variables and maternal CRP in the mediation models allowed us to address research question 1, and examination of regression pathways between maternal intrinsic and extrinsic emotion regulation variables and child socioemotional health in the mediation models allowed us to address research question 2.

Specific to research question 3, separate moderation models were examined for adaptive intrinsic emotion regulation, maladaptive intrinsic emotion regulation, supportive extrinsic emotion regulation, and unsupportive extrinsic emotion regulation. Maternal CRP was examined as a moderator in the four regression models and child socioemotional health was tested as the outcome variable using "Model 1" in PROCESS to test for simple moderation. Regarding research question 4, separate mediation models were examined for adaptive intrinsic emotion regulation, maladaptive intrinsic emotion regulation, supportive extrinsic emotion regulation, and unsupportive extrinsic emotion regulation. Within PROCESS "Model 4," maternal CRP was examined as a mediator in the four regression models. Child socioemotional health was tested as the outcome variable in all four regression models.

Examination of mediation as outlined in research question 4 was achieved through tests of indirect effects in PROCESS. All indirect effects were tested with follow-up bootstrap analyses. To test for significance of the mediation effects, we used Hayes's (2013) procedure and calculated the 95% confidence intervals (CIs) of the 5000 bias-corrected and accelerated bootstrapping analyses. If the value zero is not included in the CI, this indicates significant effect at $\alpha < 0.05$ (Hayes, 2013; Hayes & Matthes, 2009; Preacher & Hayes, 2008).

CHAPTER III

RESULTS

Preliminary Analyses

Confirmatory Factor Analysis

CFA were used to test a priori hypotheses about factor structure (Fabrigar & Wegener, 2012; Matsunaga, 2010) and provide further evidence of construct validity of the BASC-3 BESS Parent-P (Reynolds & Kamphaus, 2015). To provide statistical rationale for combining the internalizing and externalizing subscales in this measure and excluding the adaptive skills subscale, the complete BASC-3 BESS Parent-P measure was examined as well as the subscales of interest in the current study. CFA were run testing three hypothesized models of the factor structure of the BASC-3 BESS Parent-P: (1) a three-factor structure with distinct internalizing, externalizing, and adaptive skills subscales; (2) a two-factor structure with a combined internalizing and externalizing subscale and an adaptive skills subscale; and (3) a one-factor model with one combined scale. The CFA models were assessed using Hu and Bentler's (1999) criteria for good model fit, including the comparative fit index (CFI), Tucker-Lewis index (TLI), root mean square error of approximation (RMSEA) and its 90% confidence interval, and chi-square (χ_2). CFI and TLI $\geq .95$ and RMSEA $< .05$ are evidence for a good fitting model (Hu & Bentler, 1999) and CFI = .92-.94 and RMSEA $\leq .08$ are evidence for an adequate fitting model (Byrne, 2010).

CFA with maximum likelihood (ML) was used to explore the construct validity and model fit of the three a priori hypothesized models. First, the three-factor structure of the BASC-3 BESS Parent-P was analyzed. The chi-square test suggested a poor-fitting

model, $X_2(321) = 578.26$, $p < .001$. All other fit indices indicated a model that fit poorly, CFI = .69, TLI = .66, RMSEA = .09, 90% CI [.08 - .10]. Further inspection of the covariance matrix showed that the internalizing and externalizing subscales were multicollinear, $r = .94$, $p < .001$, providing rationale for combining these subscales to create a composite measure of child socioemotional health. Second, a two-factor structure of the BASC-3 BESS Parent-P was analyzed. The chi-square test suggested that this was also a poor-fitting model, $X_2(323) = 580.72$, $p < .001$. All other fit indices indicated a model that fit poorly, CFI = .69, TLI = .66, RMSEA = .10, 90% CI [.08 - .10]. Last, the one-factor structure of the BASC-3 BESS Parent-P was analyzed. The chi-square test suggested that this too was a poor-fitting model, $X_2(325) = 666.45$, $p < .001$. All other fit indices indicated a model that fit poorly, CFI = .59, TLI = .55, RMSEA = .11, 90% CI [.08 - .10].

Although the CFA did not reveal good model fit for any of the three hypothesized models, there is reason to be cautious with these results. First, it is likely that the sample size in this study is insufficient to conduct an accurate CFA, which could pose "a considerable risk of misspecification of the model and bias in the existing measurement scales" (MacCallum et al., 1999, p. 96). It is generally recommended that if there are five or more items per factor (as there are in the BASC-3 BESS Parent-P) and that if each item is closely related to the factor, a sample of 100-200 *may* be sufficient, but that larger samples are preferable, especially if the aforementioned conditions are in any way compromised or if there are indices that covary significantly with multiple factors, as with the high covariance between internalizing and externalizing in our sample (Kline, 2005; MacCallum et al., 1999; Russell, 2002). Considering the current study sample size

of 76, in combination with the points above, it is unlikely that a minimum sample size threshold has been met to accurately test model fit using CFA in our sample. However, as previously described, at least one study (i.e., Edyburn et al., 2020) with a larger sample has supported combining the internalizing and externalizing subscales when they are highly correlated, as they were in this study.

Given the multicollinearity in the current sample between internalizing and externalizing behaviors, previous evidence of multicollinearity of internalizing and externalizing subscales on the BASC-3 BESS Parent-P in preschool children when reported by parents, best model fit of the measure when the scales are combined and the adaptive subscale is excluded (Edyburn et al., 2020), and the theoretical rationale for examining these subscales as a composite measure, the internalizing and externalizing subscales were combined in this study to represent a composite outcome measure of child socioemotional health, with higher scores indicating *poorer* socioemotional health (i.e., the presence of more internalizing and externalizing problems).

Primary Analyses

Related to research question 1 and contrary to hypotheses that mothers' use of reappraisal and supportive extrinsic emotion regulation strategies would be negatively correlated with mothers' chronic inflammation and mothers' use of suppression and unsupportive extrinsic emotion regulation strategies would be positively correlated with mothers' chronic inflammation, neither adaptive intrinsic emotion regulation, $F(3, 71) = -22.99$, $p = .34$, $R^2 = .22$, nor maladaptive intrinsic emotion regulation, $F(3, 71) = 1.38$, $p = .25$, $R^2 = .24$, was significantly associated with CRP. Additionally, neither supportive extrinsic emotion regulation, $F(3, 72) = 1.27$, $p = .29$, $R^2 = .22$, nor unsupportive extrinsic

emotion regulation, $F(3, 72) = .75$, $p = .53$, $R^2 = .03$ was significantly associated with CRP.

Regarding research question 2 and the hypotheses that mothers' use of adaptive intrinsic and supportive extrinsic emotion regulation strategies would be positively associated with their children's socioemotional health and mothers' use of maladaptive intrinsic and unsupportive extrinsic emotion regulation strategies would be negatively associated with their children's socioemotional health, only unsupportive extrinsic emotion regulation was significantly associated with child socioemotional health, $F(5, 70) = 3.15$, $p = .01$, $R^2 = .18$, with greater reported use of unsupportive extrinsic emotion regulation strategies associated with poorer child socioemotional health (i.e., more internalizing and externalizing problems). Adaptive intrinsic emotion regulation, $F(4. 70) = 1.51$, $p = .21$, $R^2 = .28$, maladaptive intrinsic emotion regulation, $F(4, 70) = 1.48$, $p = .22$, $R^2 = .28$, and supportive extrinsic emotion regulation, $F(4, 71) = 1.40$, $p = .24$, $R^2 = .27$, were not significantly associated with child socioemotional health.

Related to research question 3 and contrary to hypotheses that the association between mothers' use of adaptive intrinsic, maladaptive intrinsic, supportive extrinsic, and unsupportive extrinsic emotion regulation strategies and their child's socioemotional health will be moderated by mothers' chronic inflammation, such that mother's use of a specific strategy and their child's socioemotional health will be different across all levels of maternal CRP, none of the moderation models were significant (see Table 3). Specifically, the overall model in the first moderation analysis evaluating adaptive intrinsic emotion regulation was nonsignificant, $F(5, 69) = 1.22$, $p = .31$, $R^2 = .08$. Similarly, the overall model in the second moderation analysis evaluating maladaptive

intrinsic emotion regulation was also nonsignificant, $F(5, 69) = 1.62$, $p = .17$, $R^2 = .10$. The overall model in the third analysis evaluating supportive extrinsic emotion regulation was also nonsignificant, $F(5, 70) = 1.13$, $p = .35$, $R^2 = .07$. The fourth analysis examining unsupportive extrinsic emotion regulation yielded a significant overall model, $F(5, 70) = 3.15$, $p < .05$, $R^2 = .18$. As noted above, there was a significant main effect of unsupportive extrinsic emotion regulation on child socioemotional problems, but the interaction of unsupportive intrinsic emotion regulation and maternal CRP was nonsignificant, $b = .0003$, $t(70) = .46$, $p = .65$.

Table 3
Multiple Regressions of Intrinsic and Extrinsic Emotion Regulation and Maternal C Reactive Protein on Child Socioemotional Health (N = 76): Testing Moderation

Predictor Variable	*b* (*SE*)	*t*	*p*
Adaptive Intrinsic ER			
Adaptive Intrinsic ER	-.07 (.14)	-.52	.60
CRP	-.001 (.001)	-1.01	.32
Maternal BMI	.13 (.08)	1.7	.09
Child Age	1.31 (.89)	1.47	.15
Adaptive Intrinsic ER X CRP	-.0001 (.0001)	.002	.72
Maladaptive Intrinsic ER			
Maladaptive Intrinsic ER	.09 (.16)	.52	.60
CRP	-.0004 (.0008)	-.47	.64
Maternal BMI	.15 (.08)	1.91	.06
Child Age	1.29 (.88)	1.47	.15
Maladaptive Intrinsic ER X CRP	.0003 (.0002)	1.44	.15
Supportive Extrinsic ER			
Supportive Extrinsic ER	.13 (.38)	.34	.73
CRP	-.001 (.001)	-.96	.34
Maternal BMI	.13 (.08)	1.64	.10
Child Age	1.42 (.90)	1.58	.12
Supportive Extrinsic ER X CRP	.0001 (.0004)	.31	.76
Unsupportive Extrinsic ER			
Unsupportive Extrinsic ER	1.32 (.43)	3.09	.003
CRP	-.001 (.001)	-.84	.41
Maternal BMI	.11 (.07)	1.44	.16
Child Age	1.36 (.84)	1.63	.11
Unsupportive Extrinsic ER X CRP	.001 (.001)	.46	.21

Note. ER = Emotion Regulation; CRP = Maternal C Reactive Protein; BMI = Body Mass Index.

Related to research question 4 and contrary to hypotheses that (a) adaptive maternal intrinsic and supportive extrinsic emotion regulation strategies would each be independently associated with lower maternal CRP, which would then, in turn, be associated with greater child socioemotional health, and that (b) maladaptive maternal intrinsic and unsupportive extrinsic emotion regulation strategies would each be independently associated with higher CRP, which would then, in turn, be associated with

poorer socioemotional health in their child, none of the four mediation models revealed significant indirect effects (see Table 4).

Table 4

Bootstrap Analysis of the Magnitude and Statistical Significance of Indirect Effects (Mediator Variable: CRP)

Independent variable	***B* mean indirect effect (*SE*)**	**95% CI mean indirect effect [*LL*, *UL*]**	**Completely standardized indirect effect (*SE*)**	**95% CI Completely standardized indirect effect [*LL*, *UL*]**
Adaptive intrinsic ER	.017 (.031)	[-.045, .083]	.015 (.026)	[-.039, .069]
Maladaptive intrinsic ER	.022 (.043)	[-.031, .137]	.016 (.023)	[-.023, .097]
Supportive extrinsic ER	-.051 (.088)	[-.259, .091]	-.016 (.027)	[-.079, .029]
Unsupportive extrinsic ER	.013 (.065)	[-.130, .149]	.003 (.016)	[-.033, .038]

Note. Dependent variable for all analyses was child socioemotional health. All indirect effects are nonsignificant. CRP = Maternal C-Reactive Protein; ER = emotion regulation.

CHAPTER IV

DISCUSSION

Summary

This study tested the association between intrinsic and extrinsic maternal emotion regulation strategies and maternal inflammation, and between mother's use of intrinsic and extrinsic emotion regulation strategies and the socioemotional health of their children. Whether maternal inflammation played a mediating or moderating role in this association was also interrogated. Contrary to previous studies, neither maternal intrinsic emotion regulation strategies (i.e., adaptive/reappraisal, maladaptive/suppression) nor maternal extrinsic emotion regulation strategies (i.e., supportive, unsupportive) were found to be associated with maternal inflammation. Additionally, only parent use of unsupportive extrinsic emotion regulation strategies was found to be associated with poorer child socioemotional health. Maternal inflammation functioned as neither a moderator nor a mediator in any of the proposed models.

Conclusions

While we expected to find an association between emotion regulation strategies and CRP that would support the compelling observations made in prior studies suggesting that emotion regulation strategies developed in childhood go on to impact disease risk in adulthood (Appleton et al., 2013; Gross, 1998; Gross & Levenson, 1993, 1997; Lam et al., 2009; Roos et al., 2018; Rozanski & Kubzansky, 2005), our findings challenge existing literature by suggesting that the association between adaptive and maladaptive forms of intrinsic emotion regulation and biological stress indices is not straightforward. These results add weight to prior studies examining intrinsic emotion

regulation and biological health that have elicited mixed results (Butler et al., 2006; Lam et al., 2009; Mauss et al., 2007).

This study failed to replicate previous studies demonstrating an association between intrinsic emotion regulation strategies and physical health. Specifically, neither cognitive reappraisal nor suppression were associated with maternal CRP. This is inconsistent with the study conducted by Appleton and colleagues (2013) that found reappraisal was linked to lower CRP and suppression was linked to higher CRP. It is possible that characteristics of our sample contributed to the contrasting results. The participants in our study were predominantly White (90.7%), economically stable (48% of participants had an annual household income of $60,000 or more), and well educated (73.1% were college-educated). In contrast, the Appleton et al. (2013) study participants were less likely to be White or to have a college degree. Because CRP measures chronic inflammation as a marker of psychosocial stress, and has largely been studied in social science as it relates to experiences of adversity, it is possible that it simply did not manifest strongly in our low-risk sample (Alley et al., 2006; Danese et al., 2007; Ford et al., 2006; Howren et al., 2009; Toker et al., 2005). Indeed, the mean value of CRP in our sample (747.28 pg/mL) was much lower than the cutoff for differentiating between low and high CRP levels suggested by previous literature (1629.39 pg/mL, Ouellet-Morin et al., 2011), and only 12 participants had CRP levels in the high range. Even if a participant's habitual use of adaptive or maladaptive emotion regulation strategies impacted them in other important ways (e.g., emotionally or socially), it is possible that the overall psychosocial wellness of the participants in this sample buffered these impacts from getting "under the skin" and manifesting in chronic inflammation.

Similarly, no association was demonstrated between supportive and unsupportive extrinsic emotion regulation strategies and CRP in our study. The sample characteristics mentioned above could have also impacted this finding, but there are unique factors to consider in the association between mothers' use of extrinsic emotion regulation strategies and their chronic inflammation. Given the age of the children in this sample (3-5 years old), parenting strategies to regulate child emotions would have only been employed for a short amount of time. This result could suggest that parent biological stress occurring as a result of extrinsic emotion regulation strategies does not manifest this early in the parent-child relationship. Though associations between both intrinsic and extrinsic emotion regulation strategies and CRP were nonsignificant in this study, it could also be the case that, overall, the strategies used to regulate the emotions of others are less biologically impactful than strategies used to regulate one's own emotions. Although there is limited evidence that intrinsic and extrinsic emotion regulation strategies are used at similar frequencies in adult interpersonal interactions (Niven et al., 2011), it is possible that parents interacting with children use intrinsic strategies more frequently than extrinsic strategies. In parenting, intrinsic strategies are often used concurrently with extrinsic emotion regulation strategies (e.g., a mother effortfully controls her own emotional response as she attempts to soothe her crying child). Because children typically have a harder time regulating their own emotions than adults, parent extrinsic emotion regulation with children might need to be accompanied by fortified intrinsic emotion regulation. In other words, regulating a child's emotions could require a parent to simultaneously expend more energy regulating their own emotions in the moment, as well as use more intrinsic emotion regulation strategies while not interacting with their

child, to ensure that they can respond to their child effectively. This could explain the difference in the number of significant findings in existing literature examining intrinsic emotion regulation and biological health and extrinsic emotion regulation and biological health in parent-child relationships.

Our findings *do* support previous literature demonstrating an association between parent extrinsic emotion regulation strategies and child socioemotional health. Specifically, our results provide further confirmation that parent use of unsupportive extrinsic emotion regulation strategies is associated with poorer child socioemotional health outcomes (Denham et al., 2000; Eisenberg et al., 1998; McDowell et al., 2002). Interestingly, parent use of supportive extrinsic emotion regulation was not significantly associated with child socioemotional health in this sample. This supports previous findings suggesting that there is a stronger association between unsupportive extrinsic emotion regulation strategies and child outcomes compared to positive strategies (Lunkenheimer et al., 2007). However, given that a positive association between supportive extrinsic emotion regulation strategies and child socioemotional health has been strongly evinced in the literature (Denham et al., 2000; Eisenberg et al., 1998; Hooven et al., 1995 Ramsden & Hubbard, 2002), it is possible that other factors contribute to this null finding. The children in the current sample (ages 3-5, skewed young) are younger than children in previous studies, in which significant associations between parent use of extrinsic emotion regulation strategies and child socioemotional health have been demonstrated in school-aged children (ages 4 to 10). It could be that the impact of supportive extrinsic emotion regulation strategies on child socioemotional outcomes does not manifest in early childhood or that supportive parenting strategies are

not as effective at buffering children from experiencing internalizing and externalizing behaviors during the preschool years, which is arguably an emotionally turbulent developmental period for children overall.

Last, this study did not demonstrate that CRP acts as a significant moderator or mediator in the association between parent use of intrinsic and extrinsic emotion regulation strategies and child socioemotional health. Because we know that there are multiple pathways in the association between psychosocial factors and chronic inflammation, it is possible that associations exist among these variables, but not in the manner predicted in this study. For example, it could be that CRP "drives the engine," impacting child socioemotional health via emotion regulation strategies. It is also possible that child characteristics predict parent use of emotion regulation strategies and parent stress resulting from emotion regulation strategies. More likely, the relationship is reciprocal, with parent and child factors influencing one another over time. Exploring these various possibilities requires longitudinal data collection.

Study Limitations

The results in this study are based on cross-sectional data, and therefore, it is impossible to make causal claims about the associations among these variables or how they co-vary over time. Additionally, most studies to date have examined CRP as a biomarker of psychosocial stress with plasma CRP samples. Although the use of salivary CRP samples in such analyses shows promise (Ouellet-Morin et al., 2011), the use of saliva for detecting subclinical CRP levels is relatively new and contested in the literature (Byrne et al., 2013). The sample size (n = 76) was also underpowered to detect medium effects in moderation and mediation analyses, and it is possible that meaningful

associations were hidden as a result. Moreover, power calculations related to mediation analyses used the only published effect size estimates examining the indirect effect of emotion-related parenting behaviors on child emotion-related outcomes via maternal inflammation (i.e., Gustafsson et al., 2018); however, the parent construct of interest in that study was maternal depression, which has been more robustly associated with CRP in the literature (Raison et al., 2003). Moreover, maternal inflammation might have a stronger effect on infant outcomes than on outcomes in preschool-aged children, because of infants' recent prenatal immersion in the maternal immune environment. It is possible by the time children are preschool-aged this effect could be diminished. Follow up studies should use larger sample sizes to ensure adequate power to detect mediation and moderation effects.

Additionally, by combining internalizing and externalizing behaviors into a composite variable in this study, it is possible that relationships between specific emotion regulation strategies employed by mothers and specific aspects of their children's socioemotional health could be overlooked. However, there is high comorbidity of internalizing and externalizing disorders in children, and the overlap can also be seen in non-clinical samples, suggesting that the decision to split or combine these categories is partially a matter of investigator preference (Lilienfeld, 2003). Moreover, because this study is concerned with internalizing and externalizing behaviors inasmuch as they represent deficits in child emotion regulation (i.e., poor socioemotional health) and not as distinctive categories, combining them into a composite outcome variable makes theoretical sense. This is because internalizing and/or externalizing behaviors reflect very high or very low emotional control, neither of which are considered to be adaptive. To

contrast, children who are well-regulated would not routinely exhibit behaviors that indicate under- or over-control of their emotions; in other words, they would not exhibit frequent internalizing or externalizing behaviors (Eisenberg et al., 2001).

Edyburn et al. (2020) suggest that it may be difficult to distinguish internalizing and externalizing symptoms based on parent report among preschool children. They suggest that children in this age group may be unable to articulate their internal distress to their parents, and that internalizing symptoms might manifest more behaviorally than they would in older children (Edyburn et al., 2020). This could mean that the characteristics of internalizing behaviors could look very similar to externalizing behaviors (e.g., being prone to tantrums) among preschool-aged children. Previous literature also demonstrates a significant correlation between internalizing and externalizing behaviors when reported by parents of preschool children (Hinshaw et al., 1992), and previous studies have combined internalizing and externalizing scales as a composite measure of behavioral and emotional problems in preschool-aged children using similar parent-report measures such as the Child Behavior Checklist (CBCL; Modry-Mandell et al., 2007). However, given that preschool-aged children are unable to articulate their own experiences of internalizing and externalizing behaviors, parent and other adult (e.g., teacher) report might be the best option for studying internalizing and externalizing in this age group.

Last, this study was conducted in a racially and socioeconomically homogenous sample. Maternal parenting stress has been demonstrated to be significantly different between racial groups, due to both differences in structural inequality and parenting values (Nomaguchi & House, 2013). It has also been found that economic hardship

negatively impacts parents' ability to be emotionally engaged and nurturing, which in turn negatively impacts child socioemotional outcomes (Kiernan & Huerta, 2008). Such findings suggest that both parenting stress and parent emotion regulation strategies and related outcomes in children could differ significantly by racial and socioeconomic lines (Whaley, 2000), which compromises the generalizability of these findings to other racial and economic groups as a result. Furthermore, these data represent only the perspectives of mothers. Previous literature suggests that fathers can impact child socioemotional health through their emotion-related parenting in important and distinct ways (Chang et al., 2003) and, thus, the hypothesized associations in this study bear examination in a sample of fathers.

Future Directions

These findings provide rationale for continued investigation of the association between intrinsic and extrinsic emotion regulation strategies and biological health and also suggest that an important question to answer in addition to "*Does* emotion regulation impact biological health?" is "*For whom* does emotion regulation impact biological health?". For example, future studies could compare the association between emotion regulation and chronic inflammation in low- and high-risk samples, examining whether external stress indices (e.g., socioeconomic status, experiences of racial discrimination) either explain or influence the strength of the association. A more diverse sample could have increased the variance in chronic inflammation as well as captured a broader range of parenting and emotion regulation experiences. Additionally, the association between parent use of emotion regulation strategies and CRP could be investigated in different child age groups, and studied longitudinally, to determine both if and when impacts of

parent intrinsic and extrinsic emotion regulation on parent chronic inflammation start to manifest over the course of parenthood. Future studies should prioritize inclusion of both parents in dual-parent households, and compare single- and dual-parent households, allowing for more accurate and nuanced assessment of single and co-parenting strategies and dynamics as they relate to child outcomes. It would also be worthwhile to include other measures of chronic inflammation, such as plasma CRP, based on studies demonstrating low concordance between saliva and plasma CRP (Huang et al., 1998; Sugiyama et al., 2002). Such studies suggest that salivary CRP does not accurately measure systemic inflammation, because it is prone to localized inflammatory activity, though this is challenged by other findings showing that plasma and salivary CRP are highly correlated (Byrne et al, 2013; Ouellet-Morin et al., 2011). Future studies would also benefit from the use of observational data – both of extrinsic emotion regulation strategies and of child internalizing and externalizing behavior – which would attenuate bias related to self-report. Last, it will be important to explore all possible pathways among the variables examined in this study. Previous literature demonstrates, for example, that child characteristics influence parent use of extrinsic emotion regulation strategies (Eisenberg et al., 2001). Exploration of all possible associations among these variables would help clarify our overall understanding of the associations among psychosocial factors and biological health. Overall, this study paves the way for future investigation by revealing inconsistencies within existing literature and highlighting opportunities for strengthening knowledge related to parent use of intrinsic and extrinsic emotion regulation strategies, chronic inflammation, and child socioemotional health.

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