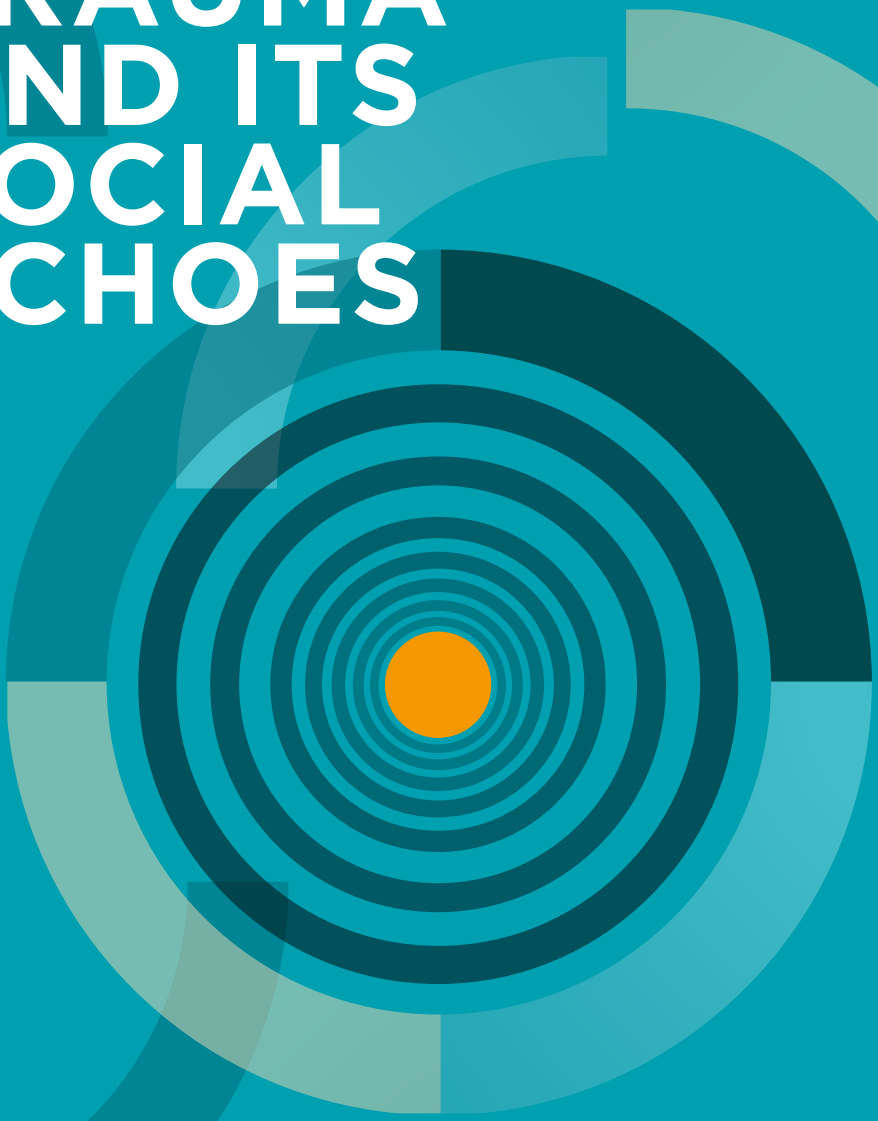
TRAUMA AND ITS SOCIAL ECHOES



Posttraumatic Stress Disorder and Social Functioning: Exploring the Role of Social Cognition and Emotion Regulation in Traumatized Individuals

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Trauma and its Social Echoes

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in Traumatized Individuals

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CHAPTER 1

General Introduction

John, a 40-year-old veteran with multiple deployments to combat zones, has faced traumatic, life-threatening situations, including emotionally distressing confrontations involving physical violence. Following his return home, John developed trauma-related symptoms: trauma-related intrusive memories and nightmares, distressful efforts to suppress thoughts and emotions linked to war, a sense of detachment and isolation from others, and a constant state of tension became recurring in his daily life. The impact of these symptoms extended beyond individual distress and significantly affected his family life. John's perception and understanding of interactions with family members changed. John often interpreted everyday family interactions as threatening, such as hugging his partner or engaging with his children while they express emotions. Physical contact and the perception of others' emotion reminded him of the physical violence and emotional distress he experienced during war. John frequently experienced anxiety and anger triggered by family interactions, and these emotions could be overwhelming and challenging for him to regulate, often leading to the avoidance of family activities and interactions in the first place. Ultimately, his relationship with his partner worsened. Parenting became a source of stress and his children felt tensed and irritable. Overall, the family experienced a decline in social functioning.

John has a posttraumatic stress disorder (PTSD), defined as a response to a traumatic event, such as the exposure to or witnessing of an event involving actual or threatened death, serious injury or sexual violence. PTSD is characterized by the persistent reexperiencing of the traumatic events through repetitive intrusive thoughts or flashbacks, avoidance of trauma-related thoughts or stimuli, negative alterations in mood and cognitions, and hyperarousal (American Psychiatric Association, 2013). Although most individuals encounter potential traumatic events in their lifetime, PTSD affects approximately 8% of the general population (de Vries & Olff, 2009; Koenen et al., 2017). Social functioning is often hypothesized to serve as an important protective factor against the development of PTSD, as social support and the ability to perceive and use supportive signals contribute to the ability to cope with stress responses post-trauma (Brewin et al., 2000; Ozer et al., 2003; Wang et al., 2021). However, as described above, PTSD symptoms can have a detrimental impact on social functioning within families (for a review, see Scoglio et al., 2022). Thus, it is important to investigate PTSD and its association with social functioning, including processes that underlie this association.

As became apparent in the case of John, PTSD symptoms such as hyperarousal and emotional reactivity may compromise key processes in human social functioning – including the ability to perceive and understand social situations (*social cognition*; Lavoie et al., 2014; Sharp et al., 2012) and the ability to act in an emotionally adequate manner (*emotion regulation*; Seligowski et al., 2015) – contributing to social problems. Insight into these social cognitive and emotion regulation processes is critical for understanding the social difficulties of traumatized individuals and to guide clinical interventions to address these processes effectively, thereby improving social functioning. However, research on the role of these processes in PTSD related social difficulties is limited. *The overarching aim of this dissertation was to examine the association between PTSD and social functioning and the role of social cognition and emotion regulation in traumatized individuals.*

The structure of this introduction is as follows. First, I will review the literature on the association between PTSD and social functioning. Second, I will describe evidence for the key roles of social cognition and emotion regulation in the social functioning of traumatized individuals. Third, I will provide an outline of this dissertation, its research objectives, and studies.

PTSD and Social Functioning

Defining PTSD Associated Social Functioning

There is no well-established definition of PTSD associated social functioning. It broadly refers to the capacity of traumatized individuals to interact with their social environment and to fulfill diverse social roles in activities and relationships, including with partners, family members, friends, colleagues, and employers (Bosc, 2000; Scoglio et al., 2022). Largely in line with Kritikos et al. (2019), I examined PTSD associated social functioning at the family level, including three domains: 1) intimate partner functioning (i.e., interpersonal difficulties between traumatized individuals and their romantic partners), 2) parenting and child adjustment (i.e., challenges in parenting and manifestations of symptoms and difficulties in children), and 3) maladaptive family functioning (i.e., reduced family strength, experienced familial difficulties, and ineffective communication patterns). I now review evidence of PTSD associated social problems in these domains.

PTSD and Social Functioning: Intimate Partner Functioning, Parenting and Child Outcomes, and Family Adjustment

Multiple studies have shown that PTSD symptoms are associated with impaired intimate partner functioning as shown in two meta-analyses (Lambert et al., 2012; Taft et al., 2011). Gewirtz et al. (2010) followed 465 National Guard Soldiers and found that increased PTSD symptoms were associated with poorer relationship satisfaction and perceived closeness one year post-deployment. Other research has shown that PTSD severity is related to reduced relationship satisfaction as reported by spouses of traumatized individuals (Goff et al., 2007; Liebman et al., 2023) and higher divorce rates among individuals with PTSD compared to those without PTSD (Cook et al., 2004). PTSD symptoms including emotional numbness, marked by reduced emotional expression, intimacy, and closeness, have been shown to predict lower relationship satisfaction (Campbell & Renshaw, 2013). Moreover, hyperarousal symptoms were related to intimate partner violence, such as physical and verbal abuse (Monson et al., 2009; Savarese et al., 2001; Taft et al., 2007). Van Voorhees et al. (2016) found that traumatized individuals tended to interpret their partners' behavior as negative and hostile, partly mediating PTSD related physical aggression. Taken together, prior studies suggest that PTSD is associated with problems in intimate partner functioning.

There is also evidence for an association between PTSD symptoms and impaired parenting. In a review of 72 studies by van Ee et al. (2016), trauma-exposed parents with PTSD symptoms exhibited less emotional availability for and more negative perceptions of their children than parents without PTSD symptoms. This aligns with findings of an association between parental PTSD symptoms and adverse parenting behaviors, including harshness, overinvolvement, and

inconsistent discipline (e.g., Allen et al., 2023; Christie et al., 2019) as well as poorer attachment with their children (for a review, see Erickson et al., 2019). Moreover, PTSD symptoms following war were associated with concerns about child-rearing practices, with parenting being perceived as more stressful (Khaylis et al., 2011). Overall, the literature consistently suggests a link between PTSD and compromised parenting.

The impact of PTSD on child adjustment is also evident. Parental stress, well-documented as a factor impairing child functioning (Creech & Misca, 2017; Hartzell et al., 2022; Lester et al., 2010), is pronounced in families of traumatized individuals. A meta-analysis of 42 studies showed an association between increased parental PTSD symptoms and adverse psychological outcomes in children, including distress, anxiety, behavior problems and PTSD (Lambert et al., 2014). The association between parental PTSD and poor adjustment has been demonstrated across all age groups, including infants, school-aged children, and adolescents (Ahmadzadeh & Malekian, 2004; Enlow et al., 2011; Pat-Horenczyk et al., 2015; Self-Brown et al., 2012). Thus, research shows parental PTSD may contribute to impaired child functioning.

The effects of PTSD on adjustment are also notable at the family level (Freytes et al., 2017; Lester et al., 2010). Poorer family functioning was reported in traumatized individuals and family members (Lester et al., 2017; Westerink & Giarratano, 1999). To illustrate, Davidson and Mellor (2001) noted that, relative to veterans without PTSD or civilians, veterans with PTSD evaluated their families as overall less healthy, characterized by more indirect and vague family communication and less interest and involvement in each other's activities. Children of veterans with PTSD noted their families as dysfunctional relative to children of veterans without PTSD. Prior work has indicated that specific PTSD symptoms, such as numbing and avoidance, may disrupt intra-familial communication, problem solving, self-disclosure, positive involvement, and smooth family interactions (Palmer, 2008). It has been shown that avoidance symptoms are associated with reduced family functioning (Evans et al., 2009), potentially due to reduced interactions among family members, thereby compromising family cohesion. In sum, existing evidence supports the notion that PTSD symptoms are associated with family maladjustment.

Theories of PTSD and Social Functioning

Evidence of PTSD associated social difficulties correspond with established theoretical models that focus on the directional association between PTSD and social functioning. Cross-sectional models, such as the cognitive-behavioral interpersonal theory of PTSD (C-BIT; Dekel & Monson, 2010), emphasizes the reciprocal link between core PTSD symptoms and interpersonal functioning and parent-child functioning (Creech & Misca, 2017). On the one hand, veterans' behavioral avoidance, like withdrawing from shared family activities such as having dinner together, may reduce the quality of familial relations. On the other hand, family members may unintentionally exacerbate veterans' PTSD symptoms such as avoidance, by modifying their own behavior, such as avoiding discussions that may trigger traumatic memories.

Longitudinal models such as the social causation model posit that social functioning acts as a protective factor influencing the trajectory and outcome of PTSD symptoms, such as receiving social support may enhance the ability to deal with stress after trauma, thereby reducing the development of PTSD symptoms (Kaniasty & Norris, 2008). In contrast, the social erosion model

suggests that PTSD symptoms may lead to social difficulties, such as increased social isolation (Shallcross et al., 2016). For example, in a longitudinal study of individuals with significant burn injuries, the severity of PTSD symptoms at 6, 12, and 24 months post-discharge was consistently associated with subsequent declines in social functioning during each follow-up throughout a 2-year period (Corry et al., 2010). This indicates that PTSD symptoms may negatively impact social functioning. A recent meta-analysis by Wang et al. (2021) provided compelling evidence supporting both the social erosion and social causation models, indicating a bidirectional association between PTSD and social difficulties.

PTSD and Social Functioning: The Role of Social cognition and Emotion Regulation

Although evidence suggests an association between PTSD and social functioning across intimate partner functioning, parenting and child adjustment, and overall family adjustment, it is less well understood what processes or factors contribute to impaired social functioning in traumatized individuals. Examining these processes is essential, as insights could be used to improve interventions targeting these processes and subsequently enhancing social functioning. In this dissertation, I propose two processes: social cognition and emotion regulation.

Social Cognition

PTSD symptoms, such as negative alterations in mood and cognition, might plausibly impair the capacity to perceive, interpret, and respond to others – abilities falling under the definition of social cognition (Green et al., 2008). Social cognitive abilities are considered vital for adequate social interactions and relationships (Sharp et al., 2012), and deficiencies in social cognition may contribute to interpersonal difficulties. Social cognition can be divided into four domains (Green et al., 2008; Lavoie et al., 2014): the interpretation of behavior of the self and others based on mental states (*mentalization*); the identification and recognition of emotional states from social stimuli, such as facial expressions (*emotion recognition*); the recognition of social regulations, rules, and goals in social situations (*social perception*); and the explanation of social situations (*attributional style*). Research has shown PTSD related deficits in each of these domains (e.g., Lavoie et al., 2014; Poljac et al., 2011; Stevens & Javanovic, 2019), and suggests that these deficits are in turn associated with poor social interactions and relationships (Nietlisbach & Maercker, 2009).

Although social cognitive deficits in patients with PTSD are documented, an examination of which specific domains might be particularly affected is still lacking. To our best knowledge, only Lavoie et al. (2014) conducted a comparison of functioning across all four domains in individuals with PTSD and other anxiety disorders (obsessive-compulsive disorder, panic disorder, generalized anxiety disorder and specific phobia) versus non-clinical controls. Results indicated PTSD specific deficits in the domains of mentalization and emotion recognition. This is in line with a number of studies that show reduced performance on mentalization tasks (e.g., Mazza et al., 2012; Mazza et al., 2015; Nazarov et al., 2014). For example, Mazza et al. (2012) found that, relative to non-clinical controls, PTSD diagnosed individuals were less

accurate in a task in which they were instructed to describe what a protagonist might feel in a certain emotional context. Traumatized individuals were also less accurate in recognizing facial emotional expressions during computerized recognition tasks (e.g., Passardi et al., 2018; Poljac et al., 2011). Thus, research has shown PTSD related impairments in social cognition (Lavoie et al., 2014; Nietlisbach & Maercker, 2009; Poljac et al., 2011), and evidence suggests that these deficits are linked to suboptimal social interactions and relationships (e.g., Sharp et al., 2012). Addressing social cognitive functioning is thus important.

Another important social cognitive skill, especially required in the ability to mentalize, is perspective-taking: the ability to take the perspective of others in relation to oneself (e.g., Hendriks et al., 2016). Perspective-taking may be compromised in traumatized individuals with PTSD, as PTSD symptoms may impair the required ability to flexibly disengage from one's own perspective and adopt that of another (de Guzman et al., 2016; Hendriks et al., 2016). For example, trauma-related triggers, such as encountering men with glasses, intended for friendly social contact, might be misinterpreted as threatening due to their resemblance to a traumatic event involving an assault by a man with a similar appearance. Consequently, PTSD symptoms may impede the ability to disengage from one's own perspective (threat view), essential for adopting that of another (non-threat view). Addressing the flexibility pertaining to the self in traumatized individuals might thus be clinically important, given that inflexibility may complicate the process of perspective-taking and thus social cognition, possibly adversely affecting social functioning.

Emotion Regulation

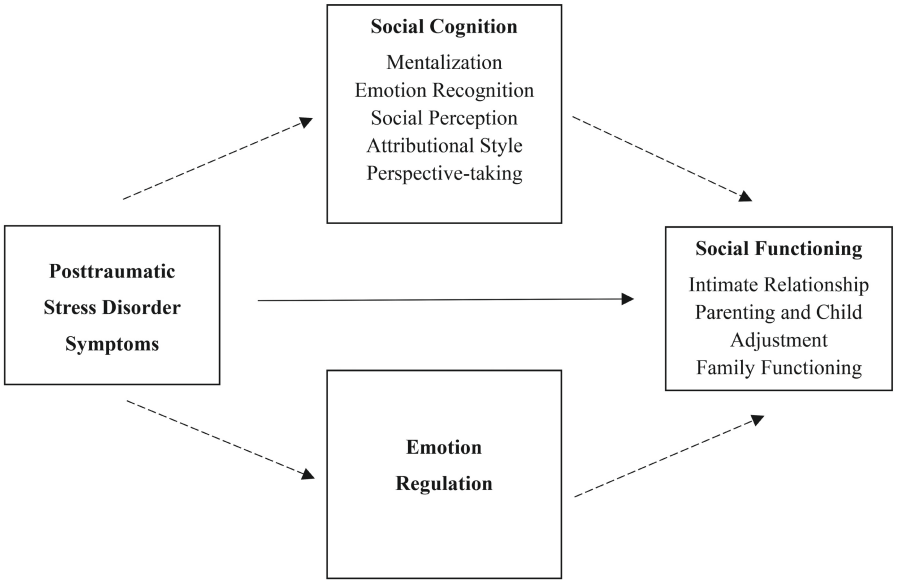
Emotion regulation, defined as the capacity to monitor, evaluate, and modify emotional reactions (Gross, 1998; Sheppes et al., 2015), is another central factor in social functioning. Distorted emotion regulation, such as after exposure to combat-related traumatic events, is a key factor in the development of PTSD and impaired social functioning (Kashdan et al., 2009; Seligowski et al., 2015). Snyder et al. (2016) found that marital functioning and child adjustment were inversely associated with emotional processing difficulties including aversive behavior, coercive parenting, and aggressive responses. In another longitudinal study, Zhang et al. (2020) found that emotion dysregulation in deployed fathers predicted parenting problems one year later and child adjustment problems two years later. These findings correspond with accumulating evidence showing that ineffective emotion regulation strategies are associated with social problems (e.g., Brockman et al., 2016; Reddy et al., 2011). The association of PTSD with emotion dysregulation might thus be another reason for the social difficulties of traumatized individuals.

Outline

The overarching aim of this dissertation was to gain more insight into the association between PTSD and social functioning and to explore the role of social cognition and emotion regulation in traumatized individuals (see Figure 1). This will further advance our understanding of the social difficulties of traumatized individuals and may help us to design interventions that can target these difficulties effectively. The first objective was to examine the social cognitive and

emotion regulation processes related to PTSD (Chapter 2, 3, 4). The second objective was to examine the effect of treatment-induced changes in social cognition and emotion regulation on the social functioning of traumatized individuals (Chapter 5).

Figure 1 *Hypothesized Study Model*



The two research objectives guided the studies in the chapters of this dissertation. In **Chapter 2**, functioning in each of the four domains of social cognition (mentalization, emotion recognition, social perception, attributional style) was compared in PTSD diagnosed individuals relative to non-clinical controls by means of a meta-analysis including 19 studies. The former group was expected to perform lower on all domains, but hypotheses about the degree as to which domains were more affected than others were exploratory of nature.

Perspective-taking is another important social cognitive ability, particularly needed in the ability to mentalize. In **Chapter 3**, it was examined and anticipated that PTSD diagnosed individuals would perform less than non-clinical controls on a task measuring the ability to flexibly disengage from one's own perspective, which is considered essential for being able to shift from one's own perspective to that of another (Hendriks et al., 2016).

Chapter 4, using a cross-sectional design, focused on whether emotion regulation and mentalization mediated the association between PTSD and social functioning (i.e., family functioning and child adjustment) as reported by an outpatient veteran sample. We expected that higher levels of PTSD symptoms were associated with more social difficulties and that this association was mediated by emotion regulation difficulties and maladaptive mentalization.

Chapter 5 describes a pilot study of the impact of a recently developed parenting intervention for veteran families, the After Deployment Adaptive Parenting Tools intervention

(ADAPT; Gewirtz et al., 2014), on PTSD related social difficulties (i.e., family functioning, intimate partner functioning, and child adjustment) through targeting mentalization and emotion regulation, as reported by participating outpatient veterans and their partners. The outcomes of veterans in ADAPT were also compared with the outcomes of veterans undergoing individualized PTSD focused treatment as usual (TAU). We expected that ADAPT would enhance social functioning, and that this treatment effect was mediated by improved mentalization and emotion regulation in veterans receiving ADAPT compared to those receiving TAU.

Finally, **Chapter 6** integrates the main findings from our studies. Directions for future research and implications for clinical practice are presented as well.

CHAPTER 2

Social Cognitive Performance in Posttraumatic Stress Disorder: A Meta-Analysis

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ABSTRACT

Social support represents a key factor in the development of posttraumatic stress disorder (PTSD). Social cognition – the ability to perceive, interpret, and respond to other people – is considered fundamental in making use of social support. Gaining knowledge on the link between PTSD and social cognition is therefore essential. Whilst social cognitive difficulties in patients with PTSD are documented, an understanding of which particular social cognitive processes might be affected more than others, is lacking. The current meta-analysis was therefore aimed to examine social cognitive functioning in four underlying social cognitive domains (mentalization, emotion recognition, social perception, and attributional style) in PTSD diagnosed patients versus controls. Meta-analyses were conducted on studies examining performance on at least one social cognitive domain in PTSD diagnosed patients compared to controls. 19 studies were included, involving 565 patients and 641 controls. Relative to controls, the PTSD group scored lower on overall social cognitive functioning (*SMD* = -0.42), specifically on mentalization (*SMD* = -0.81) and social perception (*SMD* = -0.30), whilst the latter should be interpreted with caution as only one study was found pertaining to this domain. No emotion recognition and attributional style differences were found. There was evidence of moderate heterogeneity in the results of the included studies for overall social cognition and attributional style. Findings indicate that social cognition represents a potential important clinical factor in PTSD and underscore the importance of differentiating between underlying social cognitive processes in research and treatment of PTSD.

INTRODUCTION

Social support represents a key factor in the development of posttraumatic stress disorder (PTSD) – characterized by intrusive thoughts or flashbacks, avoidance of trauma-related stimuli, negative alterations in mood and cognitions, and hyperarousal features (American Psychiatric Association, 2013). Social support can act as a buffer, as it can enhance coping with stress responses following trauma. Indeed, a lack of social support reflects a major risk factor for PTSD as shown in two meta-analyses (Brewin et al., 2000; Ozer et al., 2003). Additionally, studies have shown that a lack of social support is linked to the maintenance of PTSD (Dirkzwager et al., 2003; Schnurr et al., 2004). Evidence hence indicates that social support plays a central role in PTSD.

Whilst the role of social support in traumatized individuals is well-established, it is less well understood if and how PTSD in turn affects the use of social support. It is plausible that the symptoms of PTSD itself, such as negative alterations in mood and cognition, decrease the ability to perceive, interpret, and respond to other people. These abilities – collectively falling under the definition of *social cognition* (Green et al., 2008) – are considered fundamental in effectively making use of social support (Sharp et al., 2012). Social cognitive processes can be subdivided into four domains (Green et al., 2008). These include the interpretation of behavior of others based on their mental states (*mentalization* or *theory of mind*); the identification and recognition of emotional states from social stimuli (*emotion recognition*); the recognition of social regulations, rules, and goals in social situations (*social perception*); and the explanation of social situations (*attributional style*). To understand how patients diagnosed with PTSD can use social supportive signals more effectively, it seems essential to further understand the association between PTSD and different social cognitive domains – representing the primary goal of this study.

Association Between PTSD and Social Cognitive Domain Functioning

Research suggests that core PTSD features like emotional dysregulation, emotional numbness, and feelings of interpersonal detachment may be accompanied by an inability to adequately perceive and infer social information (e.g., Lavoie et al., 2014; Mazza et al., 2012; Stevens & Javanovic, 2019).

Particularly, PTSD diagnosed individuals depict emotion dysregulation problems (Boden et al., 2013; Ehring & Quack, 2010; Shepherd & Wild, 2014), involving an inability to process emotional cues such as recognizing others' emotional expressions (Passardi et al., 2018; Poljac et al., 2011; Schmidt & Zachariae, 2009; Steuwe et al., 2014). As such, Poljac et al. (2011) compared war veterans with PTSD to a matched control group and found that traumatized veterans were less accurate in recognizing certain facial emotional expressions (fear and sadness) during a computerized emotion recognition task. Passardi et al. (2018) also found that the recognition of positive emotional expressions was impaired in a PTSD sample, in which larger impairments were linked to a higher number of reported traumatic events and moderate levels of trauma-related dissociation. The latter converges with evidence showing that PTSD symptomatology,

such as increased levels of dissociation, are associated with decreased performance on social cognitive tasks, including emotion recognition tasks (Nazarov et al., 2014; Nazarov et al., 2015).

Moreover, ample studies indicated decreased performances on mentalization tasks (e.g., Mazza et al., 2012; Mazza et al., 2015; Nazarov et al., 2014). PTSD related mentalization problems are for instance evidenced by PTSD diagnosed military police officers performing less compared to healthy participants in a task in which they had to describe what another person might feel in certain emotional contexts (Mazza et al., 2012). These authors also found that social cognition deficits were predicted by avoidance and numbing symptoms and they accordingly formulate that "central symptoms of PTSD as avoidance/emotional numbness or social withdrawal and emotional paralysis may underlie a deficit in the acquired inability to understand others' mental states and to understand/share emotions with others" (p. 254).

Furthermore, cognitive models of PTSD (Ehlers & Clark, 2000) postulate that traumatized individuals are biased towards appraising environmental social cues as negative and threatening. To illustrate, Elwood et al. (2007) studied how victims and non-victims of interpersonal violence interpretate short videos of social scenes. Results indicated that victims perceived positive valenced videos as risky and threatening videos as more likely to escalate to threat, as compared to non-victims. The latter finding is supported by accumulating evidence showing biased attributional processing in traumatized individuals (e.g., Boffa et al., 2018; Elwood et al., 2007; Kimble et al., 2012).

Lastly, a narrowly oriented attention bias towards social threat might impair the processing and interpretation of various contextual cues (Bomyea et al., 2017; Naim et al., 2015), which is considered essential in social perception (Green et al., 2008). Taken together, previous work indicates that patients with PTSD show difficulties in different domains of social cognition.

The Current Study

Whilst social cognitive difficulties in patients with PTSD are documented, an understanding of which particular domains might be affected more than others, is still lacking. To our best knowledge, only Lavoie et al. (2014) compared functioning on all four domains in PTSD and other anxiety disorder groups versus non-clinical controls. They assessed studies on social cognition in PTSD and findings indicated deficits in the domains of mentalization and emotion recognition, suggesting that different social cognitive processes might be differentially affected in PTSD. Addressing domain functioning in PTSD is relevant, as it will inform which specific social cognitive processes should be targeted clinically, which may then help traumatized individuals to perceive and use social support more effectively, as a protective factor against PTSD symptomatology. Moreover, interventions targeting specific social cognitive processes are shown to be more effective compared to broad-based or comprehensive interventions, that target multiple social cognitive processes (see Roelofs et al., 2016 for a meta-analysis). Social cognitive aspects may also be targeted through preventive practices. Specifically, as conceptualized by the latent-vulnerability model (McCrory & Viding, 2015), already existing problems in social cognition – for instance due to early maltreatment which may distort the perceptions of oneself and others (see also Sharp et al., 2012) – may represent a latent vulnerability factor suited for prevention programs insofar as problems with social cognition

may complicate the use of social support following traumatic experiences later in life, potentially increasing the risk for developing manifest clinical conditions such as PTSD.

The aim of the current review was to examine functioning among traumatized individuals diagnosed with PTSD in the four social cognitive domains. Domain functioning was compared to non-clinical controls using a meta-analytic approach. In line with previous work, we hypothesized that the PTSD group will demonstrate deficits in all four domains compared to non-clinical controls. Hypotheses about the degree as to which domains were more affected than others in terms of effect sizes were exploratory of nature.

METHOD

This study was conducted in line with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Moher et al., 2009).

Eligibility Criteria

Articles eligible for inclusion were: (1) English written peer-reviewed articles, (2) that reported or provided data on request to calculate between-group standardized mean difference (*SMD*) estimates (i.e., sample size, means, and standard deviations), (3) in which the task performance was compared on at least one social cognitive domain, (4) between two adult age groups (≥18 years old) including one clinical group primarily diagnosed with PTSD based on formal criteria of the Diagnostic and Statistical Manual of Mental Disorders (DSM-III, DSM-VI, DSM VI-R, DSM-5; American Psychiatric Association, 2013) versus a control group without such a diagnosis.

In line with Lavoie et al. (2014), social cognitive domain tasks were operationalized as follows. In *mentalization* or *theory of mind* tasks, mental states or beliefs of a target person were identified or inferred (response based on information about both the target person and the context). For example, in the Strange Stories test (Mazza et al., 2012), short stories describing emotional situations were presented in which participants were instructed to infer what the target person might feel given the defined context.

Emotion recognition tasks involved the identification or discrimination of emotional states (response based on information of a target person without any contextual information). For example, emotional states were identified based on facial expressions (e.g., Steuwe et al., 2014), vocal cues (e.g., Nazarov et al., 2015), or eye regions (e.g., Mazza et al., 2012; Nazarov et al., 2014).

Social perception tasks included the detection of social roles, rules, or goals that characterize particular social situations (response based on contextual information). For example, the Interpersonal Perception Task-15 (Nazarov et al., 2014) consisted of short vignettes of social interactions accompanied by objective multiple-choice questions concerning the interactions (e.g., judging the relationship between two interacting people as "acquaintances" or "lovers for four years").

Attributional style tasks measured how participants tended to explain events. There were two types of attribution tasks. First, tasks indicating whether participants assessed social events as positive or negative (e.g., rating the valence of hypothetical events such as thinking of the moment that "a past memory suddenly comes to mind"; e.g., Boffa et al., 2018). Second, tasks

measuring to what extent hypothetical events were explained according to a depressive bias style, in which events were attributed to internal, stable, and global causes (Gray et al., 2003; McCormick et al., 1989).

Search Strategy

A literature search was executed on July 15, 2021 using the electronic databases Ovid MEDLINE, PsycINFO, Embase, Web of Science, PubMed, and PTSDpubs (PILOTS). Searches in all databases were conducted from inception to July 15, 2021. The following search terms were employed: "PTSD", "posttraumatic stress disorder", "post traumatic stress disorder", "post-traumatic stress disorder", or "trauma" combined with "social cogn*", "mentali*", "theory of mind", "theory-of-mind", "TOM", "perspective taking", "perspective-taking", "reflective function*", "mental state attribution", "emotion recognition", "emotion perception", "emotion processing", "emotion identification", "emotion discrimination", "emotion labeling", "facial affect", "affect recognition", "affect perception", "affect processing", "affect identification", "affect discrimination", "affect labeling", "social perception", "social knowledge", "social rule*", "social cue*", "social norm*", "social goal*", "attributional style", "attribution bias", "interpretation bias", "interpretation style", or "explanatory style". Additionally, reference lists of included articles were screened to identify additional articles for inclusion.

Data Extraction

The first and second author independently screened the titles and abstracts of all retrieved articles for possible inclusion. Potentially eligible articles were evaluated full-text using the inclusion criteria. Disagreements were resolved through discussion and if this was not possible by consultation with the last author. The following information was extracted from all included articles: authors; year of publication; title; sample size, age, and gender composition of the PTSD group and the control group; social cognitive domain(s); tasks used; and task outcome data (*M* and *SD*) to calculate between-group standardized mean difference (*SMD*) estimates.

Data Analysis

Review Manager 5 software (Version 5.3, The Nordic Cochrane Centre, Copenhagen, Denmark) was used to conduct meta-analyses and to generate forest plots. *SMD*s including 95% confidence intervals (CI) were calculated using a random effects model in which the *SMD* represented the between-group mean difference divided by the pooled standard deviation. *SMD*s were weighted using the inverse variance method. *SMD*s were interpreted as small (0.2-0.5), moderate (0.5-0.8), or large (> 0.8) based on Cohen (2013).

Five pooled *SMD* estimates were calculated: one for each social cognitive domain separately and one for all four domains combined. If needed, *SMD*s were inverted to ensure that a negative *SMD* signified lower PTSD group performance relative to controls. For studies utilizing more than one measure to assess the same domain (e.g., two mentalization tasks were used in Mazza et al., 2012), those measure outcomes were pooled before analyses, resulting in a single domain estimate per study. When task outcomes were not presented as a total score, but as several subscale scores (e.g., recognition rates of happy, fearful, and angry faces in Bell et

al., 2017), those subscale scores were also pooled before analyses. When studies examined multiple control groups – for instance, comparing a mission related PTSD group versus both with/without mission exposed control groups without PSTD (Mazza et al., 2012) – the control group that corresponded the most to the PTSD group was included in the analyses (i.e., mission exposed without PTSD).

Between-study statistical heterogeneity was analysed using the χ^2 test of significance and the I^2 statistic. The I^2 statistic indicates the percentage of variance between studies that is due to differences between studies rather than chance (Higgins et al., 2003). The degree of heterogeneity was interpreted as low (I^2 = 25%), moderate (I^2 = 50%) or substantial (I^2 = 75%). When study outliers – defined as when a study's confidence interval did not overlap with the overall pooled effect – appeared, they were excluded and analyses were run again (Viechtbauer & Cheung, 2010).

RESULTS

Study Selection

A flowchart of the selection process is shown in Figure 1. The literature search yielded 2262 records. The references of included studies yielded eight additional records. When duplicates were removed, 1734 records remained. Of these, 1684 records were excluded based on title and abstract. The full text of the remaining 50 records was examined. Of these, 19 studies met the inclusion criteria and were included in this meta-analysis.

Study Characteristics

The characteristics of the 19 studies are shown in Table 1. Together, they included 565 participants in the PTSD condition (M_{age} = 37.72 years ± 10.08; 42% males) and 641 participants in the control condition (M_{age} = 36.21 years ± 10.40; 51% males). The PTSD samples included different types of trauma history, including war-related combat (e.g., Gebhardt et al., 2017; Mazza et al., 2012), childhood abuse (Nazarov et al., 2014; Nazarov et al., 2015; Steuwe et al., 2014), exposure to natural disasters (Bell et al., 2017; Mazza et al., 2015), interpersonal violence (Fonzo et al., 2010), and a combination of types (e.g., physical assault, sexual assault, accidents; Boffa et al., 2018; Fertuck et al., 2016; Janke et al., 2018). Emotion recognition was studied most frequently (10 studies: Bell et al., 2017; Fonzo et al., 2010; Mazza et al., 2012; Nazarov et al., 2014; Nazarov et al., 2015; Nietlisbach et al., 2010; Passardi et al., 2018; Schmidt & Zachariae, 2009; Simmons et al., 2011; Steuwe et al., 2014), followed by attributional style (six studies: Allred et al., 2018; Boffa et al., 2018; Fertuck et al., 2016; Gebhardt et al., 2017; McCormick et al., 1989; Solomon et al., 1991), mentalization (five studies: Janke et al., 2018; Mazza et al., 2012; Mazza et al., 2015; Nietlisbach et al., 2010; Palgi et al., 2016), and social perception (one study: Nazarov et al., 2014).

Figure 1 *PRISMA Flowchart of the Selection Process of Included Studies*

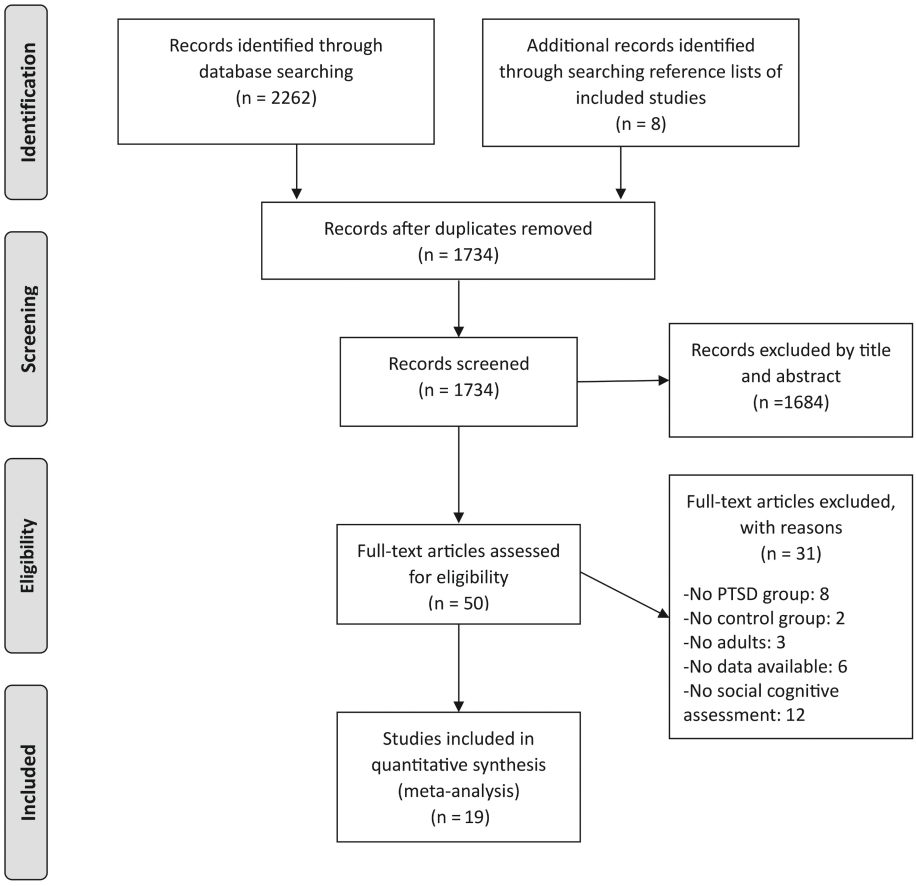


Table 1 *Study Characteristics*

Study	Trauma type(s)	*n* PTSD/C	*M*(*SD*) Age PTSD/C	% men PTSD/C	Social cognitive domain(s)	Task(s)	*SMD* (95% CI)
Mazza et al. (2015)	Earthquake exposure	7 / 10	34(9.38) / 31.7(10.3)	100 / 50	Mentalization	Multifaceted empathy test	-0.62 [-1.61, 0.38]
Janke et al. (2018)	Various (physical assault: 56%; childhood abuse: 54%)*	41 / 63	34.8(10.6) / 39.2(10.7)	17.1 / 36.5	Mentalization	Test of emotional intelligence	-0.85 [-1.26, -0.44]
Palgi et al. (2016)	Various (war: 41%; traffic accidents: 28%)*	32 / 30	43.44(11.4) / 39.87(18.9)	28.1 / 63.3	Mentalization	Compassion task	-1.13 [-1.67, -0.59]
Mazza et al. (2012)	War	20 / 15	41.13(4.8) / 41.93(4.9)	100 / 100	Mentalization; Emotion recognition	Strange stories task, Emotion attribution task; Reading mind in the eyes task	-2.48 [-3.39, -1.57]; -1.26 [-2.00, -0.52]
Nietlisbach et al. (2010)	Various (interpersonal trauma: 81%; accidental trauma or natural catastrophe: 20%)*	16 / 16	43.7(14.8) / 30(8.23)	50 / 50	Mentalization; Emotion recognition	Faux pas task; Reading mind in the eyes task	-0.60 [-1.32, 0.11]; -0.29 [-0.99, 0.41]
Steuwe et al. (2014)	Childhood abuse	16 / 16	33.6(11.6) / 30.6(12.6)	0 / 0	Emotion recognition	Facial emotion recognition task	-0.57 [-0.86, -0.33]
Simmons et al. (2011)	War	12 / 12	32.2(6.9) / 28.7(4.5)	100 / 100	Emotion recognition	Emotional face matching task	0.09 [-0.26, 0.31]
Bell et al. (2017)	Earthquake exposure	28 / 89	42.8(12.8) / 50.1(11.4)	28.6 / 35.0	Emotion recognition	Facial emotion recognition task	-0.17 [-0.60, 0.25]
Nazarov et al. (2015)	Childhood abuse	29 / 21	42(12.3) / 39.9(14.7)	0 / 0	Emotion recognition	Affective prosody battery	0.22 [-0.34, 0.78]

Passardi et al. (2018)	Various (interpersonal trauma: 95%; undefined: 5%)*	39 / 44	38.7(12.8) / 36.5(12)	25.6 / 34.0	Emotion recognition	Amsterdam dynamic facial expression set	-0.23 [-0.66, 0.20]
Fonzo et al. (2010)	Intimate partner violence	12 / 12	35(8.6) / 37(6.49)	0 / 0	Emotion recognition	Emotional face matching task	-0.33 [-1.13, 0.48]
Schmidt and Zachariae (2009)	War	16 / 16	44.1(7.9) / 36.5(8.4)	50 / 50	Emotion recognition	Reading mind in the eyes task	-1.66 [-2.48, -0.84]
Nazarov et al. (2014)	Childhood abuse	31 / 20	42.1(12) / 35.8(13.2)	0 / 0	Emotion recognition; Social perception	Reading mind in the eyes task; Interpersonal perception task	0.03 [-0.53, 0.60]; -0.82 [-1.41, -0.23]
Boffa et al. (2018)	Various (sexual assault: 27%; physical assault: 21%)*	23 / 23	33.97(11.9) / 32(9.8)	39.1 / 66.67	Attributional style	Interpretation bias index for PTSD	-2.44 [-3.22, -1.67]
Gebhardt et al. (2017)	War	53 / 53	35.4(8.6) / 36(10.2)	100 / 100	Attributional style	Similarity task	-0.60 [-0.99, -0.21]
Fertuck et al. (2016)	Various (physical abuse: 48%; sexual trauma 41%)*	29 / 19	33.2(10.3) / 41.2(13.2)	34.5 / 38.9	Attributional style	Trust-fear facial discrimination task	0.24 [-0.34, 0.82]
McCormick et al. (1989)	War	26 / 73	NA(NA) / NA(NA)	100 / 100	Attributional style	Attributional style questionnaire	-0.42 [-0.87, 0.03]
Solomon et al. (1991)	War	144 / 73	NA(NA) / NA(NA)	NA / NA	Attributional style	Causal attributions questionnaire	0.02 [-0.26, 0.31]
Allred et al. (2018)	Undefined	7 / 52	37.14(9.21) / 28.42(7)	NA / 78.8%	Attributional style	Attributions of criticism scale	-0.28 [-1.07, 0.51]

Note. Abbreviations: PTSD = posttraumatic stress disorder, C = controls, *SMD* = standardized mean difference, CI = confidence interval, NA = not available.
* For clarity, the two mostly assessed trauma types of these studies are described here, as these studies included many trauma types (e.g., up to nine in Boffa et al., 2018). A full description of the assessed trauma types can be found in these studies (Boffa et al. 2018; Fertuck et al. 2016; Janke et al. 2018; Nietlisbach et al., 2010; Passardi et al., 2018).

Meta-Analytic Results

Meta-analyses were conducted to analyse between-group differences on overall social cognition, mentalization, emotion recognition, and attributional style in PTSD diagnosed versus controls. It was not possible to run a meta-analysis for social perception, as only one study was found in this domain.

Overall Social Cognitive Performance

Overall social cognitive performance (i.e., mentalization, emotion recognition, attributional bias, social perception combined) was significantly lower in the PTSD diagnosed group compared to the controls with a moderate *SMD* of -0.60, 95% CI [-0.86, -0.33], $p < .001$. Significant and substantial heterogeneity was observed, $T^2 = 0.29, \chi^2(21) = 98.96, p < .001, I^2 = 79\%$. Four study outliers (Boffa et al., 2018; emotion recognition in Mazza et al., 2012; Schmidt & Zachariae, 2009; Solomon et al., 1991) were removed as the CIs of these studies and the overall estimate did not overlap. Overall, the significant lower social cognitive performance of the PTSD diagnosed group versus the control group with a moderate *SMD* of -0.42 remained, 95% CI [-0.62, -0.22], $p = < .001$, and significant moderate heterogeneity was found, $T^2 = 0.09, \chi^2(17) = 35.21, p < .001, I^2 = 52\%$. Results for overall social cognitive performance are shown in Figure 2.

Post-hoc analyses were executed to assess whether effect sizes and particularly the accompanied moderate level of between-study heterogeneity varied as a function of differences in trauma type, age and gender across studies. Whilst such analyses are argued to require large number of included studies (e.g., Tabachnick et al., 2007), these were still performed for exploratory reasons. Firstly, the included 19 studies were analysed in terms of trauma type and as such grouped into "interpersonal trauma" studies (childhood abuse, physical or sexual abuse: Fertuck et al., 2016; Fonzo et al., 2010; Janke et al., 2018; Nazarov et al., 2014; Nazarov et al., 2015; Nietlisbach et al., 2010; Passardi et al., 2018; Steuwe et al., 2014) and "war" studies (Bell et al., 2017; Gebhardt et al., 2017; Mazza et al., 2012; Mazza et al., 2015; McCormick et al., 1989; Palgi et al., 2016; Simmons et al., 2011) based on their sample descriptions (see Table 1). Effect sizes for both subgroups yielded a significant and moderate *SMD* ("interpersonal trauma" group: *SMD* of -0.33, 95% CI [-0.60, -0.05], $p = .02$; "war trauma" group: *SMD* of -0.59, 95% CI [-0.92, -0.26], $p < .001$) and a significant moderate heterogeneity ("interpersonal trauma" group: $I^2 = 53\%$, $p = .03$; "war trauma" group: $I^2 = 57\%$, $p = .003$). Subgroups did not differ significantly from each other ($\chi^2[1] = 1.42, p = .23$). Next, gender (operationalized as percentage males across studies) and age were also neither predictive for all included studies, nor when studies were grouped according trauma type (all p's $> .05$). Taken together, whilst based on a small number of included studies, post-hoc analyses suggest that the *SMD* and the degree of heterogeneity of overall social cognition is not affected by trauma type, gender, and age.

Mentalization

Five of the 19 studies compared mentalization between PTSD diagnosed and controls (Janke et al., 2018; Mazza et al., 2012; Mazza et al., 2015; Nietlisbach et al., 2010; Palgi et al., 2016). Mentalization performance was significantly lower in the PTSD group relative to controls with a large *SMD* of -0.87, 95% CI [-1.17, -0.57], $p < .001$. No significant evidence for heterogeneity

was found, $T^2 = 0.02$, $\chi^2(4) = 4.87$, $p = .30$, $I^2 = 18\%$. No study outliers were found. Results for mentalization are shown in panel A of Figure 3.

Emotion Recognition

Ten of the 19 studies compared emotion recognition between PTSD diagnosed versus controls (Bell et al., 2017; Fonzo et al., 2010; Mazza et al., 2012; Nazarov et al., 2014; Nazarov et al., 2015; Nietlisbach et al., 2010; Passardi et al., 2018; Schmidt & Zachariae, 2009; Simmons et al., 2011; Steuwe et al., 2014). Emotion recognition performance was significantly lower in the PTSD group compared to controls with a moderate *SMD* of -0.51, 95% CI [-0.93, -0.09], $p = .02$. There was significant and substantial heterogeneity, $T^2 = 0.34$, $\chi^2(9) = 39.62$, $p < .001$; $I^2 = 77\%$. Two study outliers (Mazza et al., 2012; Schmidt & Zachariae, 2009) were removed as the CIs of these two studies and the overall estimate did not overlap. The remaining between-group estimate of emotion recognition was not significant, *SMD* = -0.17, 95% CI [-0.37, 0.03], $p = .10$. No significant evidence for heterogeneity was found, $T^2 = 0$, $\chi^2(7) = 5.59$, $p = .59$, $I^2 = 0\%$. Results for emotion recognition are shown in panel B of Figure 3.

Attributional Style

Six of the 19 studies compared attributional style between PTSD diagnosed and controls (Allred et al., 2018; Boffa et al., 2018; Fertuck et al., 2016; Gebhardt et al., 2017; McCormick et al., 1989; Solomon et al., 1991). A marginally significant between-group difference was found in attributional style, in which the PTSD group yielded a negative interpretation bias denoted by a moderate *SMD* of -0.53, 95% CI [-1.09, 0.03], $p = .06$. Significant and substantial heterogeneity was observed, $T^2 = 0.41$, $\chi^2(5) = 40$, $p < .001$, $I^2 = 87\%$. One study outlier (Boffa et al., 2018) was removed as the CI of this study and the overall estimate did not overlap. The remaining between-group estimate of attributional style was not significant, *SMD* = -0.21, 95% CI [-0.53, 0.10], $p = .19$, and significant moderate heterogeneity was found, $T^2 = 0.07$, $\chi^2(4) = 9.56$, $p = .05$; $I^2 = 58\%$. Results for attributional style are shown in panel C of Figure 3.

Social Perception

One of the 19 studies compared social perception between PTSD diagnosed and controls (Nazarov et al., 2014). This study reported a significant lower social perception performance in PTSD diagnosed participants compared to controls with a moderate *SMD* of -0.30, 95% CI [-0.62, 0.02].

Figure 2 *Forest Plot Showing Differences in Overall Social Cognitive Functioning Between PTSD and Non-Clinical Controls, Excluding Four Study Outliers (Boffa et al., 2018; emotion recognition in Mazza et al., 2012; Schmidt & Zachariae, 2009; Solomon et al., 1991), as the CI's of These Studies and the Overall Estimate did not Overlap*

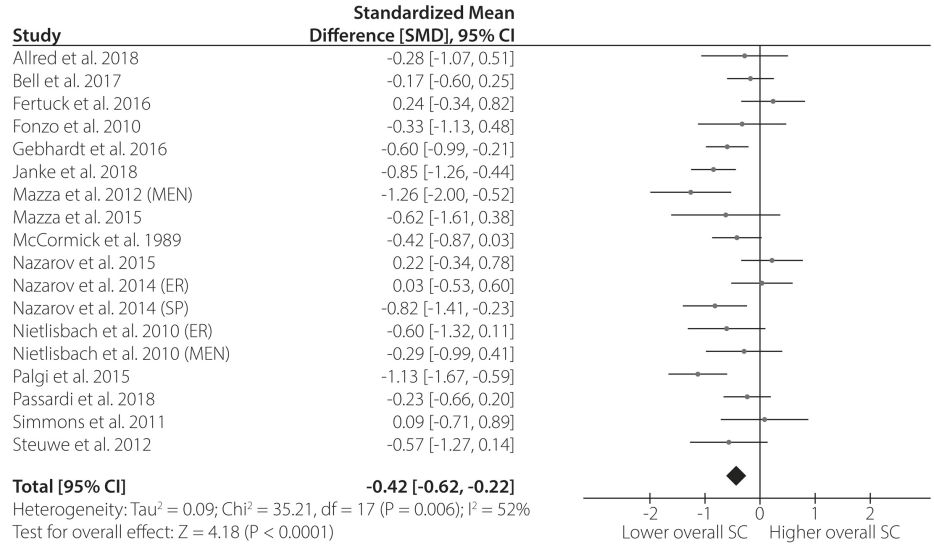
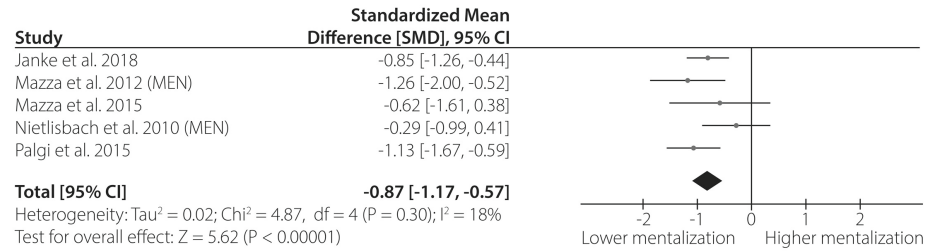
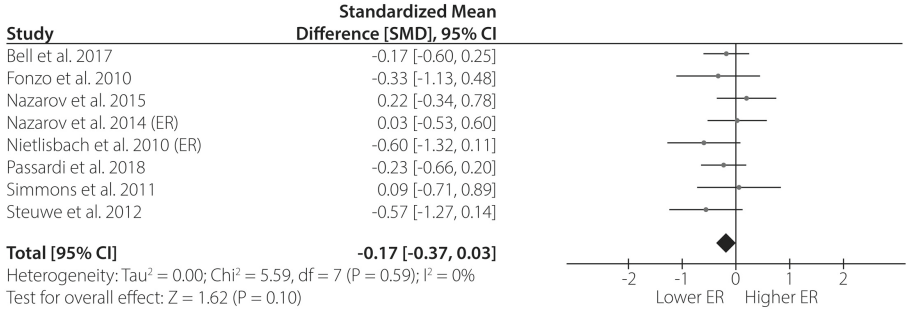


Figure 3 *Forest Plots Showing Differences in Mentalization (A), Emotion Recognition (B), and Attributional Style (C), Between PTSD and Non-Clinical Controls. Two Study Outliers on Emotion Recognition (Mazza et al., 2012; Schmidt & Zachariae, 2009) and one on Attributional Style (Boffa et al., 2018) Were Excluded From the Forest Plots, as the CI's of These Studies and the Overall Estimate did not Overlap. No Study Outliers Were Found on Mentalization*

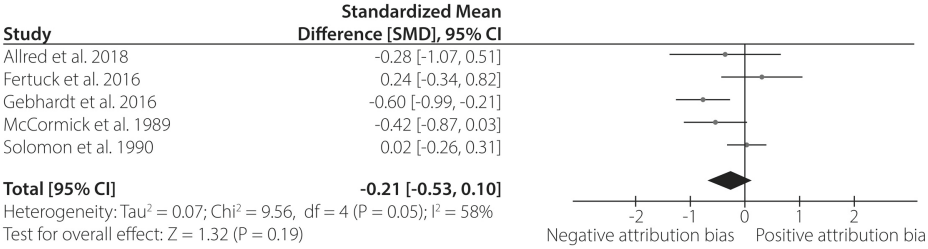
A.



B.



C.



DISCUSSION

The aim of this meta-analysis was to examine overall social-cognitive functioning and performance differences on four underlying social cognitive domains (mentalization, emotion recognition, social perception, attributional style) in PTSD compared to controls. As expected, the analyses demonstrated a deficit with a medium effect size for overall social cognition in the PTSD group compared to controls, not varying as a function of trauma type (comparing studies involving samples exposed to mostly war trauma versus interpersonal trauma), gender, or age as suggested by the results of the post-hoc analyses. It should be noted that post-hoc analyses were conducted for exploratory reasons as they were probably underpowered. A moderate amount of between-study heterogeneity was found with respect to overall social cognition. The latter could potentially be a consequence of the notion that social cognition represents an overarching construct that is built on separate yet related underlying domains. Put differently, it could hence support the idea that probing partitioned social cognitive domains in PTSD – which is our primary study interest – might be essential. To this end, our hypothesis with respect to observing impaired domain functioning in PTSD was only partially supported. The PTSD group displayed lower performances with large effect sizes for mentalization and social perception, yet the latter should be interpreted with caution as only one study pertaining to social perception was found. No group differences were found for emotion recognition and

attributional style. When overall social cognition was partitioned into four domains, only the latter domain showed heterogeneous study findings (which is elaborated on below).

Social Cognitive Functioning and Domain Performances

Given that overall social cognitive performance was lower in the PTSD group and that social cognitive skills might be considered vital in the ability to perceive and respond to social support – a well-documented protective factor for PTSD development (Brewin et al., 2000; Ozer et al., 2003) – our findings underscore that social cognition is an important clinical target in PTSD (Sharp et al., 2012). To target PTSD related social cognitive deficits effectively, it is key to identify which specific social cognitive domains are affected.

Accordingly, our results revealed that the ability to mentalize was impaired in PTSD versus controls, which converges with existing evidence (Mazza et al. 2012; Mazza et al., 2015; Nazarov et al., 2014). On the one hand, problems in mentalizing may be explained by the PTSD symptom profile. Specifically, evidence suggests that core PTSD symptoms, such as emotional numbing, being emotionally unresponsive and feeling detached from others (American Psychiatric Association, 2013), can potentially make it difficult to process and integrate social information (Mazza et al., 2012; Lavoie et al., 2014). Indeed, Mazza et al. (2012) for instance depicted that social cognition deficits were predicted by avoidance and numbing symptoms. Furthermore, neuroimaging findings showed that PTSD symptoms and impaired mentalization are linked to overlapping disrupted brain regions, including hyperactive amygdala reactivity and less activation in the medial prefrontal cortex (Pitman et al., 2012; Zoladz & Diamond, 2013). These neuroimaging findings further strengthen the idea that mentalization might be explained as a consequence of PTSD symptomatology. On the other hand, problems with the ability to infer self and others' behavior based on mental states might be seen as a predisposing factor placing individuals at risk of developing PTSD symptomatology following trauma. For instance, in their social cognitive model of PTSD, Sharp et al. (2012) postulate that, based on experiences with attachment figures, individuals build attachment schemes that helps to understand the self and others. As such, insecure attachment patterns can result in basic negative reflections of the self and others, which is proposed to adversely affect social cognitive capacities. The latter subsequently make it difficult for an individual to make use of social support, potentially increasing the risk for developing PTSD following trauma (Sharp et al., 2012). In line with the latent-vulnerability model (McCrory & Viding, 2015), social cognitive deficits such as problems with mentalization may hence pose a latent vulnerability factor for developing psychiatric symptoms following trauma later in life. Taken together, current findings point out that PTSD is accompanied by a mentalization deficit, yet follow-up research needs to determine the direction of causality between these two constructs.

Our findings further demonstrated a diminished social perception ability in PTSD relative to controls. However, these results must be interpreted with caution as only one study was found for this domain. The finding nevertheless suggests that traumatized individuals experience problems in perceiving and understanding their social context, emphasizing the importance of future research on PTSD and social perception. Processing various contextual cues is suggested to be impaired due to a narrowly oriented attentional bias to environmental threat (Bomyea

et al., 2017; Naim et al., 2015). Addressing the latter is relevant; given that studies have shown that a lack of perceived social support is related to PTSD symptom severity (Hofman et al., 2016; Jankowski et al., 2004).

Contrasting our hypothesis, no emotion recognition impairment was found in the PTSD group. This is consistent with some studies (e.g., Bell et al., 2017; Nazarov et al., 2014; Simmons et al., 2011), but diverges from others (e.g., Poljac et al., 2011; Schmidt & Zachariae, 2009; Steuwe et al., 2014). However, these latter studies mostly incorporated individuals with interpersonal trauma (e.g., childhood abuse, interpersonal combat). It may be that these clinical groups – given their trauma aetiology – respond differently to the social-emotional cues that were used in the emotion recognition tasks. Another explanation for finding no emotion recognition deficit might be that in some traumatized samples exposure to traumatic events or threatening situations lead to no reduced or even enhanced emotion recognition. For example, Masten et al. (2008) showed that maltreated children showed faster emotion recognition capabilities, interpreted as being functional for detecting threat in dangerous environments. Our current findings thus suggest no emotion recognition deficit in PTSD, but future studies should determine to what extent the recognition of emotional states depends on trauma aetiology.

Finally, the PTSD group did not differ in attributional style from controls. This was not anticipated, as cognitive models of PTSD predict that ambiguous stimuli or events are interpreted negatively (Ehlers & Clark, 2000) and biased processing is likely to be disorder-specific (e.g., van den Heuvel et al., 2005). One explanation for the lack of a difference may thus be that the included studies primarily examined causal explaining of *general* events. However, it may be essential to investigate *trauma-specific* causal attributions in PTSD (Gonzalo et al., 2012). Indeed, several studies have shown that internal, global, and stable attributions of particular traumatic events were associated with PTSD symptoms (e.g., Gray et al., 2003; Wenninger & Ehlers, 1998). For example, it has been consistently shown that internally focused self-blame attributions following sexual assault were related to PTSD symptom development (e.g., Berman et al., 2018; Boeschen et al., 2001; Filipas & Ullman, 2006; Najdowski & Ullman, 2009). Trauma-specific attributions were also shown to be more predictive of PTSD symptoms compared to a more broad-based dispositional attribution style (Gray et al., 2003). The focus on trauma-specific attributions may also explain why only Boffa et al. (2018) reported a negative attributional bias with a large effect size in PTSD, as this was the only study that used a PTSD specific measure of attributional style. Future research should further explore the role of general versus trauma-specific attributions in PTSD.

Limitations

The main limitation reflects that there was evidence of moderate heterogeneity in the results of the included studies for overall social cognition, which might be explained by between-study variability of the studies examining attributional style, as only this domain showed a moderate level of heterogeneity after social cognition was partitioned into four domains. Heterogeneous findings on attributional style might be a consequence of variations in used measures. Specifically, the inclusion of studies using indices to probe attributions pertaining

to a general spectrum of events, instead of probing trauma-specific attributions, may be the reason of observed variations across these studies.

Second, while some studies controlled for neurocognitive functioning (e.g., executive functioning in Nazarov et al., 2014; intelligence in Nietlisbach et al., 2010) and psychiatric comorbidity (e.g., secondary depressive disorder in Mazza et al., 2012), potential confounding effects of such or other unmeasured factors could not be excluded. Future studies should take such factors into account.

Third, while the present study included data concerning all social cognitive domains, the separate meta-analyses of the domains included a relatively small number of studies. The meta-analysis could not be conducted for social perception and the results for the other domains may have been underpowered, implying that significant effects may have been undetected. Hence, there is a need for studies comparing PTSD groups with non-clinical controls on social cognitive indices in order to further elucidate functioning across social cognitive domains in traumatized individuals. The incorporation of more studies would make it possible to further probe and detect potential effects of partitioned social cognitive domains, which would lead to an increased understanding with regard to the social cognitive profile in traumatized individuals. An increased understanding is of clinical importance, given that it could provide insights as to which domains could be seen as targets to intervene on.

Fourth, the findings were based on cross-sectional between-group comparison studies. Future longitudinal research should determine whether social cognitive deficits are a risk factor for developing PTSD symptomatology following trauma or to what extent traumatic events and the presence of PTSD contribute to problems in social cognition.

Conclusion

Regardless of these limitations, this study indicates that PTSD is accompanied by social cognitive impairments. The findings demonstrated that underlying social cognitive domains were differentially affected, indicating impairments in mentalization and social perception specifically. No deficiencies were found for emotion recognition and attributional style, yet future research should determine the role of trauma aetiology. Social cognition is an important clinical factor in the aetiology and maintenance of PTSD. The current study underscores the importance of differentiating between underlying social cognitive domains in research and treatment of PTSD.

CHAPTER 3

Assessing Psychological Inflexibility Pertaining to Self in Patients with Posttraumatic Stress Disorder Using an Indirect Measure of (Nonassociative) Propositions

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ABSTRACT

Relational frame theory (RFT) is a modern behavioral account of human language and cognition, which focuses on relations or propositions, rather than associations, as core explanatory constructs. In an attempt to measure such propositions, RFT researchers have developed the implicit relational assessment procedure (IRAP). It has been argued that the size of an IRAP effect may provide a metric for psychological inflexibility. The current study aimed to determine whether psychological inflexibility, as measured by the self-focused Natural Language-IRAP (NL-IRAP), would be higher in a clinical sample of individuals with a diagnosis of PTSD ($N = 29$) when compared to a non-clinical sample. Subsequently, the study investigated whether the self-focused NL-IRAP could be used to predict the presence of a clinical diagnosis, using a ROC analysis. As predicted, higher levels of psychological inflexibility were observed for the clinical group. The self-focused NL-IRAP also correctly classified the presence of PTSD (AUC = 76%) with a sensitivity level of 79% and a specificity level of 59%. Overall, the use of the IRAP as a non-associative clinical measure appears promising.

INTRODUCTION

Relational frame theory (RFT) is a modern behavioral account of human language and cognition, which focuses on relations or propositions, rather than associations, as core explanatory constructs. For RFT, the basis of human language is derived relational responding (or relating), which accounts for the emergence of new learning that was not previously trained or directly prompted or instructed (Hayes et al., 2001). In an attempt to measure relating, RFT researchers developed a range of experimental preparations, including the implicit relational assessment procedure (IRAP; Barnes-Holmes et al., 2006; Kavanagh, Roelandt, et al., 2019), a computer-based task that requires participants to respond quickly and accurately in ways that are both consistent and inconsistent with their history of relational responding. The IRAP assumes that individuals respond more readily to history-consistent relations than history-inconsistent relations. The difference in response latency between history consistent and inconsistent responding is what generates the IRAP effect. Over the past decade, the IRAP has been used to examine relating in many clinical and non-clinical domains with robust effects (for a meta-analysis, see for example Vahey et al., 2015).

Many studies have attempted to employ the IRAP as a measure of implicit cognition, but one in which relatively rapid relational (or propositional) reasoning is targeted rather than "raw" associations in memory (for a detailed discussion, see Hughes et al., 2011). Specifically, interpreting IRAP performances in purely associative terms, which is common using many other measures of implicit cognition, such as in the implicit association task (IAT; Greenwald et al., 1998) for example, has proven difficult because the IRAP requires that participants confirm or disconfirm specific propositions, rather than simply associating pairs of stimuli. Critically, the IRAP measures the speed and accuracy of the confirmatory and disconfirmatory responses and could therefore be seen as providing a "middle-ground" between *indirect* associative measures (e.g., the IAT) and *direct* self-report measures that ask participants to rate their agreement/disagreement with particular propositions. Other more recently developed methods, derived from the IRAP, have begun to emerge but they remain relatively small in number (e.g., de Houwer et al., 2015).

One of the potential benefits of using the IRAP in the clinical domain is that it appears to possess a reasonable level of predictive validity (Vahey et al., 2015) and it connects with the concept of psychological inflexibility that lies at the center of the theoretical model underlying acceptance and commitment therapy (ACT; Hayes et al., 2006). Specifically, it has been argued that the relative size of an IRAP effect, and the extent to which it is possible to manipulate it with laboratory and/or therapeutic interventions, may provide a metric for psychological inflexibility itself (Hussey & Barnes-Holmes, 2012; Kavanagh, Matthyssen, et al., 2019). For example, larger IRAP effects may be interpreted, in certain contexts, as evidence for higher levels of psychological inflexibility because participants find it difficult to reverse their response patterns across consistent versus inconsistent blocks of trials. For illustrative purposes, imagine an IRAP that was designed to target propositions concerning the self. One of the trial-types might ask a participant to respond to the proposition "I'm proud when I succeed in my exams". On consistent blocks of trials (i.e., consistent with common-sense expectations) participants

would be required to confirm this statement as "True" (by pressing a key labelled "True"). On inconsistent blocks of trials, the opposite response pattern would be required (pressing a key labelled "False"). The assumption is that relatively large IRAP effects would indicate *low* flexibility because participants found it difficult to reverse their response patterns across consistent versus inconsistent blocks of trials (Murphy et al., 2019; O'Toole et al., 2009). In more concrete terms, a large IRAP effect in this context indicates that participants found it difficult to deny that they feel proud when they succeed.

Using a measure, such as the IRAP to assess psychological inflexibility with regard to the self, and how the self reacts to life events, would certainly be relevant to recent arguments that psychological inflexibility may be a critical feature of a stable sense of self and psychological well-being. Or to put it another way, psychological inflexibility may be associated with psychological struggle (e.g., Barnes-Holmes et al., 2020; McEnteggart et al., 2017). The current study constitutes the first attempt to test this basic argument using both clinical and non-clinical samples. Specifically, the primary aim of the study was to measure the psychological inflexibility pertaining to the self using the IRAP with a clinical sample of individuals with a diagnosis of posttraumatic stress disorder (PTSD). This sample was employed because there is a growing body of research that supports a relationship between psychological trauma, the sense of self, and psychological suffering (see McEnteggart et al., 2017). Indeed, traumatized individuals often depict an instable and fragile sense of self (e.g., Berntsen & Rubin, 2006; Kashdan et al., 2006). The self-focused Natural Language-IRAP (NL-IRAP) in Kavanagh, Roelandt, et al. (2019) was employed in the current study. The self-focused NL-IRAP focused on self-based reactions to both positive and negative events and thus seemed directly relevant to the current population of individuals with event-based traumatic histories. The key prediction was that larger IRAP effects will be observed for the clinical sample when compared to the non-clinical sample. Put simply, we predicted higher levels of psychological inflexibility in the clinical group. A second aim of the study was to determine if psychological inflexibility pertaining to the self, as measured by the self-focused NL-IRAP, could predict the presence of a clinical diagnosis, using a ROC analysis.

METHOD

Participants

Clinical Sample

Forty-eight participants with a clinical diagnosis of PTSD were recruited for the study, 10 females and 38 males. Participants' ages ranged from 22 to 61 years old ($M = 43.6$) and were recruited via advertising and clinical referral from a Psychotrauma centre in the Netherlands. Most participants experienced war-related combat trauma (70.8%), followed by childhood abuse (14.6%), and a combination of trauma types (e.g., physical or sexual abuse; 14.6%). All participants attended treatment for PTSD and were categorized as such based on the DSM-5 criteria using the Posttraumatic Stress Disorder Checklist (PCL-5; Weathers et al., 2013) and a clinical assessment. Each participant was paid an hourly rate of 10 euros.

Because participants sometimes failed to reach various performance criteria for the self-focused NL-IRAP (details provided subsequently), it was necessary to recruit more than the required 29 participants in order to yield an adequate dataset for analyses (see required sample size calculation below). Twelve of these participants were excluded from the study because they did not complete all stages of the self-focused NL-IRAP (relatively large attrition rates for IRAP studies employing clinical samples is not unusual because the task is perceived to be relatively challenging; for a meta-analysis, see Vahey et al., 2015). Therefore, 36 clinical participants successfully completed the study, 27 of these were male and 9 were female. No sex, age, PCL score or trauma distribution differences were found relative to the initial sample (p's > .05).

In the absence of a previous IRAP study employing the clinical sample recruited for the current research, we were guided by the results of a meta-analysis of IRAP effects in the clinical domain, indicating that a minimum of 29 participants is required to achieve a power of 0.8 for first order correlations (Vahey et al., 2015).

Non-Clinical Sample

The data from a study employing the same IRAP and self-report measure (Study 2 in Kavanagh, Roelandt, et al., 2019) in a non-clinical university sample were used as a comparison sample. Participants were recruited through random convenience sampling. A total of 49 participants completed this study, 35 females and 14 males. Participants ranged from 18-49 years old (M = 24.5). Sample data for both the clinical and non-clinical groups are provided in Table 1.

Table 1 *Descriptive Statistics on all Variables for the Two Groups*

Variable	Clinical Group (n = 29)	Non-Clinical Group (n = 49)
	%	%
Male	75	29
	M (SD)	*M (SD)*
Age	40.93 (8.08)	24.5 (5.14)
Self-focused NL-IRAP D_{IRAP}-scores		
Positive-Positive trial type	0.45 (0.33)	0.15 (0.27)
Positive-Negative trial type	0.39 (0.40)	0.15 (0.34)
Negative-Positive trial type	0.25 (0.41)	0.06 (0.32)
Negative-Negative trial type	0.43 (0.35)	0.25 (0.35)
CAPE		
Overall Frequency	1.84 (0.42)	1.72 (0.32)
Frequency of Positive Symptoms	1.41 (0.28)	1.43 (0.34)
Frequency of Negative Symptoms	2.24 (0.50)	1.94 (0.44)
Frequency of Depressive Symptoms	2.34 (0.61)	2.08 (0.52)
Overall Distress	1.75 (0.46)	2.15 (0.54)
Distress associated with Positive Symptoms	1.27 (0.29)	1.66 (0.44)
Distress associated with Negative Symptoms	2.06 (0.57)	2.07 (0.58)
Distress associated with Depressive Symptoms	2.43 (0.71)	2.54 (0.73)

Materials and Apparatus

The study comprised the self-focused NL-IRAP (Barnes-Holmes et al., 2006) and the Community Assessment of Psychic Experiences (CAPE; Stefanis et al., 2002). The CAPE was employed because the role of the self has been implicated in psychotic-like experiences (Cicero et al., 2015; Savla et al., 2013) and has been used in numerous IRAP studies that have investigated the self in individuals who have experienced trauma and has been demonstrated to be a good predictor of psychological distress and IRAP performances (e.g., Kavanagh et al., 2018; Kavanagh, Matthyssen, et al., 2019; Kavanagh, Roelandt, et al., 2019; McEnteggart et al., 2016). The CAPE was also included in line with the methodology of Kavanagh, Roelandt, et al. (2019) and thus to assess whether this measure was able to predict group membership. Furthermore, this measure can readily be used in both clinical and non-clinical samples, thus offering a valid comparison measure for the two samples in the current study (e.g., Savla et al., 2013).

Self-Focused NL-IRAP

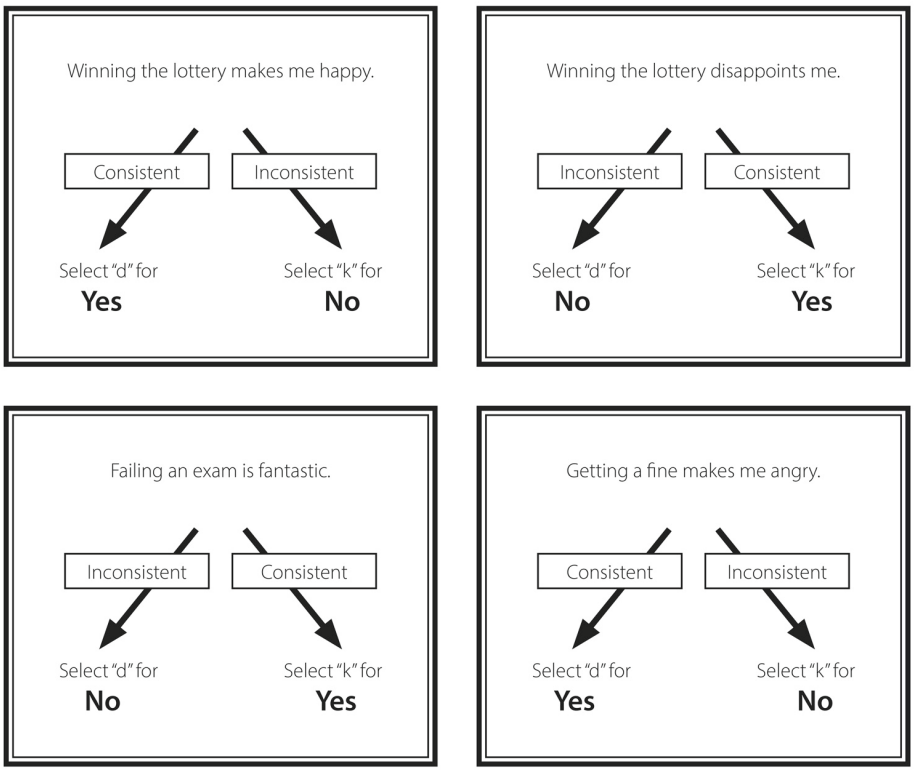
The self-focused NL-IRAP (Barnes-Holmes et al., 2006; Kavanagh, Roelandt, et al., 2019) required participants to respond to various statements about themselves (e.g., "My self-esteem increases if someone says I look good"). The self-focused NL-IRAP presented 16 statements, each referring to an event (either positive or negative) *and* a positive or negative reaction to that event. The 16 statements were divided into four trial-types (see Figure 1). For example, consider the four statements: "My self-esteem increases if someone says I look good" (*Positive Event-Positive Reaction*); "I feel ugly if someone says I look good" (*Positive Event-Negative Reaction*); "I'm happy if a loved one dies" (*Negative Event-Positive Reaction*); and "If a loved one dies, I'm miserable" (*Negative Event-Negative Reaction*); see also Table 2. The response options "Yes" and "No" were presented at the bottom left- and right-hand corners on each trial. Further IRAP task and procedure details are described in more detail below.

Table 2 *Natural Language Statements From the Self-Focused NL-IRAP*

Trial-types	Stimuli
Positive Event – Positive Reaction	My self-esteem increases if someone says I look good.
	I feel liberated if my enemy dies.
	Winning the lottery makes me happy.
	I'm proud when I succeed in my exams.
Positive Event – Negative Reaction	I feel ugly if someone says I look good.
	I'm angry if my enemy dies.
	Winning the lottery disappoints me.
	It frustrates me if I succeed in my exams.
Negative Event – Positive Reaction	I'm happy if a loved one dies.
	Getting fines make me happy.
	Failing an exam is fantastic.
	I rejoice if someone I hate wins the lottery.
Negative Event – Negative Reaction	If a loved one dies, I'm miserable.
	Getting a fine makes me angry.
	Failing an exam is disappointing.
	It irritates me if someone I hate wins the lottery.

Note. Statements were presented to participants in Dutch. Trial type labels denote each of the two parts of the statement, but not necessarily the sequence in which they appeared in the statement.

Figure 1 *Examples of the Four Trial Types in the Self-Focused NL-IRAP: Positive Event-Positive Reaction, Positive Event-Negative Reaction, Negative Event-Positive Reaction, Negative Event-Negative Reaction*



Note. The arrows and words *Consistent* and *Inconsistent* were not shown on-screen. Trial type labels denote each of the two parts of the statement, but not necessarily the sequence in which they appeared in the statement.

CAPE

The CAPE (Stefanis et al., 2002) measures psychotic-like experiences in the general population. The scale consists of 42 items rated along three subscales: positive symptoms (20 items, e.g., "Do you ever feel as if there is a conspiracy against you?"), negative symptoms (14 items, e.g., "Do you ever feel that you experience few or no emotions at important events?") or depressive symptoms (eight items, e.g., "Do you ever feel sad?"). Each item is rated on two 4-point Likert scales from 0 (*never*) to 3 (*nearly always*) to indicate (1) the frequency of symptoms and (2) the level of distress associated with each symptom. The CAPE provides overall frequency and distress scores of experiences, and total frequency and distress scores for each of the three subscales. In order to account for partial non-responses, all scores are weighted for the number of valid answers per subscale (i.e., sum score divided by number of items completed). In all cases, higher scores indicate greater frequency or distress regarding symptoms; however, there

are no clinical cut-offs for this measure. The Dutch version was completed by participants. The scale has demonstrated adequate internal reliability (intraclass correlation coefficients) for the three subscales: positive = 0.63, negative = 0.64, and depression = 0.62 (Konings et al., 2006).

Procedure

The current study was approved by the institutional review committee and by the Medical Ethical Committee of the University of Utrecht, the Netherlands (number 17/829). The clinical sample participated in a research room in a psychiatric facility. All participation was on an individual basis. As per the guidelines outlined in McEnteggart et al. (2017), the experimenter interacted with participants during all phases of the experiment. Participants were offered multiple opportunities to take breaks between the blocks of the self-focused NL-IRAP, which significantly extended the duration of the experiment. On average, these sessions (IRAP and CAPE administration) lasted between 1.5 and 2.5 hours (with regular breaks as requested) and all participation was completed in one session, in which the CAPE was completed in approximately 15 minutes. Informed consent was obtained from all participants. Each participant was exposed to the self-focused NL-IRAP and the CAPE, with the order of each counterbalanced across participants.

Self-Focused NL-IRAP

The IRAP consisted of a standardized procedure in line with Barnes-Holmes et al. (2006) and Kavanagh, Roelandt, et al. (2019). Additional information on the content and format of the self-focused NL-IRAP can be found in Kavanagh, Roelandt, et al. (2019). The self-focused NL-IRAP consisted of blocks of 32 trials (two presentations of the 16 statements) presented quasi-randomly. There were a maximum of eight pairs of practice blocks, followed by three pairs of test blocks. The content of the practice and test blocks were identical. It was particularly important in this IRAP to ensure that participants were responding to each of the statements *from their own perspective.* Hence, participants were instructed at the beginning of the self-focused NL-IRAP, as follows: "The program will present statements on the screen which refer to you. Please remember that when you see 'I' or 'me' on-screen, this refers to you (the participant)". On each trial, a self-related statement was presented in the middle of the screen (e.g., "I'm proud when I succeed in my exams"), with two response options ("Yes" and "No") at the bottom left and right of the screen. Participants were simply instructed to figure out, based on individual trial feedback, what the task involved. Participants responded on each trial using either the "d" key for the response option on the left or the "k" key for the response option on the right. The locations of the response options "Yes" and "No" alternated from trial to trial in a quasi-random order, such that they did not remain in the same left-right locations for more than three successive trials. The instruction "The previously correct and incorrect answers have been reversed" was presented between blocks of trials.

When participants selected the response option that was deemed correct within that block, an inter-trial interval of 400 ms was presented, after which the next trial occurred. When participants selected the response option that was deemed incorrect for that block, the stimuli remained on the screen and a red "X" appeared beneath the statement. The program

proceeded to the 400 ms inter-trial interval (and next trial) only after the correct response option was selected. This pattern of trial presentations, with corrective feedback, continued until the entire block of 32 trials was presented. Trials were presented in a quasi-random order within each block, with the constraint that each statement was presented twice across the 32 trials. *Consistent* trial blocks required responding to the four trial-types that was deemed to be in accordance with positive events producing positive reactions and negative events producing negative reactions (i.e., *Positive Event-Positive Reaction/Yes, Positive Event-Negative Reaction/No, Negative Event-Positive Reaction/No,* and *Negative Event-Negative Event/Yes)*. *Inconsistent* trial blocks required responding to the four trial-types that was in accordance with positive events producing negative reactions and negative events producing positive reactions (i.e., *Positive Event-Positive Reaction/No, Positive Event-Negative Reaction/Yes, Negative Event-Positive Reaction/Yes,* and *Negative Event-Negative Reaction/No)*. The self-focused NL-IRAP always commenced with a consistent block of trials.

When participants completed each block of trials, the self-focused NL-IRAP program provided them with feedback on their performance during that block. The feedback consisted of a message informing them how accurately and how quickly they had responded overall during that block. The average speed of responding was calculated from stimulus onset to the first correct response across all 32 trials within the block. Participants were required to achieve a maximum median latency of no more than 8000 ms *on each trial-type*. The original Kavanagh, Roelandt, et al. (2019) study applied a median latency of 5000 ms for the non-clinical population, but with a clinical population, a longer response latency window was applied (see McEnteggart et al., 2017). It should be noted, however, that analyses of the latency data showed that the average latency for the clinical sample on the test blocks on the self-focused NL-IRAP was approximately 3000 ms.

Participants were also required to achieve a minimum accuracy of no less than 75%, at the trial-type level (i.e., no more than 2 errors were permitted per trial-type). If participants achieved both accuracy and latency criteria on any pair of practice blocks, they proceeded to the first pair of test blocks; if they failed on the eighth pair of practice blocks, participation in the experiment was terminated. A fixed set of six test blocks was presented with no accuracy or latency criteria required for participants to progress from one block to the next. However, percentage correct and median latency were again presented at the end of each block to encourage participants to maintain criterion-level responding from the practice blocks.

Data-analysis

First, the self-focused IRAP and CAPE indices will be examined using general linear model to probe potential differences between the clinical group relative to the controls. Second, it was examined whether scores on these indices could predict the presence of a clinical diagnosis. To investigate this, we conducted a Receiver Operator Characteristic (ROC) analysis in which the probability of a true positive, or a "hit" (i.e., sensitivity) is plotted against the probability of a false positive or a "false alarm" (i.e., 1 minus specificity, see Fawcett, 2006). From this, the area under the curve (AUC) can be calculated, which is the statistical likelihood that a randomly chosen member of the "positive" group (in this case, the clinical group) will have a higher score than a

randomly chosen member of the "negative" group (in this case, the control group). Therefore, a test with perfect ability to predict group membership would have an AUC of 100%, and a test with no ability to detect group membership would have an AUC of ~50%.

RESULTS

Self-Focused NL-IRAP

Consistent with standard IRAP practice, mean response latencies for consistent and inconsistent blocks were initially divided according to trial-type and calculated for each participant (see Barnes-Holmes, Barnes-Holmes, et al., 2010). Based on the latency and accuracy criteria, four participants failed to complete the practice blocks (and did not proceed to the test blocks) on the self-focused NL-IRAP. Hence, all four datasets were excluded from further analyses. For the remaining participants, the same accuracy and latency criteria were applied in the test blocks, except that the criteria now applied across all six test blocks. This meant that no more than eight errors were permitted per trial-type across the six test blocks. Using these criteria, three participants failed to complete the self-focused NL-IRAP. All three datasets were excluded from further analyses, leaving the final number of datasets in the analyses at $N = 29$.

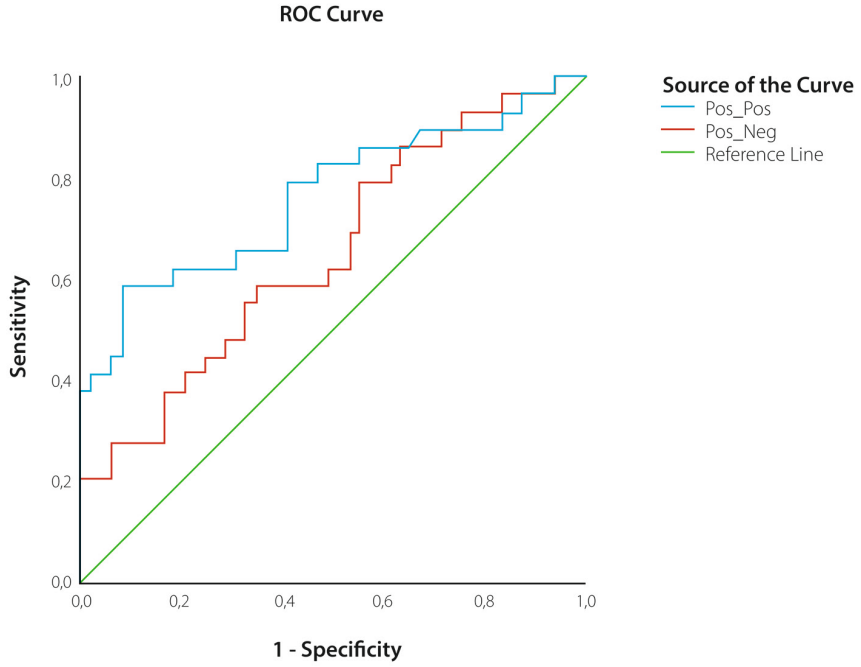
Consistent with the majority of published IRAP studies, D_{IRAP}-scores for the self-focused NL-IRAP were calculated for each of the four trial-types (see Table 1, Barnes-Holmes, Barnes-Holmes, et al., 2010), such that positive D_{IRAP}-scores during consistent blocks indicated responding "Yes" more quickly than "No" on *Positive Event-Positive Reaction* and on *Negative Event-Negative Reaction* trial-types, and responding "No" more quickly than "Yes" on *Positive Event-Negative Reaction* and on *Negative Event-Positive Reaction* trial-types. Negative D_{IRAP}-scores indicated the opposite pattern: "No" more quickly than "Yes" on *Positive Event-Positive Reaction* and on *Negative Event-Negative Reaction* trial-types, and responding "Yes" more quickly than "No" on *Positive Event-Negative Reaction* and on *Negative Event-Positive Reaction* trial-types. This scoring algorithm uses the same rationale as the D_{IAT} algorithm and is typically employed as it has proven to be effective at taking individuals differences such as into account, such as age, motor skills and/or cognitive ability (e.g., Barnes-Holmes, Barnes-Holmes, et al., 2010; Greenwald et al., 2003; O'Toole & Barnes-Holmes, 2009; Vahey et al., 2015).

A 2 × 4 mixed repeated measures Analysis of Variance (ANOVA) was conducted for group and trial-type. There was a significant main effect for trial-type, $F(3, 74) = 6.876$, $p < .001$, $\eta^2 = .083$, and for group, $F(1, 76) = 14.285$, $p < .001$, $\eta^2 = .158$; the interaction was non-significant ($p > .05$). Post-hoc tests in the form of four independent *t*-tests indicated that three of the four trial-types differed significantly between the groups: *Positive Event-Positive Reaction*, $t(76) = -4.291$, $p < .001$, $d = 1.01$, 95% confidence interval (CI) [0.52, 1.49], *Positive Event-Negative Reaction*, $t(76) = -2.778$, $p = .007$, $d = 0.68$, CI [0.18, 1.12], and *Negative Event-Positive Reaction*, $t(76) = -2.374$, $p = .02$, $d = 0.56$, CI [0.09, 1.02].

ROC analyses for each of the four trial-types were conducted, and the D_{IRAP}-scores on the *Positive Event-Positive Reaction*, AUC = 0.76, $p < .001$, and *Positive Event-Negative Reaction* trial-types, AUC = 0.65, $p = 0.02$, were good predictors of the clinical group (see Figure 2). Using the better predictor of the two, a cut-off of .24 for the *Positive Event-Positive Reaction* D_{IRAP}-score

yields a sensitivity level of 79.3% and a specificity level of 59.2% (see Figure 2). A cut-off of .10 for the *Positive Event- Negative Reaction* D_{IRAP}-score yields a sensitivity level of 79.3% and a specificity level of 55.1%.

Figure 2 *ROC Curve of the Positive Event-Positive Reaction and Positive Event-Negative Reaction Trial-Types*



CAPE

The CAPE weighted overall and subscale scores are provided in Table 1. A 2 × 2 multivariate ANOVA with overall frequency and distress was conducted for group. No group effect was found ($p > .05$). Additionally, ROC analyses of the CAPE data were also conducted and findings yielded non-significant results (all p's $> .05$).

DISCUSSION

The current study was the first attempt to use the self-focused NL-IRAP as a measure of psychological inflexibility, with regard to self, in a clinically diagnosed population currently attending a specialised psychiatric facility for the diagnosis and treatment of PTSD. As predicted, larger IRAP effects were observed for the clinical sample when compared to the non-clinical sample, suggesting higher levels of psychological inflexibility in the clinical group. The second aim of the study was to determine if psychological inflexibility, as measured by the self-focused NL-IRAP, could predict the presence of a clinical diagnosis, using a ROC analysis. Two trial-types (i.e., *Positive Event-Positive Reaction* and *Positive Event-Negative Reaction*) were significant

predictors of such diagnosis. However, only the *Positive Event-Positive Reaction* trial-type correctly classified the group with an acceptable AUC of 76%, with a sensitivity level of 79.3% and a specificity level of 59.2%.

Interestingly, the CAPE failed to classify the clinical group from a non-clinical group at a statistically significant level. Whilst the CAPE was also included in line with the methodology of Kavanagh, Roelandt, et al. (2019) and thus to examine whether this measure was able to predict group membership, future studies could also employ alternative measures of psychological stress and well-being, including self-concept or trauma-related indices. On balance, the CAPE targeted internal psychological experiences, and the associated distress, and thus it was not a *direct* measure of how participants reacted to their own psychological content. In contrast, the self-focused NL-IRAP directly measured reaction times to propositions concerning (hypothetical) life events, which may have increased its utility in accurately differentiating the two groups. For example, perhaps some or indeed many of the participants in the clinical sample did not produce high scores on the CAPE, which would reduce its sensitivity for the whole group. A post-hoc analysis of the data did indeed indicate that over half of the participants failed to score above 1.74 (weighted score) on the CAPE frequency scale and thus there was considerable overlap between the distribution of scores between the clinical and non-clinical samples. Taken together, results indicated that the CAPE did not differentiate between the clinical and non-clinical samples, yet future research may also probe group differences using more direct trauma-related indices.

In this context, it is interesting that measuring the ease with which participants react to their own psychological events (using the self-focused NL-IRAP) appeared to provide reasonable sensitivity in differentiating between clinical and non-clinical groups. The IRAP employed in the current study targeted propositions (with regard to self), but measured accuracy/latency rather than self-rating scales. This result highlights a possible advantage for propositional over associative models of human cognition in the clinical domain (see Smyth et al., 2008). At the very least, it suggests that it may be useful to conceptualize clinically relevant measures as lying on a continuum. For example, at one end of the continuum, an evaluative priming task might be considered as a task that aims to measure associations in memory, with a self-report scale at the other end aiming to measure propositions concerning the clinically relevant behaviors; the IRAP, which presents propositions but measures reaction time rather than ratings could be seen as lying "mid-way" along the continuum between these two extremes.

Another interesting finding that emerged from the study was that the only trial-types that classified the clinical group from the non-clinical group were the trial-types pertaining to positive events. This finding suggests that the inflexibility involved in reactions to positive and negative events for the clinical group may not be due to a generic or global level of inflexibility, as measured by the self-focused NL-IRAP. For instance, it could be argued that the valence of (or sensitivity to) positive events may have been greater for the clinical group employed in the current study due to their direct experience of traumatic events. Intuitively, of course, one might have expected the difference between the clinical and non-clinical samples to have been focused on the *negative* events (given that they were diagnosed with PTSD), but it appears that this was not the case. On balance, perhaps a history of PTSD served to create

a type of positive hyper-sensitivity for positive (over negative) events (Berntsen et al., 2011; Elman et al., 2018; Walker et al., 2003); in addition, it may be that negative reactions to negative life-events are so strong in both normative and clinical populations that their reactions to such events will fail to discriminate between the two groups. With that said, the difference between the two groups on the *Negative-Negative* trial-type were in the intuitively expected direction (i.e., the clinical group produced a larger IRAP effect), and thus perhaps a larger sample, yielding increased statistical power, would have produced a significant result.

One potential limitation in the study design was the possible presence of unmeasured factors that may have influenced IRAP performances, including comorbid condition(s) within the clinical sample (e.g., acquired brain injury, substance abuse). Future research could address this as well as the role of other factors of interest that may or may not affect IRAP performances, such as differences related to trauma history. Specifically, it may have been interesting to record and assess the nature and extent of each individuals' PTSD related traumatic experiences in order to investigate any potential differences in the IRAP effects. For instance, would individuals with fewer traumatic experiences demonstrate less sensitivity to positive events, or vice versa? Moreover, the non-clinical group was not assessed or screened on the presence of psychiatric diagnoses or the extent of clinical levels of psychopathology. The latter would be of interest, given that (sub-)clinical levels of mental health complaints are prevalent in the general and student populations (e.g., Ayuso-Mateoset et al., 2010; Beiter et al., 2015; Remes et al., 2016). Indeed, future studies should incorporate assessments of psychiatric complaints, as particular conditions such as anxiety symptomatology may negatively affect the level of psychological flexibility (Tirch et al., 2012). Lastly, following Kavanagh, Roelandt, et al. (2019), the CAPE was employed as a measure of psychological distress. However, given that the CAPE involves an index for psychotic-like experiences and distress, future studies should additionally include other trauma-related indices to assess clinical levels associated with psychotrauma more directly.

Future research could further address the clinical applicability of the IRAP by optimizing and probing different task performance parameters, such as using less stringent accuracy and latency thresholds, thereby potentially reducing attrition rates – which are common and expected in both clinical and non-clinical samples (see for example Vahey et al., 2015). However, relatively strict performance criteria seems to be a prerequisite for the IRAP data to be valid (i.e., inducing rapid relational responding; Barnes-Holmes et al., 2006; Kavanagh, Roelandt, et al., 2019) and reliable (e.g., shorter latencies have shown to improve reliability properties; Barnes-Holmes, Murphy, et al., 2010; Drake et al., 2016; Golijani-Moghaddam et al., 2013). Additionally, McEnteggart et al. (2017) provides concrete recommendations for using the IRAP in order to circumvent the practical difficulties associated with the task and to further reduce attrition, particularly within in a clinical population (e.g., such as initial exposure to the IRAP to familiarize with the procedure and providing additional task instructions). Moreover, future studies could examine whether the predictive properties of the IRAP as a clinical tool could be further increased by including IRAP content tailored to specific clinical populations of interest, such as using trauma-related IRAP statements in PTSD samples. Nevertheless, whilst future research should further examine IRAP performances in traumatized individuals and

other forms of psychopathology in clinical contexts, the current findings suggest that use of the IRAP as a non-associative clinical measure appears promising.

CHAPTER 4

Deployment-related PTSD Symptomatology and Social Functioning in Veteran Families: Probing the Mediating Roles of Emotion Regulation and Mentalization in an Outpatient Veteran Sample

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ABSTRACT

Deployment-related posttraumatic stress disorder (PTSD) impacts social functioning in families. Therefore, it is important to examine the factors that contribute to social functioning in families that are confronted with deployment-related PTSD. The goal of this study was to assess the association between PTSD symptom severity and social functioning using self-report questionnaires in an outpatient veteran sample and to test the mediating roles of emotion regulation (Study 1, $N = 100$) and mentalization (Study 2, $N = 38$). Study 1 demonstrated that emotion regulation problems fully mediated PTSD associated family dysfunctioning. Study 2 did not demonstrate a mediation role of mentalization, but also did not demonstrate an association between PTSD and social dysfunctioning. Maladaptive mentalization was associated with poor child adjustment. Critically, a between-study comparison revealed that PTSD symptom severity was significantly higher in Study 1 than in Study 2. Overall, our findings suggest that social dysfunctioning may only appear when a given *severity threshold* of PTSD is reached, in which emotion regulation might be a key clinical factor. Maladaptive mentalization may be critical for post-deployment child adjustment. Future research should further examine social functioning in samples with different PTSD severity profiles and include the role of mentalization. Longitudinal data are needed to gain further insight into the causal relationships among the factors considered and the etiological pathways that lead to developing social dysfunction over time.

INTRODUCTION

Military deployment and deployment-related posttraumatic stress disorder (PTSD) symptomatology can negatively impact social functioning in veteran families (Creech et al., 2014; Erbes et al., 2011; Khalys et al., 2011). Gaining insight in social functioning in families dealing with PTSD is critical and may provide clinical targets for intervention. The goal of the current study was to examine the association between PTSD and social functioning in veteran families in an outpatient veteran sample and to examine the potential mediating roles of veterans' deficits in emotion regulation and mentalization.

Association between PTSD and Social Functioning in Veteran Families

Accumulating evidence has indicated that deployment-related PTSD symptomatology – characterized by combat-related intrusive thoughts or flashbacks, avoidance behavior, negative alterations in mood and cognitions, and hyperarousal (American Psychiatric Association, 2013) – may impact intra-familial relations (for a review, see Creech & Misca, 2017). This converges with accounts that emphasize the link between PTSD and impaired interpersonal functioning, including the cognitive-behavioral interpersonal theory of PTSD (C-BIT; Dekel & Monson, 2010) and the cascade model of intra-familial symptom transmission (Snyder et al., 2016).

The C-BIT model states that core PTSD symptoms may negatively affect intimate relationship quality and also parent-child functioning (Creech & Misca, 2017). For example, veterans' behavioral avoidance can be linked to withdrawal from family activities (e.g., dining, playing with children), thereby reducing intra-familial relationship satisfaction (Dekel & Monson, 2010). Conversely, family members may facilitate veterans' PTSD symptoms such as avoidance by changing their own behavior, such as avoiding conversations about topics that may trigger trauma-related memories.

In their cascade model, Snyder et al. (2016) argued that deployment "provides a key initiating context for symptom cascades across family members" (p. 4). They found empirical support for their model in a sample of 183 veteran families in which parents' PTSD symptoms and child internalizing and externalizing symptoms were reciprocally linked. These findings suggest that deployment-related PTSD and family functioning are reciprocally related.

Thus, both theory and empirical evidence indicate that PTSD symptoms are associated with social problems in veteran families. Examining the factors that underly this association is important to further understand and target PTSD related social difficulties in families and in turn improve social functioning.

Mediating Role of Emotion Regulation and Mentalization

Emotion regulation is defined as the ability to monitor, evaluate, and modify emotional reactions (Sheppes et al., 2015; Thompson, 1994). Deficits in emotion regulation are hypothesized to negatively affect post-deployment social functioning. Research has shown that emotion regulation can be distorted following war and can be a key factor in the development of PTSD and post-deployment social problems (Kashdan et al., 2009; Seligowski et al., 2015). For example, Zhang et al. (2020) followed deployed fathers for two years and found that fathers'

emotion dysregulation at baseline predicted coercive parenting at 1-year follow-up, in which the latter was accompanied by emotional and behavioral problems in children at 2-year follow-up. These findings converge with findings that observed inadequate emotion regulation strategies, such as the tendency to avoid unwanted thoughts or feelings (i.e., experiential avoidance; Hayes et al., 1996), were linked to less family engagement and couple adjustment problems (e.g., Brockman et al., 2016; Reddy et al., 2011). Thus, social dysfunctioning in veteran families has shown to be associated with veterans' emotion regulation difficulties.

Another factor hypothesized to negatively impact post-deployment social functioning is a compromised ability to *mentalize* (Adolphs et al., 2001; Green et al., 2008). Mentalization refers to the ability to perceive, infer, and understand mental states of oneself and others (Green et al., 2008). It is one aspect of social cognition, or the ability to understand and effectively act in social situations (Green et al., 2008; Janssen et al., 2022). Ample evidence has indicated that combat veterans experience difficulties in mentalizing (e.g., Janssen et al., 2022; Poljac et al., 2011; Nazarov et al., 2014). Mazza et al. (2012) described impairments in mentalization in a deployed group of PTSD diagnosed individuals. They performed worse than healthy participants on a task in which they were asked to describe what another person might feel in certain emotional contexts. Specifically, mentalizing deficits may be explained by present PTSD symptomatology: symptoms central to PTSD – such as emotional numbness and avoidance – may interfere with the adequate processing and integration of social information (Lavoie et al., 2014; Mazza et al., 2012).

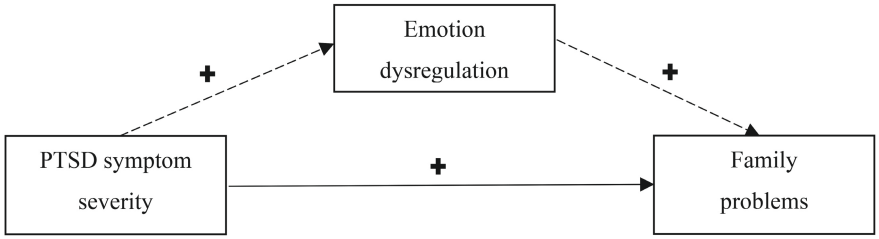
The Current Study

Thus, previous research suggests that both emotion regulation and mentalization difficulties in veterans could result from deployment-related PTSD and subsequently predict social problems. Therefore, the goal of this study was to examine the association between PTSD and social (dys)functioning in veteran families, and whether this association was mediated by emotion regulation (Study 1) and mentalization (Study 2).

Data were collected in an outpatient veteran sample. Social problems were measured with a broad-based family functioning measure. In Study 1, we examined the association between PTSD symptoms and family difficulties and the mediating role of emotion regulation (see Figure 1, Model 1). In Study 2, we examined the mediating role of maladaptive mentalization on family functioning as well as child functioning. Two aspects of mentalization were measured with the Reflective Functioning Questionnaire (RFQ). The RFQ measures the ability to develop models of the mind of self and others and specifically the degree of certainty about mental states in which higher levels of uncertainty (i.e., a lack of knowledge about mental states) and lower levels of certainty (i.e., how convinced an individual is that their view corresponds with reality) are indicative for maladaptive mentalization (Fonagy et al., 2016). We examined the associations between PTSD symptoms with family functioning (Figure 2, Model 2a) and child functioning (Figure 2, Model 2b), and whether these associations were mediated by maladaptive mentalization (i.e., more uncertain and less certain mentalization).

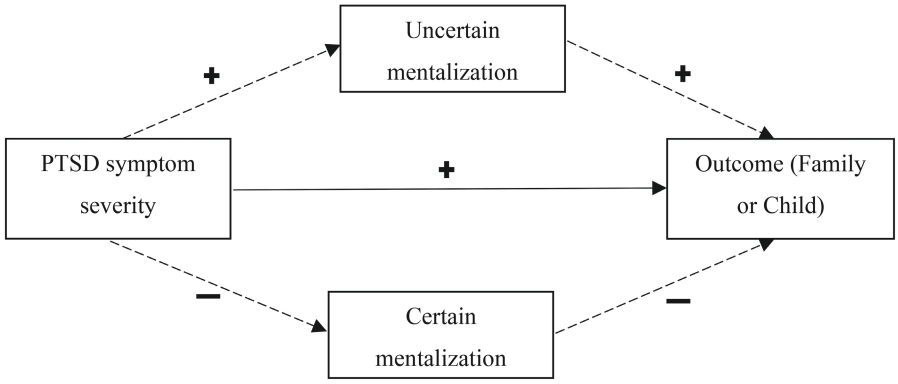
Overall, we expected that higher levels of PTSD symptoms would be associated with social difficulties in both studies and that this association was mediated by emotion regulation difficulties (Study 1) and maladaptive mentalization (Study 2).

Figure 1 *Simple Mediation Model of the Hypothesized Mediating or Indirect Effect of Emotion Dysregulation (Model 1)*



Note. As illustrated, PTSD symptom severity was expected to be positively associated with family problems (bold line). This direct relation was hypothesized to be mediated by a deficit in emotion regulation (top path; dotted lines).

Figure 2 *Mediation Models of the Hypothesized Mediating or Indirect Effects of Uncertain and Certain Mentalization Pertaining Family Problems (Model 2a) and Child Maladjustment (Model 2b)*



Note. PTSD symptom severity was expected to be directly positively associated with family or child problems. This direct association was hypothesized to be mediated by a higher level of uncertain mentalization and a lower level of certain mentalization. Two identical models were run: one with family problems as the outcome and one with child problems as the outcome.

STUDY 1

Method

Participants

Participants were outpatient veterans referred for treatment to a specialized psychotrauma centre in the Netherlands between 2016 and 2021, having at least one child aged 18 year or below under their parental supervision at a minimum of one day per week, including step and foster children. Patients filled in the questionnaires at the start of their treatment. The initial data file included 114 patients. Of these, 14 were excluded as their measurements were incomplete (e.g., missing data, one or more questionnaires were not filled in). The final sample consisted of 100 patients (M_{age} = 41.69 years, SD_{age} = 6.95; 93% male; 97% Dutch), predominantly living/cohabiting with an intimate partner (74%). The mean number of children aged 18 years or younger was 1.66 (*SD* = 0.83); the average age of the children was 10.02 years (*SD* = 8.99).

Measures

Family Functioning. The Systematic Clinical Outcome and Routine Evaluation (SCORE-15; Stratton et al., 2014) is a 15-item self-report measure of family functioning. Participants rated how much each item described their family on a 5-point scale (1 = very well, 5 = not at all). An example item is: "In our family, we can trust each other". The SCORE-15 demonstrated good internal consistency in Study 1 (α = .88) and Study 2 (α = .87).

PTSD Symptom Severity. The PTSD Checklist-5 (PCL-5; Blevins et al., 2015) is a 20-item self-report measure of PTSD symptom severity. Participants rated to what degree symptoms were disrupting in the past month on a 5-point scale (1 = not at all, 5 = extremely). An example item is: "Do you have bad dreams about the traumatic experiences?". The PCL-5 demonstrated excellent internal consistency in Study 1 (α = .91) and Study 2 (α = .96).

Emotion Dysregulation. The Difficulties in Emotion Regulation Scale (DERS; Gratz & Roemer, 2004) is a 36-item self-report measure of emotion dysregulation. Participants rated how much each item applied to them on a 5-point scale (1 = almost never, 5 = almost always). An example item is: "When I am upset, I can't control my behavior". The DERS demonstrated excellent internal consistency in the current sample (α = .90).

Procedure

Patients filled in the questionnaires digitally via the routine outcome measurement (ROM) as a standard part of their first treatment appointment. They were instructed that the ROM data would be used to track their treatment progress and might be used anonymously for research – none of the participants objected. As the ROM data is already standardly administered for treatment purposes and as data is analyzed as part of a larger aggregated dataset, no informed consent was required, as approved by the Institutional Ethical Review Board (CWO/2104) of the treatment facility and in line with the policy of the Dutch Medical Ethical Committee. An independent researcher extracted a SPSS data file with the questionnaire data from the ROM database. Another independent researcher performed the analyses.

Analytical Strategy

Statistical analyses were run with SPSS 25.0. First, one-sample Kolmogorov-Smirnov (K-S) tests were run to assess whether variables were normally distributed and outliers were removed (i.e., absolute *z*-values larger than ± 3.00; Tabachnick et al., 2007). Descriptive statistics (*M* and *SD*) of the indices were calculated. Second, Pearson correlations were computed and confirmed by non-parametric Spearman correlations when variables were not normally distributed. Based on Cohen (2013), correlations were interpreted as small (0.10), moderate (0.30), or large (0.50). Third, to test the mediating role of emotion dysregulation, Model 1 (Figure 1) was tested using Hayes' PROCESS macros (Hayes, 2018). A bootstrap model with 5000 samples was used to compute the indirect effect of emotion regulation with a 95% confidence interval (CI).

Results

Descriptive Statistics

Patient, family, and questionnaire data are shown in Table 1. Variables were normally distributed (K-S tests, *p*'s > .05). No outliers were detected. Correlations between study variables can be found in Appendix Table 1.

Table 1 *Patient, Family and Questionnaire Outcomes in Study 1 and 2*

Outcome	Study 1 (*n* = 100)	Study 2 (*n* = 38)
	%	%
Male	93	100
Dutch nationality	97	94.7
Cohabiting with intimate partner	74	86.8
	M (*SD*)	*M* (*SD*)
Age veteran	41.69 (6.95)	41.97 (5.41)
Number of children under 18	1.66 (0.83)	1.94 (0.81)
Age of children under 18	10.02 (8.99)	10.56 (8.2)
PTSD symptom severity*	52.11 (12.65)	43.84 (18.94)
Family dysfunctioning	2.46 (0.64)	2.46 (0.58)
Emotion dysregulation	115.94 (22.69)	-
Uncertain mentalization	-	1.33 (0.74)
Certain mentalization	-	0.62 (0.69)
Poor child adjustment	-	27.32 (5.79)

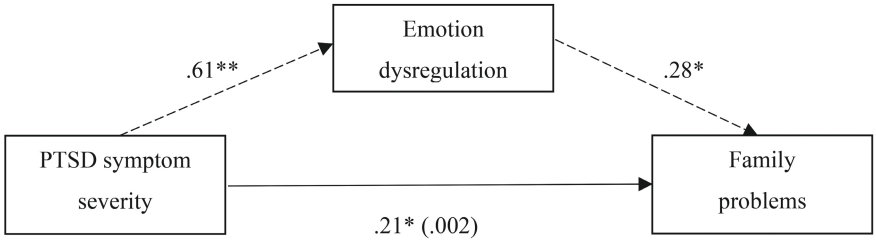
Note. *A significant between-study difference was observed pertaining this outcome.

Mediation Analysis

As shown in Figure 3, PTSD symptom severity predicted emotion dysregulation, β = .61, $t(97) = 7.59$, $p < .001$, and emotion dysregulation predicted family problems, β = .28, $t(96) = 2.31$, $p = .02$. PTSD symptom severity predicted family problems, β = .21, $t(97) = 2.11$, $p = .04$, when entered without emotion dysregulation in the regression model. The indirect effect of PTSD symptom severity via emotion dysregulation was significant, as the CI did not overlap with zero (β = .17, lower limit = .01, upper limit = .36). The direct effect of PTSD symptom severity on

family problems was no longer significant when taking emotion dysregulation into account, β = .002, $t(97) = .30$, $p = .76$, meaning that the association between PTSD symptom severity and family problems was fully mediated by emotion dysregulation.

Figure 3 *Simple Mediation Model of the Indirect Effect of Emotion Regulation Pertaining the Association Between PTSD Symptom Severity and Family Problems (Model 1)*



Note. Standardized regression coefficients for the relationship between PTSD symptom severity and family dysfunctioning (bold line) as mediation through emotion dysregulation (top path; dotted lines). The coefficient between PTSD symptom severity and family problems, when taking emotion regulation into account, is noted in parentheses.
*$p < .05$; **$p < .01$

STUDY 2

Method

Participants

The sample and eligibility criteria were similar to Study 1. The participants of Study 2 were proactively approached. 38 patients were included ($M_{age} = 41.97$ years, $SD_{age} = 5.41$; 100% male, 95% Dutch) and were predominantly living/cohabiting with an intimate partner (86.8%). The average number of children aged 18 years or younger was 1.94 ($SD = 0.81$); their average age was 10.56 years ($SD = 8.2$).

Measures

The measures of PTSD symptom severity and family functioning were the same as for Study 1.
Mentalization. The RFQ is an 8-item self-report measure of reflective functioning as an operationalization of mentalization (Fonagy et al., 2016) and has two subscales: uncertainty (RFQu) and certainty (RFQc) about mental states. Items were rated on a 7-point scale (1 = strongly disagree, 7 = strongly agree). Example items of the RFQu and RFQc are, respectively: "Sometimes I do things without really knowing why" and "People's thoughts are a mystery to me". Items were recoded such that higher RFQu and lower RFQc scores indicate maladaptive mentalizing. Both subscales demonstrated good internal consistency (RFQu, α = .71; RFQc, α = .73).

Child Functioning. The parent version of the Strengths and Difficulties Questionnaire (SDQ; Goodman & Goodman, 2009) is a 25-item self-report measure to assess emotional and behavioral problems of children aged 4 to 17. Items were rated on a 3-point scale (0 = not true, 2 = certainly true). An example item is: "My child often has temper tantrums or hot tempers". The SDQ demonstrated good internal consistency (α = .74).

Procedure

The study procedure was approved by the Institutional Ethical Review Board (CWO/2104) of the treatment facility and the Medical Ethical Committee of the University of Utrecht, the Netherlands (number 17/829). Patients received written study information after their first treatment appointment. After a week, they were contacted by phone to clarify the study procedure and to determine whether they had at least one child aged 18 years or younger under their parental supervision at least one day per week. If the veteran decided to participate, they filled in an informed consent. Questionnaires were filled in online.

Analytical Strategy

The analytical strategy was identical to Study 1. To test the mediation role of uncertain and certain mentalization, Model 2a and 2b (Figure 2) were tested using Hayes' PROCESS macros (Hayes, 2018). RFQc was not normally distributed (K-S test, $p < .001$). The individual pathways involving RFQc were confirmed non-parametrically.

Results

Descriptive Statistics

Patient, family, and questionnaire data for Studies 1 and 2 are shown in Table 1. Study differences for all variables were assessed. The PTSD symptom severity level was significantly higher in Study 1 ($M = 52.11$, $SD = 12.65$) than in Study 2 ($M = 43.84$, $SD = 18.94$), $t(136) = -2.410$, $p = .02$. There were no other study differences. No outliers were detected. Correlations between study variables are shown in Appendix Table 1.

Mediation Analyses

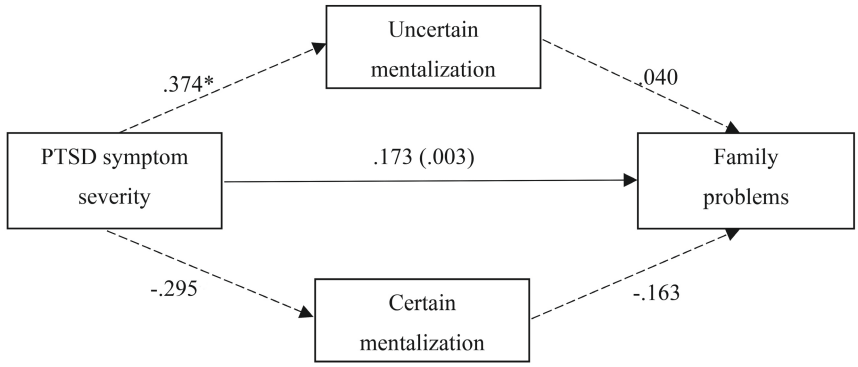
Two mediation analyses were run to examine the mediating role of uncertain and certain mentalization in the association between PTSD symptom severity and family problems (Model 2a, see Figure 4, panel A) and child maladjustment (Model 2b, see Figure 4, panel B). As models only differed in the outcome variable (family vs. child functioning), pathways concerning PTSD symptom severity, uncertain mentalization, and certain mentalization were identical in both models. In both models, higher PTSD symptom severity levels predicted more uncertain mentalization, $\beta = -.374$, $t(6) = 2.42$, $p = .02$. PTSD symptom severity did not predict certain mentalization ($p > .05$). In both models, neither PTSD symptom severity nor uncertain or certain mentalization predicted family dysfunctioning or child maladjustment (p's $> .05$). Indirect effects of uncertain and certain mentalization were still tested as they could still be probed in the absence of significant direct pathways (Hayes, 2018). No indirect effect

was found, indicating no mediation effects in both models, as evidenced by non-significant indirect effects of uncertain and certain mentalization on family problems (respectively, lower limit = -.05, upper limit = .12 and lower limit = -.01, upper limit .01) and child maladjustment (respectively, lower limit = -.02, upper limit = .11 and lower limit -.09, upper limit .05).

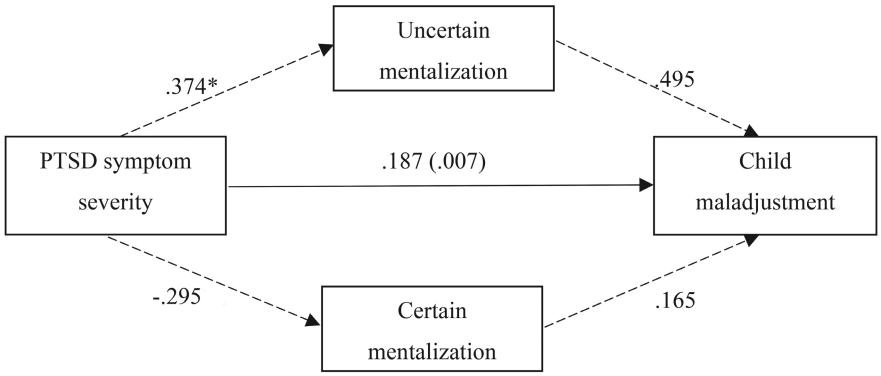
Figure 4

Parallel Mediation Models of the Indirect Effects of Uncertain and Certain Mentalization Pertaining Family Problems (Model 2a) and Poor Child Adjustment (Model 2b)

A.



B.



Note. Standardized regression coefficients for the relationship between PTSD symptom severity and family dysfunctioning (panel A: bold line) and poor child adjustment (panel B: bold line). Standardized regression coefficients for the hypothesized mediation paths through uncertain and certain mentalization (respectively top and bottom dotted line paths in both panel A and B). The coefficient between PTSD symptom severity and family problems (panel A) and poor child adjustment (panel B), when taking uncertain and certain mentalization into account, are noted in parentheses.

*$p < .05$; **$p < .01$

DISCUSSION

The goal of the current study was to examine the association between deployment-related PTSD and social functioning in families, and the mediating roles of emotion regulation (Study 1) and mentalization (Study 2) in this association. In Study 1, the association between PTSD and family problems was indeed fully mediated by emotion regulation problems. However, in Study 2 there was no association between PTSD and social functioning and no mediation by mentalization. Instead, individual (PTSD symptoms, mentalization) and social (family and child functioning) processes were mostly distinctly interrelated; only maladaptive mentalization (i.e., uncertain mentalization) was associated with poor child adjustment. The absence of PTSD related social difficulties in Study 2 contrasts with the findings of Study 1. A potential critical difference between the studies could be that the average PTSD symptom severity level was significantly higher in Study 1 than in Study 2.

The *severity threshold* of PTSD symptomatology may thus have been a key factor in our findings and may be important to understand relational functioning in veteran families. The role of the severity threshold of PTSD symptoms and the study differences in PTSD related social functioning may be understood when considering existing accounts of PTSD and social functioning, such as the C-BIT (Dekel & Monson, 2010) and the cascade model (Snyder et al., 2016). These accounts consider elevated PTSD symptoms as a key contributor for social problems. This may explain why PTSD associated social difficulties were only found in Study 1, in which the average PTSD severity level was significantly higher than in Study 2. Ample evidence has indicated that social functioning may deteriorate above a certain level of PTSD symptomatology (e.g., Creech & Misca, 2017; Samper et al., 2004). Our findings extend previous work by suggesting that social problems may only appear when a given PTSD severity threshold is reached. This implies that the PTSD severity level is a critical factor for the timing of clinical (systemic) interventions. Future research should further explore which PTSD threshold levels exactly are linked to social functioning in veteran families.

As anticipated, Study 1 demonstrated that PTSD related family dysfunctioning was mediated by emotion regulation problems. This is consistent with research that has shown that emotion regulation can be impaired following war and may contribute to the development of PTSD and post-deployment social deficits (e.g., Kashdan et al., 2009; Zhang et al., 2020). Indeed, prior studies among veterans have shown that impaired emotion regulation capacities, such as the tendency to avoid and suppress emotional experiences (i.e., experiential avoidance), were related to less family involvement and more interpersonal problems (Brockman et al., 2016; Reddy et al., 2011). Our findings point out that emotion regulation deficits may be an important clinical factor in targeting PTSD and related social problems. Further addressing the associations among PTSD, emotion regulation, and social functioning in veteran families is thus of clinical importance.

Contrasting our anticipation, Study 2 did not demonstrate a mediating role of mentalization underlying PTSD related social difficulties at either the family or the child level. This is not in line with previous research that has shown an association between PTSD related mentalization deficits and social dysfunctioning (e.g., Janssen et al., 2022; Lavoie et al., 2014; Poljac et al., 2011).

One explanation for the absent mediating role of mentalization is that Study 2 did not demonstrate PTSD related social difficulties in the first place. Multiple studies across a range of PTSD diagnosed samples have shown mentalization deficits related to PTSD (for a review, see Janssen et al., 2022). It can be expected that these deficits further contribute to the social problems already associated with elevated PTSD severity levels (e.g., Creech & Misca, 2017) and poor mentalization capacities (e.g., Fonagy et al., 2007; Gergely & Unoka, 2008). Follow-up research should determine the potential mediating role of mentalization, particularly in families with more severe forms of PTSD related social problems.

An alternative explanation for the absent mediating role of mentalization could be that mentalization impairments might be particularly related to more specific social processes. Accordingly, in Study 2 maladaptive mentalization was linked to child maladjustment, consistent with research that has shown that poor mentalization might particularly hinder parents to bond with their children, thereby reducing children's well-being (Fonagy et al., 2007). Stressful contexts, such as war deployment, have been shown to impair the ability to mentalize; the capacity to think about others' thoughts and feelings is inhibited when functioning under enduring distress (Luyten & Fonagy, 2015). Thus, maladaptive mentalization might be especially critical for child adjustment. It would be interesting to further examine the role of mentalization and related social processes (e.g., couple attachment, overall family functioning), especially when more severe forms of PTSD and social disruption are present. As Fonagy and Allison (2012) noted, family systems include various dyads (e.g., veteran-child, veteran-partner). Impaired mentalization may initially negatively affect functioning in specific dyadic interactions, gradually affecting overall intra-familial functioning. Future research should examine the role of mentalization in families with more severe degrees of PTSD-related social disruption, and examine different aspects of social functioning (e.g., child adjustment, couple attachment, family system functioning).

A methodological explanation for the lack of mediation in Study 2 could be that the sample was too small, yielding insufficient statistical power to detect mediation. Based on Fritz and McKinnon (2007), identifying true effects would require a sample size between at least 34 and 78 participants for correlational patterns with a moderate to large size of effect. Others suggest that resampling by bootstrapping circumvents problems with power and can be applied to small samples (e.g., Hayes & Scharkow, 2013). Nevertheless, prospective studies should incorporate larger sample sizes when probing PTSD associated family dysfunction and the mediating role of mentalization.

Limitations

This study had some limitations. First, some potentially confounding effects could not be excluded. Co-occurring psychiatric conditions may have negatively impacted the outcomes of interest. For example, social functioning may be negatively affected by the presence of post-deployment depressive symptomatology (Bonde et al., 2016) and high-risk behaviors, such as alcohol use and aggression (Brown et al., 2012). These and other possible confounding factors could not be controlled for and may have led to different results between our two studies. Future research should take such factors into account.

Second, our study did not include outcome data from veterans' family members. This is important, because perceptions of PTSD related social problems may differ between family members. Prospective research should include the perspective of multiple family members.

Third, the present results were based on cross-sectional data and analyses. Previous work suggests that deployment related PTSD negatively impacts mentalization and emotion regulation processes, which then contribute to subsequent social difficulties in veteran families. In order to test this in detail, longitudinal data are needed to further determine the direction of causality between these variables and to assess and understand the etiological pathways for developing family dysfunction over time.

Fourth, this study focused on mentalizing, as this cognitive form of empathy has been shown to be impaired in PTSD diagnosed individuals (for a review, see Janssen et al., 2022). Given that studies have also indicated associations between PTSD with affective empathy (i.e., the ability to share feelings of others; Parlar et al., 2014, Warrier et al., 2018), future studies should examine whether affective empathy mediates PTSD associated social difficulties.

Conclusion

In spite of these limitations, this study yielded three main findings of clinical importance. First, social functioning in families was negatively affected by deployment-related PTSD symptomatology as a function of reported symptom severity. This means that social problems may only appear when a given *severity threshold* of PTSD symptomatology is reached. Second, our findings underscore the importance of emotion regulation problems as a key factor in PTSD related social problems. Third, we found no evidence for mentalization as a mediator in a sample demonstrating no PTSD related social problems, yet future research should examine the mediating role of mentalization in larger samples with different PTSD severity profiles. The current study did point out that a reduced ability to create mental models of others' behavior was linked to poor child adjustment, emphasizing that deficits in mentalization capacities may be critical for post-deployment child maladjustment.

Appendix Table 1 *Correlations Between the Study Variables in Study 1 and Study 2*

Variable	1	2	3	4	5	6	7	8
Study 1								
1. PTSD symptom severity								
2. Family dysfunctioning	.21*							
3. Emotion dysregulation	.61**	.31*						
Study 2								
4. PTSD symptom severity								
5. Family dysfunctioning				.172				
6. Uncertain mentalization				.374*	.210			
7. Certain mentalization				-.326*	-.165	-.803**		
8. Child dysfunctioning				.175	.395*	.341*	-.303	

Note. Non-parametric Spearman correlations are shown for all correlation pairs involving certain mentalization, as this variable was not normally distributed. Abbreviations: PTSD = posttraumatic stress disorder.
*$p < .05$; **$p < .01$

CHAPTER 5

Effects of the ADAPT Intervention on Social Functioning in Veterans and Their Partners: A Pilot Study

This article is submitted as:
Janssen, P. G. J., Stoltz, S. E. M. J., Cillessen, A. H. N., & van Ee, E. Effects of the ADAPT intervention on social functioning in veterans and their partners: A pilot study.

ABSTRACT

Deployment-related posttraumatic stress disorder (PTSD) can negatively impact social functioning in veteran families. Addressing social difficulties in these families is thus important. The goal of this study was to conduct an observational pilot of the clinical effectiveness of After Deployment Adaptive Parenting Tools (ADAPT), a parenting intervention for veterans and their partners. Social functioning (family functioning, parent reported child functioning, parental attachment) was assessed at baseline, end-of-treatment, and 6-month follow-up. Veteran outcomes in ADAPT were compared with outcomes for veterans undergoing treatment as usual (TAU) consisting of individualized PTSD treatment. Emotion regulation and mentalization were tested as mediators of effect. Results showed a direct and sustained reduction in post-treatment family problems in veterans, and preliminary evidence of a decrease in family problems in partners at 6-month follow-up. Relative to ADAPT, no significant reduction of family problems was observed in the TAU group. No significant effects were found on child functioning and parental attachment. No mediation effects were found of emotion regulation and mentalization. This study yielded initial evidence of the clinical effectiveness of ADAPT to improve family functioning, yet future research should examine the mediating processes that explain these effects, preferably using longer time frames with more follow-up measurements.

INTRODUCTION

Deployment-related posttraumatic stress disorder (PTSD) symptomatology can negatively impact social functioning in veteran families (Creech et al., 2014; Erbes et al., 2011; Khaylis et al., 2011). Addressing social difficulties in these families is thus important. The goal of this study was to assess the clinical effectiveness of a tailored parenting intervention for veteran families – After Deployment Adaptive Parenting Tools (ADAPT; Gewirtz et al., 2014) – by examining its influence on social functioning in treatment-seeking veterans and their partners.

Association Between Deployment-Related PTSD and Social Functioning

Deployment-related PTSD symptomatology is defined by combat-related intrusive thoughts or flashbacks, avoidance of trauma-related triggers, negative alterations in mood and cognitions, and hyperarousal (American Psychiatric Association, 2013). This symptomatology is associated with social problems in families (Cook et al., 2004; Creech & Misca, 2017; Janssen, Stoltz, et al. 2022; Snyder et al., 2016). In a recent meta-analysis, combat-related PTSD was associated with increased social problems in military families, including parenting problems, family maladjustment, and offspring problems (Kritikos et al., 2019). For example, evidence suggests that core PTSD symptoms, such as behavioral avoidance, may result in disengagement from family activities, like meals or playing with children, which may ultimately lead to a decrease in familial relationship satisfaction (Dekel & Monson, 2010). PTSD related emotional numbness – being emotionally unresponsive and detached from others (American Psychiatric Association, 2013) – has been suggested to diminish the engagement in social interactions, which may lead to poor social functioning (Cook et al., 2004; Janssen, van Est et al., 2022; Ruscio et al., 2002). Taken together, prior research underlines the association between deployment-related PTSD and impaired social functioning in veteran families. Despite this evidence, empirically supported family interventions addressing social functioning are scarce.

After Deployment Adaptive Parenting Tools (ADAPT)

ADAPT is a parenting intervention, specifically developed for military families with school-aged children (Gewirtz et al., 2014). ADAPT is an adaptation of the Parent Management Training Oregon (PMTO) intervention model, which targets five key parenting practices: positive involvement, skill encouragement, problem-solving, monitoring, and effective discipline (Forgatch & Patterson, 2010). PMTO can be delivered in different group formats, typically involving 6-14 weekly sessions. Extensive evidence has shown that PMTO based interventions are effective in addressing social functioning by enhancing parenting and increasing child adjustment (for a meta-analytic review, see Cai et al., 2022).

ADAPT is tailored for military families, as it provides sessions in a post-deployment context, including discussions of the parenting challenges that arise when returning from deployment (Gewirtz et al., 2014). Mindfulness and emotion coaching techniques are also included to target post-deployment emotion regulation deficits (i.e., the inability to monitor, evaluate, and modify emotional reactions; Sheppes et al., 2015; Thompson, 1994). This is important, because regulation deficits are a core feature of both PTSD and family dysfunctioning (Janssen, Stoltz, et

al., 2022). Although not studied directly, the potential of ADAPT to facilitate interactions across parent-parent and parent-child levels suggests that it may effectively target the capacity to mentalize (i.e., the ability to perceive, infer, and understand oneself and others; Green et al., 2008), potentially enhancing social functioning (Janssen, van Est et al., 2022). Thus, ADAPT might be well-suited to address post-deployment social functioning. Consistent with this, prior research has shown effects of ADAPT on improved social functioning in veteran families. A randomized controlled trial of ADAPT in a community sample of 345 military families found enhanced parental efficacy and improved parenting practices at 6 and 12 months post baseline relative to a control group (Gewirtz et al., 2018).

The Current Study

Despite initial evidence of the effectiveness of ADAPT in military families, its applicability to clinical populations, including treatment-seeking veteran families with PTSD associated social problems, is not yet known. Examining ADAPT in traumatized populations is important, given that elevated PTSD symptoms might be associated with social problems in veteran families (Janssen, Stoltz et al., 2022).

The goal of this study was to conduct an observational pilot of the clinical effectiveness of ADAPT in Dutch outpatient veterans and their partners. We assessed the impact of ADAPT on social functioning at three time points (baseline, end-of-treatment, 6-month follow-up) in participating veterans and partners. Veteran outcomes in ADAPT were compared with outcomes for veterans undergoing treatment as usual (TAU) consisting of individualized PTSD treatment (see below). Given the pilot nature of this study, partners were not included in the TAU group. ADAPT might be specifically suited for veterans because it targets emotion regulation and mentalization. Therefore, we tested whether emotion regulation and mentalization mediated the effects of ADAPT (compared to TAU) on social functioning.

To assess social functioning comprehensively, we used a broad-based family functioning measure as the primary outcome. Secondary outcomes were parent reported child adjustment, given that ADAPT indirectly targets child outcomes through enhanced parenting practices (Gewirtz et al., 2014), and the assessment of parental attachment, as attachment is assumed to be increased as parents are facilitated to collaborate within ADAPT (Gewirtz et al., 2011). Two aspects of mentalization were assessed with the Reflective Functioning Questionnaire (RFQ). The RFQ measures the ability to construct mental models of self and others, and the certainty and uncertainty of these models. High uncertainty (i.e., denoting a lack of knowledge about mental states) and low certainty (i.e., how convinced an individual is that their view corresponds with reality) indicate maladaptive mentalization (Fonagy et al., 2016). Given that PTSD and social functioning are associated (e.g., Janssen, Stoltz et al., 2022), pre-treatment PTSD symptom severity levels were included as a covariate in the analyses of the veterans.

We hypothesized that ADAPT would enhance social functioning as indicated by veterans and partners over time. We also expected that ADAPT treatment would be associated with enhanced social functioning in veterans compared to veterans following TAU, and that this association would be mediated by improved emotion regulation and mentalization (i.e., less uncertain and more certain mentalization).

METHOD

Participants

The present study included two groups: the ADAPT group, consisting of veteran partner couples, and the TAU group, consisting of veterans but no partners. Participants were recruited between 2019 and 2022 after clinical referral to ADAPT or TAU at a specialized psychotrauma centre in the Netherlands. To be eligible, participants in both groups had to be in a romantic relationship for at least six months and participants needed to have at least one child between 4 and 12 years of age who was under their parental supervision for a minimum of one day per week, including step and foster children.

The ADAPT group consisted of 17 male veterans and a female partner. Their ages ranged between 30 and 48 years (M_{age} = 38.6 years). Of these 17 couples, one couple stopped without reason after one ADAPT session; this couple was considered as a dropout. One partner did not provide consent without reason. As a result, the final sample for the analyses involved 16 veterans (M_{age} = 40.9 years, SD_{age} = 4.15; all male) and 15 partners (M_{age} = 36.4 years, SD_{age} = 3.72; all female). The mean number of children was 2.1 (*SD* = .85), with a mean age of 8.25 years (*SD* = 3.19).

The TAU group included 17 male veterans. Five veterans were excluded as they did not have children, resulting in a final sample of 12 veterans (M_{age} = 43.54, SD_{age} = 7.05; all male). The mean number of children was 1.94 (*SD* = .82), with a mean age of 9.31 years (*SD* = 4.09). The demographics for both groups are summarized in Table 1.

Table 1 *Demographic Characteristics for both Groups*

Outcome	**ADAPT**		**TAU**
	Veteran (*n* = 16)	**Partner (*n* = 15)**	**Veteran (*n* = 12)**
	M (*SD*) or number	*M* (*SD*) or number	*M* (*SD*) or number
Age (years)	40.9 (4.15)	36.4 (3.72)	43.54 (7.05)
Male	16	0	12
Educational level*			
Low	2	1	3
Middle	4	5	5
High	4	4	4
Deployment site			
Only Bosnia	7	-	6
Only Afghanistan	5	-	4
More sites**	3	-	2

Note. Veterans were deployed no more than three time.

*Educational level: low = up to lower secondary education, middle = completed upper secondary education, high = secondary higher education or university.

**One veteran was deployed to multiple sites, including Bosnia, Afghanistan and Kosovo.

Treatment

After Deployment Adaptive Parenting Tools (ADAPT)

ADAPT was provided biweekly in 4-hour sessions, with a maximum treatment duration of 4 months and the participation of three to five couples. Five core parenting skills were addressed: skill encouragement, positive involvement, family problem-solving, monitoring, and effective discipline. Sessions consisted of psychoeducation, active discussions, role playing and homework exercises. ADAPT is an extension of PMTO, tailored for military families by adding mindfulness and emotion coaching techniques to address post-deployment (PTSD associated) emotion regulation problems and difficulties with effectively responding to children's emotions (Gewirtz et al., 2014). Moreover, the content of the sessions is embedded in the post-deployment context (e.g., by discussing parenting problems developed after deployment). ADAPT was delivered by two licensed facilitators who received training and supervision from PMTO qualified trainers. All sessions were videotaped and supervised to assure treatment integrity.

Treatment As Usual (TAU)

TAU consisted of regular individualized PTSD treatment, including interventions such as prolonged exposure (Powers et al., 2010), Eye Movement Desensitization and Reprocessing (EMDR; Shapiro, 2012), and (group) psychoeducation. Specific treatment elements varied among veterans, and there was no standardized treatment protocol. Veterans in the TAU group received a combination of these treatment elements as part of their usual care. Due to the variability in treatment received, it was not possible to precisely identify the particular treatment elements that each veteran adhered to within the TAU group.

Measures

Primary Outcome Measure

Family Functioning. The Systematic Clinical Outcome and Routine Evaluation (SCORE-15; Stratton et al., 2014) is a 15-item measure of family functioning in terms of family strengths, difficulties, and communication. Participants rated how much each item described their family on a 5-point scale (1 = very well, 5 = not at all). An example item is: "In our family, we can trust each other". A higher mean score across all items indicated more family problems. The SCORE-15 demonstrated acceptable internal consistency ranges across timepoints for both groups: ADAPT (veterans, α = .74 to .80 and partners, α = .72 to .78) and TAU (α = .71 to .78).

Secondary Outcome Measures

Child Adjustment. The parent version of the Strengths and Difficulties Questionnaire (SDQ; Goodman & Goodman, 2009) is a 25-item parent report measure of emotional and behavioral problems of children aged 4 to 17. Items were rated on a 3-point scale (0 = not true, 2 = certainly true). An example item is: "My child often has temper tantrums or hot tempers". A higher mean score across all items indicated less child adjustment. The SDQ demonstrated

acceptable internal consistency across timepoints for both groups: ADAPT (veterans, α = .73 to .76 and partners, α = .74 to .79) and TAU (α = .71 to .76).

Parental Attachment. The Experiences in Close Relationships Questionnaire (ECR; Sibley et al., 2005) is a 36-item measure of romantic attachment with two subscales: anxiety over abandonment (attachment anxiety) and avoidance of intimacy (attachment avoidance). Items were rated on a 7-point scale (1 = strongly disagree, 7 = strongly agree). Example items of the anxiety and avoidance subscales are, respectively: "I need a lot of reassurance that I am loved by my partner" and "I try to avoid getting too close with my partner". Higher mean subscale scores indicate more attachment anxiety or attachment avoidance. Both subscales showed good to excellent internal consistency across timepoints for both groups: ADAPT (attachment anxiety: veterans, α = .85 to .88 and partners, α = .86 to .90; attachment avoidance: veterans, α = .85 to .91 and partners, α = .87 to .92) and TAU (attachment anxiety: α = .88 to .89; attachment avoidance: α = .86 to .88).

Mediators

Emotion Dysregulation. The Difficulties in Emotion Regulation Scale (DERS; Gratz & Roemer, 2004) is a 36-item self-report measure of emotion dysregulation. Participants rated how much each item applied to them on a 5-point scale (1 = almost never, 5 = almost always). An example item is: "When I am upset, I can't control my behavior". A higher mean score across all items indicated more emotion dysregulation. The DERS demonstrated good internal consistency across timepoints for veterans in both groups: ADAPT (α = .83 to .88) and TAU (α = .83 to .87).

Mentalization. The Reflective Functioning Questionnaire (RFQ) is an 8-item self-report measure of reflective functioning as an operationalization of mentalization (Fonagy et al., 2016) and has two subscales: uncertainty (uncertain reflective functioning) and certainty (certain reflective functioning) regarding mental states. Items were rated on a 7-point scale (1 = strongly disagree, 7 = strongly agree). Example items of the uncertain and certain reflective functioning are, respectively: "Sometimes I do things without really knowing why" and "People's thoughts are a mystery to me". Items were recoded such that higher levels of uncertain reflective functioning and lower levels of certain reflective functioning indicated maladaptive mentalizing. Both subscales demonstrated acceptable internal consistency across timepoints for both groups: ADAPT (uncertain reflective functioning: veterans, α = .71 to .74 and partners, α = .72 to .76; certain reflective functioning: veterans, α = .72 to .74 and partners, α = .73 to .77) and TAU (uncertain reflective functioning: α = .72 to .75; certain reflective functioning: α = .73 to .77).

Covariate

PTSD Symptom Severity. The PTSD checklist (PCL-5; Blevins et al., 2015) is a 20-item self-report measure of veterans' PTSD symptom severity. Veterans rated to what degree symptoms were disrupting in the past month on a 5-point scale (1 = not at all, 5 = extremely). An example item is: "Do you have bad dreams about the traumatic experiences?". A higher mean score across all items indicated higher severity. The PCL-5 demonstrated excellent internal consistency for veterans in both groups: ADAPT (α = .96) and TAU (α = .94).

Design and Procedure

To replicate clinical practice, an open-label non-randomized design was utilized, in which the decision to follow ADAPT or TAU was determined by clinical referral. After referral, potential participants received written study information. They were then contacted by phone to clarify the study procedure and to determine whether they met the eligibility criteria. If participants decided to participate, they provided informed consent. Data were collected through self-report questionnaires at three timepoints: baseline (within two weeks before treatment started), 4-month post-baseline, and 10-month post-baseline. Questionnaires took approximately 60 minutes (veterans) or 40 minutes (partners) to complete and were filled in individually in a research room. The study procedure was approved by the Institutional Ethics Review Board (CWO/2104) of the treatment facility and the Medical Ethics Committee of the University of Utrecht, the Netherlands (number 17/829).

Analytical Strategy

Statistical analyses were run with SPSS 25.0. First, descriptive statistics (*M* and *SD*) of the indices were calculated. One-sample Kolmogorov-Smirnov (K–S) tests were run to assess whether variables were normally distributed and outliers were removed (i.e., absolute *z*-values larger than ± 3.00; Tabachnick et al., 2007).

Second, to evaluate social functioning following ADAPT, separate repeated measures ANOVAs for veterans and partners were conducted to determine changes in the primary and secondary outcomes with Time (baseline, 4-month post-baseline, and 10-month post-baseline) as a within-subject factor.

Third, to compare veteran outcomes with data from veterans undergoing TAU, repeated measures ANOVA was run to assess Group (ADAPT vs. TAU veterans) × Time effects for the primary and secondary outcomes.

Fourth, to test the mediating role of emotion regulation and mentalization (uncertain and certain mentalization) in the association between Group and social functioning, Hayes' PROCESS macros (Hayes, 2018) was used. We tested the indirect effects of the mediators on social functioning with Group as predictor. To minimize temporal overlap between mediators and outcomes, we used 4-month post-baseline minus baseline scores for the mediators and 10-month post-baseline minus baseline scores for the social functioning outcomes. Bootstrap modeling (5000 samples) calculated indirect effects within a 95% confidence interval level.

All analyses of veterans were controlled for pre-treatment PTSD symptom severity by including the baseline index as a covariate. Post-hoc comparisons were Bonferroni corrected for multiple testing. Cohen's *d* was used as the index of effect size (Cohen, 2013), in which *d* thresholds were interpreted as small (0.20), medium (0.50), or large (0.80).

RESULTS

Descriptive Statistics

Descriptive statistics for ADAPT and TAU groups across timepoints are shown in Table 2. Variables were normally distributed (K–S tests, *p*'s > .05). No outliers were detected.

Two couples in the ADAPT group were excluded from analyses involving the 10-month post-baseline measure due to missing data. Pairwise comparisons indicated no significant pre-treatment outcome differences between veterans in the ADAPT and TAU groups (*p*'s > .05).

Table 2 *Descriptive Statistics for all Study Variables for both Groups Across Timepoints*

Variable	ADAPT		TAU
	Veteran (*n* = 16)	**Partner (*n* = 15)**	**Veteran (*n* = 12)**
	M (*SD*)	*M* (*SD*)	*M* (*SD*)
Family Dysfunctioning			
Baseline	2.78 (0.74)	2.28 (0.48)	3.20 (0.75)
4-month post-baseline	2.25 (0.38)	2.26 (0.68)	3.27 (0.83)
10-month post-baseline	2.07 (0.49)	2.10 (0.43)	3.08 (0.81)
Attachment anxiety			
Baseline	3.21 (1.36)	2.92 (1.31)	2.48 (1.11)
4-month post-baseline	2.93 (1.21)	3.00 (1.08)	2.70 (1.23)
10-month post-baseline	3.20 (1.56)	2.59 (1.02)	2.95 (1.33)
Attachment avoidance			
Baseline	2.97 (1.29)	2.62 (0.97)	3.33 (1.38)
4-month post-baseline	2.94 (1.40)	2.63 (0.85)	3.15 (1.32)
10-month post-baseline	2.95 (0.96)	2.33 (0.74)	3.22 (1.45)
Child functioning			
Baseline	1.19 (0.22)	1.10 (0.25)	1.05 (0.29)
4-month post-baseline	1.09 (0.23)	1.46 (0.24)	1.04 (0.32)
10-month post-baseline	1.09 (0.29)	0.97 (0.27)	0.98 (0.30)
Emotion Dysregulation			
Baseline	2.89 (0.59)	-	2.85 (0.76)
4-month post-baseline	2.72 (0.75)	-	2.61 (0.85)
10-month post-baseline	2.54 (0.81)	-	2.64 (0.81)
Uncertain reflective functioning			
Baseline	1.45 (0.71)	0.44 (0.38)	1.15 (0.73)
4-month post-baseline	1.13 (0.63)	0.27 (0.28)	0.99 (0.69)
10-month post-baseline	1.03 (0.91)	0.43 (0.39)	1.01 (0.85)
Certain reflective functioning			
Baseline	0.43 (0.69)	1.38 (0.72)	0.47 (0.47)
4-month post-baseline	0.51 (0.57)	1.59 (0.87)	0.70 (0.87)
10-month post-baseline	0.70 (0.71)	1.47 (0.81)	0.72 (0.85)
PTSD symptom severity			
Baseline	2.31 (1.06)	-	2.28 (0.82)

Note. The *n* for veterans and partners in the ADAPT group was 14 and 13, respectively, for the 10-month post-baseline measures.

Effects of ADAPT on Social Functioning in Veterans and Partners

For veterans, there was a significant time effect on family functioning, $F(2, 24) = 4.88$, $p = .01$, $\eta^2 = .29$. In line with Figure 1, post-hoc analyses indicated a significant improvement in family functioning from baseline to 4-month post-baseline, $t(13) = 3.873$, $p < .001$, $d = .97$, 95% CI [.36, 1.56], and from baseline to 10-month post-baseline, $t(13) = 3.251$, $p = .003$, $d = .87$, 95% CI [.24, 1.48]. No significant difference was observed between the 4-month and 10-month post-baseline timepoints ($p > .05$).

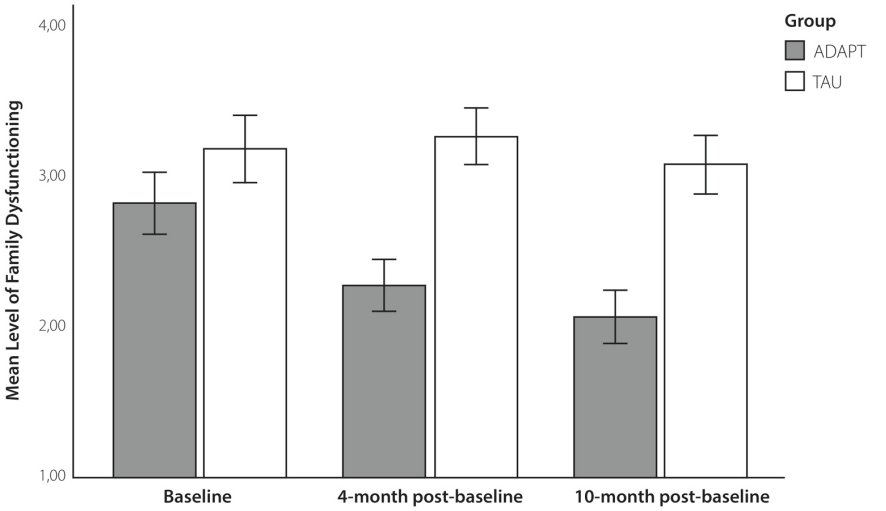
For partners, there was no significant time effect on family functioning ($p > .05$). Exploratory post-hoc analyses yielded a significant improvement in family functioning from baseline to 10-month post-baseline, $t(12) = 2.098$, $p = .04$, $d = .58$, 95% CI [-.02, 1.16]. No significant differences were observed between baseline and the 4-month post-baseline, as well as between the 4-month and 10-month post-baseline timepoints (p's $> .05$).

For both veterans and partners, no significant time effects were observed for child functioning, attachment anxiety, and attachment avoidance (p's $> .05$).

Effects of ADAPT on Social Functioning in Veterans in the ADAPT vs TAU Groups

There was a significant Group × Time interaction effect on family functioning, $F(2, 48) = 3.203$, $p = .04$, $\eta^2 = .12$. In line with Figure 1, post-hoc analyses indicated no significant between-group differences in baseline family functioning, yet family functioning significantly improved in the ADAPT group relative to the TAU group at 4-month post-baseline, $t(25) = 4.622$, $p < .001$, $d = -1.73$, 95% CI [-2.58, -.85], as well as at 10-month post-baseline, $t(25) = 4.179$, $p < .001$, $d = -1.61$, 95% CI [-2.47, -.72]. There were no significant main or interaction effects for child functioning, attachment anxiety, and attachment avoidance (p's $> .05$).

Figure 1 *Mean Level of Family Dysfunctioning as Reported by Veterans in the ADAPT and TAU Groups Across Timepoints*



Note. Error bars represent standard errors. Abbreviations: ADAPT = After Deployment Adaptive Parenting Tools, TAU = individualized PTSD focused treatment as usual.

Mediation by Emotion Regulation and Mentalization of the Association Between Group (ADAPT vs TAU) and Social Functioning

Three mediation analyses examined whether emotion dysregulation, uncertain reflective functioning, and certain reflective functioning mediated the associations between Group and social functioning. The direct pathway was identical in all analyses, indicating that ADAPT treatment predicted higher family functioning, $\beta = -1.009$, $t(2) = -3.87$, $p < .001$. Group did not predict the mediators, nor did the mediators predict family functioning (p's $> .05$). Indirect effects were still tested as they could still occur in the absence of significant direct pathways (Hayes, 2018). No indirect effects were found, indicating the absence of mediation in all analyses, evidenced by non-significant effects for emotion regulation, certain reflective functioning, and uncertain reflective functioning, given that the CI of these indices did overlap with zero.

DISCUSSION

The goal of this pilot study was to assess the clinical effectiveness of ADAPT, a parenting intervention tailored to veteran families, by examining its effects on social functioning in treatment-seeking veterans and their partners. The results for our primary outcome measure showed a reduction in family problems for veterans participating in ADAPT at post-treatment and 6-months follow-up. There was no difference between post-treatment and 6-months follow-up, suggesting that the treatment effects sustained over six months. Notably, when

comparing veterans receiving individualized TAU to those receiving ADAPT, no such reduction in family problems was observed. For partners participating in ADAPT, although the overall time effect of ADAPT on family functioning did not reach statistical significance, exploratory pairwise post-hoc analyses revealed a reduction in family problems at 6-months follow-up. Regarding our secondary outcome measures, no significant effects were found on parent reported child functioning and parental attachment. Lastly, mediation analyses yielded no mediation effects of emotion regulation and mentalization in the treatment outcomes of ADAPT compared to TAU.

The findings of this study provide initial support of the clinical effectiveness of ADAPT in improving family functioning, involving family strength, experienced familial difficulties and effective communication patterns. This improvement is evidenced by a direct and sustained reduction in post-treatment family problems in veterans, and the suggestion of a decrease in family problems in partners at 6-month follow-up. The faster reduction in family problems among veterans compared to partners is not fully understood. One possible explanation is that central processes addressed by ADAPT, such as parenting and emotion regulation (Gewirtz et al., 2014), might be more disrupted in veterans relative to their partners. Indeed, combat-related PTSD symptomatology in veterans is known to adversely impact parenting and emotion regulation (Gewirtz et al., 2018; Kritikos et al., 2019). Consequently, veterans may derive more immediate benefits from the ADAPT program, as it particularly targets parenting and emotion regulation – implicating that ADAPT might be particularly well-suited for veterans. Nonetheless, improved family functioning was observed in both veterans and partners, converging with evidence that has shown the effectiveness of PMTO-based interventions, like ADAPT, in addressing social functioning (for a meta-analytic review, see Cai et al., 2022). Importantly, our study extends prior research by showing the potential effectiveness of ADAPT in enhancing social functioning within a clinical context, particularly among treatment-seeking veteran families experiencing PTSD associated social problems, also when compared to individualized TAU. Taken together, these findings indicate that ADAPT might be clinically effective in addressing post-deployment social difficulties in families, which is important given that deployment-related PTSD can negatively impact social functioning in veteran families (Creech et al., 2014; Erbes et al., 2011; Khaylis et al., 2011).

We found no effect of ADAPT on child functioning, contrary to ample research demonstrating the effectiveness of PMTO-based interventions in enhancing child functioning, including the reduction of internalizing and externalizing problems (e.g., Cai et al., 2022). Considering the association between PTSD symptomatology and social problems in veteran families (e.g., Kritikos, 2019), child functioning might be particularly hard to address in the studied clinical population, given that the severity level of child maladjustment might be high in this group. Indeed, the mean scores on our child adjustment index, with the SDQ ranging from 0.98 to 1.46, were above the SDQ clinical cut-off based on recent Dutch norms (Theunissen et al., 2022), suggesting heightened child maladjustment. The lack of a treatment effect on child functioning might be explained by the notion that observable improvements in child functioning resulting from enhanced parenting may require time, especially when higher levels of child maladjustment are present. Further research using longer timeframes

is essential to ascertain whether the effectiveness of ADAPT varies across different severity profiles of child adjustment.

A potential explanation for the lack of effect on parental attachment is that ADAPT is not set up to facilitate parental attachment processes. Whilst couples are stimulated to collaborate in practicing parenting skills as a parental unit (Gewirtz et al., 2011), ADAPT does not directly target attachment systems including interpersonal anxiety or avoidance. To target attachment processes more effectively, one strategy might be to expand ADAPT with sessions focused on these processes. This approach is consistent with other family-based programs for veterans in the Dutch mental health care, such as multifamily therapy (MFT), a mentalization based program for improving social functioning in which several veteran families participate in sessions. MFT also includes sessions focused on parental relationship functioning (e.g., van Ee et al., 2018). Thus, while we found no treatment effect on parental attachment, prospective research should examine whether ADAPT can address parental attachment, for example by incorporating additional treatment sessions specifically targeting parental attachment.

We found no support for the hypothesis that the treatment effect of ADAPT was mediated by emotion regulation and mentalization, and no direct treatments effects were observed on these putative mediators in the first place. The absence of treatment effects on emotion regulation is consistent with some studies (e.g., Gewirtz et al., 2016), yet diverges from others (e.g., Gewirtz et al., 2018, 2019). Mentalization has not been examined previously in the context of ADAPT studies. The 10-month duration of our study may explain the lack of direct effects on the mediators; changing emotion regulation and mentalizing might take more time. The need for extended timeframes to detect mediation effects is consistent with findings from other PMTO-based studies, such as Forgatch and DeGarmo (1999) and Gewirtz et al. (2018). They noted that extended study periods are required for parenting practices to consolidate and to subsequently mediate changes in child adjustment. Although we did not find mediation effects of emotion regulation and mentalization, it is possible that such effects will take place and be found in a longer study.

Limitations

This study had some limitations. First, participants were not randomly assigned to the ADAPT and TAU groups. The assignment to ADAPT or TAU was based on clinical referral, replicating clinical practice. Although no pre-treatment differences were observed in the examined indices and pre-treatment PTSD differences were adjusted for, the groups may have differed in other ways that we did not assess. For instance, compared to the TAU group, participants in the ADAPT condition might have been more motivated to address social difficulties, potentially making a referral to ADAPT more convenient. The absence of randomization limits the internal validity of this study, but it does enhance external validity by closely resembling clinical practice (Tabachnick et al., 2007). However, to demonstrate efficacy, comparing ADAPT versus TAU using a randomized controlled trial or single case experimental study designs are needed.

Second, due to the variability of the treatments that the participants in the TAU group received, it was not possible to precisely identify the treatment elements adhered to by each veteran, such as EMDR, prolonged exposure or psychoeducation. Our preliminary evidence

suggests that ADAPT as a couple-based parenting intervention might be more effective to improve family functioning than individual TAU. However, it will be interesting to determine the clinical effectiveness of ADAPT by comparing it with more specific individual treatment modalities.

Third, our sample was small, which limits the statistical power to detect effects. Particularly, results for family functioning exhibited moderate to large effects, while child functioning and parental attachment mostly displayed small effects, hence requiring larger samples to detect changes. Bootstrapping techniques might address power-related issues in small samples (e.g., Hayes & Scharkow, 2013), but identifying mediation effects would require larger samples sizes (e.g., Fritz & McKinnon, 2007). Future studies should use larger samples, particularly to probe the effects of ADAPT on child functioning and parental attachment, and mediation by emotion regulation and mentalization.

Conclusion

The current pilot study yielded initial evidence of the clinical effectiveness of ADAPT to improve family functioning, as evidenced by reduced family problems among treatment-seeking veterans and their partners. It implies that ADAPT can be clinically effective to alleviate post-deployment social difficulties. This is important given that deployment-related PTSD can negatively impact social functioning in veteran families (Kritikos et al., 2019). Because our findings are preliminary, future research should further determine the effects of ADAPT on social functioning and further examine the mediating processes that explain these effects, preferably using a larger scaled randomized controlled design.

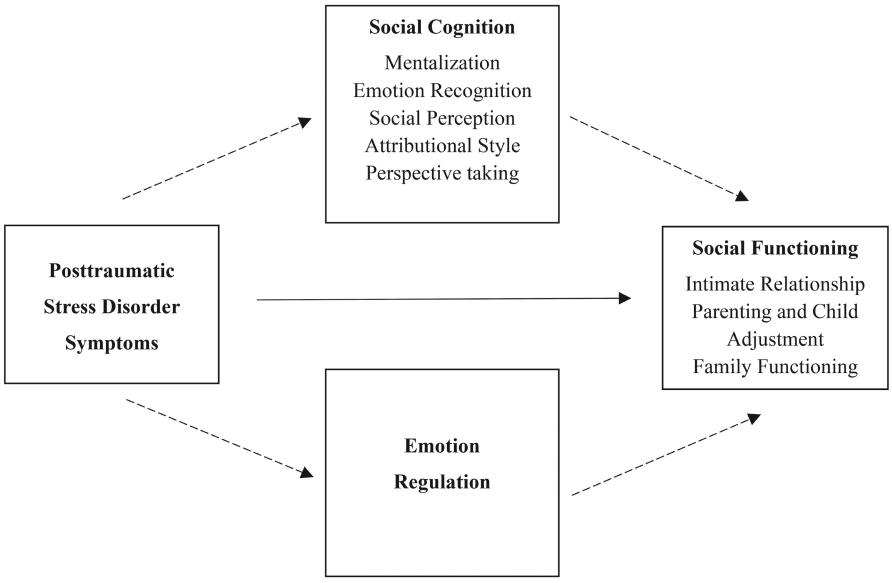
CHAPTER 6

General Discussion

Traumatic experiences such as domestic violence, combat, or natural disasters can lead to the development of PTSD (American Psychiatric Association, 2013). The impact of PTSD extends beyond traumatized individuals and also affects their social context, such as family life (Kritikos et al., 2019; Scoglio et al., 2022). PTSD may compromise key processes in human social functioning, including the ability to perceive and understand social situations (Lavoie et al., 2014; Sharp et al., 2012) and the ability to act in an emotionally adequate manner (Seligowski et al., 2015), contributing to social problems. Insight into these social cognitive and emotion regulation processes is critical for understanding PTSD related social difficulties. This insight can guide clinical interventions to effectively target impairments in social cognition and emotion regulation, ultimately improving the social functioning of traumatized individuals.

However, research on the role of social cognition and emotion regulation processes in PTSD related social difficulties is limited. The overarching aim of this dissertation was to gain more insight into the association between PTSD and social functioning and to explore the role of social cognition and emotion regulation in traumatized individuals (see Figure 1). The first objective was to examine social cognitive and emotion regulation processes related to PTSD. The second objective was to examine the effect of treatment-induced changes in social cognition and emotion regulation on the social functioning of traumatized individuals. This final chapter integrates the main findings from the four studies addressing these objectives. Directions for future research and implications for clinical practice are presented as well.

Figure 1 *Hypothesized Study Model*



Integration of Findings

PTSD and Social Functioning: The Role of Social cognition and Emotion Regulation

Although the association between PTSD and social functioning is well documented, the mechanisms underlying this association remain largely understudied. This dissertation offers a first step in conceptualizing social cognition and emotion regulation as potential mechanisms underlying social difficulties in traumatized individuals. Preliminary evidence suggests an association between PTSD symptoms, such as heightened arousal and emotional reactivity, and impaired social cognitive and emotion regulation abilities (e.g., Lavoie et al., 2014; Seligowski et al., 2015; Stevens & Javanovic, 2019). The studies of this dissertation extend previous research and provide support for a contributing role of problems with social cognition and emotion regulation in the social functioning of individuals who have experienced trauma.

We found an overall deficit in social cognition in traumatized individuals diagnosed with PTSD compared to non-clinical controls. This deficit was primarily driven by impairments in mentalization, and to some extent by problems with social perception (Chapter 2). PTSD symptoms may hinder reflective thoughts about self and others due to increased stress and arousal, impairing the ability to interpret behavior in terms of mental states (Fonagy et al., 2007; Luyten et al., 2020). Traumatized individuals may also have a narrowly oriented attention bias towards social threat which might impair the processing and interpretation of the broader social context (Bomyea et al., 2017).

Furthermore, we found support for the presence of a mentalization deficit as we demonstrated PTSD related impairments in perspective-taking (Chapter 3), which is a requisite ability for mentalization (e.g., Hendriks et al., 2016). This aligns with previous research suggesting that difficulties in flexibly disengaging from one's own perspective may hinder the transition from self-focus to adopting another perspective (de Guzman et al., 2016; Hendriks et al., 2016). Unexpectedly, we did not find a mediating role of mentalization in the association between PTSD and family functioning difficulties (Chapter 4). This differs from previous research that has shown an association between PTSD related mentalization deficits and poor social functioning (e.g., Mazza et al., 2012, 2015; Nazarov et al., 2014). The absence of mediation might be explained by the fact that no PTSD associated social difficulties were found in the first place in the study of Chapter 4. As ample studies have shown mentalization deficits associated with PTSD, it can be expected that these deficits further contribute to the social problems already associated with PTSD symptoms (e.g., Creech & Misca, 2017; Scoglio et al., 2022) and poor mentalization capacities (e.g., Fonagy et al., 2007; Gergely & Unoka, 2008). Our findings emphasize the role of social cognition, particularly problems with mentalization and social perception, as important clinical factors in PTSD associated social problems.

Our findings also suggest that problems with emotion regulation may play an important role in the social functioning of individuals with PTSD, as we found that emotion dysregulation mediated the association between PTSD and family problems (Chapter 4). This corresponds with studies that have shown a general emotion dysregulation problem in PTSD (for a meta-analysis, see Seligowski et al. 2015). Traumatized individuals may employ specific emotion regulation strategies, such as thought suppression or expressing anger, that offer immediate

relief by temporarily reducing negative feelings. However, such strategies may eventually lead to the maintenance or even increase of these unwanted experiences over the longer term (Khan et al., 2021). Impaired emotion regulation capacities, such as the tendency to avoid emotional experiences and not being able to inhibit impulsive behavior, are related to less family engagement (Brockman et al., 2016; Reddy et al., 2011) and more verbal and physical aggression toward intimate partners (Galovski & Lyons, 2004). Thus, our findings indicate that emotion regulation deficits also represent an important factor in PTSD associated social problems. Recent evidence indicates that emotion regulation difficulties prospectively predict PTSD symptom severity during individualized PTSD treatment (Meuleman et al., 2024). Our findings indicate the clinical importance of addressing emotion regulation problems not only at an individual level but also at a broader social functioning level in the treatment of traumatized individuals.

Taken together, our findings largely support the role of social cognitive processes, including mentalization and social perception, and emotion regulation difficulties, in the social functioning of individuals with PTSD, as illustrated in Figure 1. These findings are of clinical importance because they can clarify the underlying mechanisms of the well-documented association between PTSD and social functioning. The presented model offers a theoretical and clinical framework for the examination of social processes in the social functioning of traumatized individuals. A further examination of this model will enhance our understanding of how PTSD not only impacts individuals, but also their social context.

Impact of Treatment-Induced Changes of Social Cognition and Emotion Regulation

Given that impairments in social cognition and emotion regulation may impact the social functioning and broader social context of individuals, I examined whether treatment-induced changes in these processes would lead to less social functioning problems. I conducted a pilot study of the After Deployment Adaptive Parenting Tools (ADAPT) program, an intervention program addressing PTSD related social difficulties, possibly through mentalization and emotion regulation (Chapter 5). This study provided initial evidence of improved family functioning. However, the results did not support the hypothesis that the treatment effects were mediated by changes in mentalization or emotion regulation in traumatized individuals. The lack of effects of the intervention on emotion regulation is in line with some earlier studies (e.g., Gewirtz et al., 2016), but different from other studies (e.g., Gewirtz et al., 2018). Mentalization has not been examined previously in the context of ADAPT studies. As considered in Chapter 5, the pilot study may have been too short (10 months) for an effect on the mediators; changing emotion regulation and mentalizing might take more time. This would be consistent with other studies of mediating processes in the same intervention model (e.g., Forgatch & DeGarmo, 1999; Gewirtz et al. 2018). Given the preliminary nature of our findings, future research should further examine the effects of interventions targeting PTSD associated social difficulties and examine the mediating processes that explain these effects, preferably using longer time frames with more follow-up measurements.

In a broader context, our findings suggest that social functioning problems may decrease more over time in ADAPT than in traditional individualized PTSD therapy. Individual PTSD

therapy primarily focuses on reducing PTSD symptoms without explicitly addressing social functioning (see, for reviews, Charney & Marx, 2012; Scoglio et al., 2022). However, symptom reduction does not consistently lead to improvements in social functioning (e.g., Sayer et al., 2010). This highlights the importance of broadening PTSD therapy to include the assessment and treatment of social functioning. Such an integrative approach will benefit PTSD treatment, addressing commonly associated social difficulties in individuals who have experienced trauma. Targeting social processes also has the potential to reduce the development of PTSD, given that social support is a buffer against posttraumatic stress responses (Brewin et al., 2000; Ozer et al., 2003; Wang et al., 2021).

Strengths, Limitations and Future Directions

The studies in this dissertation had several strengths. First, various methodological approaches were applied, allowing us to examine cross-sectional data, mediating processes, and treatment effects. Measurements were mostly conducted using different types of instruments (e.g., task-based and self-report), enhancing the robustness of our findings. For example, mentalization was assessed through questionnaires and a reaction time-based computer task, capturing explicit/conscious as well as implicit/automatic aspects of mentalization. Third, I used patient samples, thereby increasing the generalizability of my findings to clinical practice.

There were also limitations. First, I mostly used cross-sectional designs, making it not possible to draw conclusions about the direction of effects between PTSD, social functioning, social cognition, and emotion regulation. Prior research suggests that PTSD symptoms have a negative impact on social cognition and emotion regulation, consequently contributing to subsequent social difficulties. This converges with the social erosion model, which posits that PTSD symptoms precede the onset of social difficulties (Shallcross et al., 2016). Conversely, in line with the social causation model, problems with interpersonal abilities, such as inferring behavior based on mental states or regulating emotions, may also predispose individuals to PTSD following trauma (Kaniasty & Norris, 2008). For example, Sharp et al. (2012) proposed that early insecure attachment may lead to negative views of the self and others as well as emotional regulation difficulties. This could increase the risk of developing psychiatric symptoms, including PTSD, later in life after experiencing trauma. Longitudinal designs are needed to determine the temporal relationships and directionally between variables, enhancing our understanding of the etiological pathways involved in the development of PTSD related social difficulties over time.

Second, three of the four studies mostly or exclusively included samples of veterans with a history of adult war trauma (Chapter 3, 4, 5). This limits the generalizability of my findings to the social functioning of traumatized individuals with different trauma histories. I addressed the role of trauma history in my meta-analysis by comparing studies involving samples with predominantly war trauma with studies including participants exposed to interpersonal trauma (Chapter 2). I found no differences in social cognitive performance, although it is important to note that this analysis was conducted post-hoc for exploratory purposes and was likely underpowered. It is still possible that different trauma histories have different effects on social cognition and emotion regulation. For example, childhood abuse may particularly lead to

negative views of self and others, contributing to mentalization problems (Sharp et al., 2012). As another example, early onset chronic interpersonal trauma had a more negative impact on emotion regulation than non-interpersonal, late onset interpersonal, and early onset singular interpersonal trauma among 616 trauma survivors (Ehring & Quack, 2010). Future studies should compare samples with diverse trauma histories to ascertain the extent to which the contributions of social cognition and emotion regulation to PTSD associated social difficulties depend on trauma etiology.

Third, although some studies in our meta-analysis (Chapter 2) controlled for neurocognitive functioning and psychiatric comorbidity (e.g., Mazza et al., 2012; Nazarov et al., 2014; Nietlisbach et al., 2010), possible confounding effects of such or other unmeasured factors were not taken into account. I did not include the presence of psychiatric diagnoses or clinical levels of psychological complaints beyond PTSD. This might be important, given that mental health complaints other than PTSD may also negatively affect the social functioning of traumatized individuals (e.g., Ayuso-Mateos et al., 2010; Beiter et al., 2015; Remes et al., 2016). Future research on social cognition and emotion regulation of traumatized individuals should also include other factors that can lead to social problems.

Fourth, I defined PTSD associated social functioning focused on the family level, but except for the study in Chapter 5, my findings were not based on (dyadic) outcome data from family members. In Chapter 5, in which I tested an intervention for PTSD associated social difficulties, veteran patients reported a direct and sustained reduction in post-treatment family problems, and their partners reported a decrease in family problems at the 6-month follow-up. Thus, considering potential differences in perceptions of (treatment-induced changes in) PTSD associated social problems among family members, prospective research should incorporate the perspectives of multiple family members including children when examining social functioning in PTSD.

Fifth and finally, future research is needed to replicate and further examine my model (Figure 1). Social cognition, emotion regulation, and social functioning are multidimensional constructs, but I was not able to measure all their aspects. For instance, I focused on the cognitive dimension of mentalizing, but affective aspects of mentalization, including the ability to share the feelings of others (Parlar et al., 2014; Warrier et al., 2018), might also be associated with the social functioning of traumatized individuals. I also measured general emotion dysregulation, although research suggests that traumatized individuals may particularly use specific maladaptive strategies, such as thought suppression, experiential avoidance, and worry (e.g., Ehring et al., 2016). Thus, while evidence supports PTSD associated deficits and a contributing role of social cognition and emotion regulation, it is important to test the complete model by taking the multidimensionality of these constructs into account. This requires larger samples and a statistical approach that considers the overall model fit, such as structural equation modeling. This will further enhance our understanding of the key processes involved in PTSD associated social difficulties.

Implications

This dissertation builds on previous research indicating that PTSD not only affects individuals but also their social environment, such as their family life. The results of this dissertation suggest that social cognitive and emotion regulation processes may be disrupted in traumatized individuals, which may contribute to their social difficulties. While PTSD treatment traditionally focuses on the individual, we should also focus on social functioning. My findings also suggest that social cognition and emotion regulation are key factors in the treatment of PTSD associated social problems. Given the potential disruption of such processes in traumatized individuals, problems with social cognition and emotion regulation should be assessed and addressed in clinical interventions targeting PTSD related social difficulties. It will be meaningful to address specific social cognitive processes, particularly mentalization and social perception. Interventions targeting specific social cognitive processes have shown to be more effective than broad-based or comprehensive interventions that target multiple social cognitive processes at once (see, for a meta-analysis, Roelofs et al., 2016).

Conclusion

The overarching aim of this dissertation was to gain more insight into the association between PTSD and social functioning and to examine the role of social cognition and emotion regulation in traumatized individuals. I found an overall deficit in social cognition in traumatized individuals, with specific social cognitive deficits in mentalization and social perception. My findings indicated that emotion regulation deficits represent another important factor in PTSD and associated social problems. Initial evidence did not show treatment-induced mediation effects of emotion regulation and mentalization, but it is possible that such effects will take place over a longer time frame, given that these processes probably need time to change. My findings emphasize that social cognition and emotion regulation processes play an important role in PTSD associated social problems and need to be addressed in clinical practice.

English Summary

Many individuals experience potential traumatic events in their lifetime, such as physical violence, sexual abuse, or life-threatening situations (de Vries & Olff, 2009; Koenen et al., 2017). It is estimated that 8% of the general population develops a posttraumatic stress disorder (PTSD). PTSD is characterized by the reexperiencing of the traumatic events through repetitive intrusive thoughts or flashbacks, avoidance of trauma-related stimuli, negative alterations in mood and cognitions, and hyperarousal (American Psychiatric Association, 2013). The consequences of PTSD extend beyond the individual, also impacting their social environment, such as family life (Kritikos et al., 2019; Scoglio et al., 2022). Thus, it is important to study PTSD and its association with social functioning, and the processes underlying this association.

Prior research suggests that PTSD symptoms, such as hyperarousal, can compromise key processes in human social functioning, including the ability to perceive and understand social situations (social cognition; Lavoie et al., 2014; Sharp et al., 2012) and the ability to act in an emotionally appropriate manner (emotion regulation; Seligowski et al., 2015). Insight into these social cognitive and emotion regulation processes is critical for understanding the social difficulties of traumatized individuals. This insight can also be applied to improve or complement trauma treatment, which is often individualized and symptom-focused, with (systemic) interventions targeting the social functioning of traumatized individuals. However, research on the role of social cognition and emotion regulation in PTSD related social difficulties is limited. The overarching aim of this dissertation was to examine the association between PTSD and social functioning and the role of social cognition and emotion regulation in traumatized individuals. The first objective was to examine social cognitive and emotion regulation processes related to PTSD. The second objective was to examine the effect of treatment-induced changes in social cognition and emotion regulation on the social functioning of traumatized individuals. These two research objectives guided the studies in the chapters of this dissertation.

Chapter 2 describes a meta-analysis of differences between individuals diagnosed with PTSD and non-clinical controls in four social cognitive domains: mentalization (interpretation of behavior of the self and others based on mental states), emotion recognition (identification and recognition of emotional states from social stimuli, such as facial expressions), social perception (recognition of social regulations, rules, and goals in social situations), and attributional style (the explanation of social situations). The meta-analysis included 19 studies with 565 patients and 641 controls. The analyses yielded a deficit for overall social cognition, with a medium effect size, in the PTSD group compared to controls. This deficit was consistent across trauma types (war vs. interpersonal) and did not differ by gender or age. The PTSD group performed lower, with large effect sizes, on mentalization and social perception, but the findings regarding social perception should be interpreted with caution as only one study examined this. There was no group difference for emotion recognition and attributional style. The findings indicate that social cognition is a potentially important clinical factor in PTSD and that it is important to differentiate between underlying social cognitive processes in research and treatment of PTSD.

Perspective-taking, the ability to take the perspective of others in relation to oneself, is another important social cognitive ability, particularly needed in the ability to mentalize (Hendriks et al., 2016). Therefore, in **Chapter 3**, I examined whether PTSD diagnosed individuals

performed worse than non-clinical controls on a task measuring the ability to flexibly disengage from one's own perspective, which is considered essential for being able to shift from one's own perspective to that of another (Hendriks et al., 2016). Using a computerized task, PTSD diagnosed individuals with various trauma histories ($N = 29$) and non-clinical controls responded to statements about themselves (e.g., "My self-esteem increases if someone says I look good"). On consistent trials (i.e., consistent with common-sense expectations), participants would be required to confirm this statement as "True". On inconsistent trials, the opposite response was required. Larger differences in response latencies between consistent and inconsistent trials indicate that participants find it difficult to reverse their response patterns and hence indicate a lower level of self-flexibility. As expected, higher levels of inflexibility were observed for the PTSD group. A lower level of self-flexibility also predicted the presence of PTSD with a sensitivity of 79% and a specificity of 59%. These findings suggest that traumatized individuals found it difficult to deny or disengage from self-related statements, which is assumed to be necessary to take the perspective of someone else. Addressing flexibility regarding the self in patients with PTSD thus is clinically important, as low self-flexibility impairs perspective-taking and the ability to mentalize, possibly negatively affecting social functioning.

In **Chapter 4**, I examined the association between PTSD symptom severity and social functioning in an outpatient veteran sample and the mediating roles of emotion regulation (Study 1, $N = 100$) and mentalization (Study 2, $N = 38$). Study 1 showed that emotion regulation problems fully mediated the association between PTSD and family dysfunctioning. Study 2 did not show a mediating role for mentalization, but also did not demonstrate an association between PTSD and social dysfunctioning. It is important to keep in mind that participants in Study 1 scored significantly higher on PTSD symptom severity than participants in Study 2. This suggests that social dysfunctioning may only appear beyond a certain severity threshold of PTSD, in which emotion regulation might be a key clinical factor. Future research should further investigate the mediating role of mentalization, with larger samples that include various PTSD severity profiles.

Chapter 5 presented a pilot study in which I examined the mediating roles of emotion regulation and mentalization in the treatment effect of the ADAPT parenting intervention (Gewirtz et al., 2014) on PTSD associated social difficulties in veteran families. Outcomes, reported by participating veterans and their partners, included family functioning, intimate partner functioning, and child adjustment. The outcomes of veterans in ADAPT were compared to those undergoing individualized PTSD focused treatment as usual (TAU). Results showed a direct and sustained reduction in post-treatment family problems in veterans, and preliminary evidence for a decrease in family problems in partners at 6-month follow-up. When comparing veterans receiving individualized TAU to those receiving ADAPT, no significant reduction of family problems was observed in the TAU group. No significant effects were found on parental attachment and reported child functioning. Unexpectedly, no mediation effects were found of emotion regulation and mentalization in the treatment outcomes of ADAPT compared to TAU. This pilot study yielded initial evidence of the clinical effectiveness of ADAPT to improve family functioning, yet future research should examine the mediating processes that explain these effects, preferably using longer time frames with more follow-up measurements.

To conclude, we found an overall deficit in social cognition in traumatized individuals, with specific social cognitive deficits in mentalization and social perception. My findings indicated that emotion regulation deficits represent another important factor in PTSD and associated social problems. Initial evidence did not show treatment-induced mediation effects of emotion regulation and mentalization, but it is possible that such effects will be found with a longer study time frame, given that these processes may need time to change. My findings emphasize that social cognition and emotion regulation play an important clinical role in PTSD associated social problems. This highlights the importance of broadening PTSD focused therapy by including the assessment and treatment of social functioning.

Nederlandse Samenvatting

Veel individuen ervaren potentieel traumatische gebeurtenissen in hun leven, zoals fysiek geweld, seksueel misbruik of levensbedreigende situaties (de Vries & Olff, 2009; Koenen et al., 2017). Naar schatting ontwikkelt 8% van de algemene bevolking hierdoor een posttraumatische stressstoornis (PTSS). PTSS wordt gekenmerkt door het herbeleven van traumatische gebeurtenissen middels repetitieve intrusieve gedachten of flashbacks, vermijding van trauma gerelateerde stimuli, negatieve veranderingen in stemming en cognities, en een verhoogde spanning en prikkelbaarheid (hyperarousal; American Psychiatric Association, 2013). De gevolgen van PTSS zijn niet beperkt tot het individu en hebben ook invloed op de sociale omgeving, zoals het gezinsleven (Kritikos et al., 2019; Scoglio et al., 2022). Daarom is het van belang om de associatie tussen PTSS en sociaal functioneren te onderzoeken, inclusief de processen die aan deze associatie ten grondslag liggen.

Eerder onderzoek suggereert dat PTSS symptomen, zoals hyperarousal, vaardigheden kunnen ondermijnen die essentieel zijn om sociaal te kunnen functioneren, zoals het vermogen om sociale situaties waar te nemen en te begrijpen (sociale cognitie; Lavoie et al., 2014; Sharp et al., 2012) en het vermogen om op een emotioneel passende manier te reageren (emotieregulatie; Seligowski et al., 2015). Inzicht in deze sociaal cognitieve en emotieregulatie processen draagt bij aan het begrijpen van de onderliggende mechanismen in het sociale (dis)functioneren van getraumatiseerde individuen. Dit inzicht kan ook worden toegepast om traumabehandeling, die vaak geïndividualiseerd en symptoomgericht is, te verbeteren of aan te vullen met (systemische) interventies die gericht zijn op het sociale functioneren van getraumatiseerde individuen. Echter, onderzoek naar de rol van sociale cognitie en emotieregulatie bij PTSS en sociaal functioneren is beperkt. Het overkoepelende doel van dit proefschrift was het onderzoeken van de associatie tussen PTSS en sociaal functioneren en de rol van sociale cognitie en emotieregulatie bij getraumatiseerde individuen. Het eerste doel was om inzicht te krijgen in de associatie tussen PTSS en sociaal cognitieve en emotieregulatie processen. Het tweede doel was het onderzoeken van het effect van behandeling geïnduceerde veranderingen in sociale cognitie en emotieregulatie op het sociaal functioneren van getraumatiseerde individuen. De hoofdstukken van dit proefschrift vloeien voort uit deze twee doelen.

Hoofdstuk 2 beschrijft een meta-analyse gericht om verschillen te onderzoeken tussen individuen gediagnosticeerd met PTSS en niet-klinische controles op vier sociaal cognitieve domeinen: mentaliseren (interpretatie van het gedrag van jezelf en anderen in termen van mentale toestanden), emotieherkenning (identificatie en herkenning van emotionele toestanden, zoals emotionele gezichtsuitdrukkingen), sociale perceptie (herkenning van sociale regels en doelen) en attributiestijl (verklaren van sociale situaties). We hebben 19 studies geïncludeerd met in totaal 565 patiënten en 641 controles. De resultaten toonden aan dat de PTSS groep lager scoorde dan controles op algehele sociaal cognitieve vaardigheden, met een medium effectgrootte. Dit was consistent over verschillende traumatypes (oorlog vs. interpersoonlijk) en verschilde niet op basis van geslacht of leeftijd. De PTSS groep presteerde lager, met grote effectgroottes, op het mentaliseren en sociale perceptie, hoewel de bevinding met betrekking tot sociale perceptie voorzichtig moet worden geïnterpreteerd, omdat dit slechts in één studie was onderzocht. Er was geen groepsverschil voor emotieherkenning en

attributiestijl. De bevindingen geven aan dat sociale cognitie een belangrijke factor is bij PTSS en dat er onderscheid gemaakt moet worden tussen verschillende sociaal cognitieve processen in het onderzoek naar en de behandeling van PTSS.

Perspectiefname is het vermogen om het perspectief van een ander aan te kunnen nemen. Dit is een andere belangrijke sociaal cognitieve vaardigheid, noodzakelijk voor het vermogen tot mentaliseren (Hendriks et al., 2016). Daarom onderzocht ik in **Hoofdstuk 3** of individuen gediagnosticeerd met PTSS slechter presteerden dan niet-klinische controles op een taak die het vermogen meet om flexibel afstand te nemen van het eigen perspectief, wat als essentieel wordt beschouwd om te kunnen schakelen van het eigen perspectief naar dat van een ander (Hendriks et al., 2016). Met behulp van een computertaak reageerden PTSS gediagnosticeerde individuen met verschillende trauma achtergronden ($N = 29$) en niet-klinische controles op uitspraken over henzelf (bijvoorbeeld, "Mijn zelfbeeld verbetert als iemand zegt dat ik er goed uitzie"). Op consistente trials (d.w.z. consistent met wat logischerwijs verwacht mag worden) moesten participanten deze uitspraak als "Waar" selecteren. Op inconsistente trials was het tegenovergestelde antwoord vereist. Grotere verschillen in reactietijd tussen consistente en inconsistente trials geven aan dat participanten het moeilijk vinden om hun reactiepatroon te veranderen, wat duidt op minder flexibiliteit. Zoals verwacht scoorde de PTSS groep lager op flexibiliteit. Lagere flexibiliteit voorspelde ook de aanwezigheid van PTSS met een sensitiviteit van 79% en een specificiteit van 59%. Getraumatiseerde individuen hadden dus moeite om zelf-gerelateerde uitspraken te ontkennen of los te laten, wat nodig is om het perspectief van een ander in te nemen. Een focus op flexibiliteit met betrekking tot het zelf bij patiënten met PTSS kan dus klinisch belangrijk zijn, omdat dit het sociale functioneren negatief kan beïnvloeden.

In **Hoofdstuk 4** onderzocht ik de associatie tussen de ernst van PTSS symptomen en sociaal functioneren in een poliklinische groep veteranen en de mediërende rol van emotieregulatie (Studie 1, $N = 100$) en mentaliseren (Studie 2, $N = 38$). Studie 1 toonde aan dat de associatie tussen PTSS en familie disfunctioneren volledig werd gemedieerd door problemen met emotieregulatie. Studie 2 liet geen mediërende rol zien voor mentaliseren, maar toonde ook geen associatie aan tussen PTSS en sociaal disfunctioneren. Belangrijk is dat de ernst van PTSS symptomen significant hoger was in Studie 1 dan in Studie 2. Deze bevindingen suggereren dat sociaal disfunctioneren mogelijk pas optreedt boven een bepaalde mate van PTSS, waarbij emotieregulatie een belangrijke klinische factor kan zijn. Vervolgonderzoek moet de mediërende rol van mentaliseren nader onderzoeken, bij voorkeur met grotere steekproeven en met verschillende PTSS ernstprofielen.

Hoofdstuk 5 beschrijft een pilotstudie waarin ik de mediërende rollen van emotieregulatie en mentaliseren onderzocht in het behandeleffect van ADAPT (Gewirtz et al., 2014), een opvoedinterventie gericht op de vermindering van PTSS gerelateerde sociale problemen in veteraanfamilies. Uitkomstmaten waren het gezinsfunctioneren, het functioneren van het kind, en de mate van gehechtheid tussen ouders, zoals gerapporteerd door de participerende veteranen en hun partners. De resultaten van veteranen in ADAPT werden vergeleken met veteranen die de gebruikelijke individuele PTSS-gerichte behandeling volgden ("treatment as usual" of "TAU"). De resultaten toonden een directe en aanhoudende

afname van gezinsproblemen bij veteranen na ADAPT, en de suggestie van een afname van gezinsproblemen bij partners bij de follow-up na 6 maanden. Er werd geen significante afname van gezinsproblemen waargenomen in de TAU groep. Er werden geen significante effecten gevonden van de behandeling op de andere uitkomstmaten. Ook werden geen mediërende effecten gevonden van emotieregulatie en mentaliseren. Deze pilotstudie levert initieel bewijs voor de klinische effectiviteit van ADAPT om gezinsfunctioneren te verbeteren, maar toekomstig onderzoek dient de mediërende processen te onderzoeken die deze effecten verklaren, bij voorkeur met studies met een langere duur en meer follow-up metingen.

Concluderend toont dit proefschrift aan dat er sprake is van een tekort aan sociaal cognitief functioneren bij getraumatiseerde individuen, specifiek in mentaliseren en sociale perceptie. Daarnaast bleek dat een beperking in de emotieregulatie een belangrijke factor is bij PTSS en daaraan gerelateerde sociale problemen. Initiële bevindingen lieten geen door behandeling geïnduceerd mediatie effect zien van sociale cognitie en emotieregulatie, hoewel het mogelijk is dat dergelijke effecten worden gevonden in een onderzoek van langere duur, omdat deze processen waarschijnlijk tijd nodig hebben om te veranderen. Mijn bevindingen benadrukken dat sociale cognitie en emotieregulatie een belangrijke klinische rol spelen bij sociaal gerelateerde problemen bij PTSS. Dit onderstreept het belang van het verbreden van therapie voor PTSS door de inclusie van diagnostiek en behandeling van sociaal functioneren.

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Curriculum Vitae

Peter Janssen was born on the 28th of March 1990 in Oss, the Netherlands. After obtaining his secondary school diploma at the Mavo Sint Jan, he completed his vocational education in Social Pedagogical Work at the Leijgraaf in Oss. During various internships in disability care and psychiatry, Peter deepened his fascination with working with people, particularly in psychiatry. This led him to pursue a degree in Applied Psychology at the Hogeschool Arnhem Nijmegen (HAN) in Nijmegen, where he completed his first-year degree.

Peter then moved to Nijmegen to study Psychology at Radboud University. There, he earned his first-year degree (cum laude) and bachelor's degree in Psychology (cum laude). During his bachelor, he also participated in an Honors program. At the same university, Peter achieved both a Research Master in Behavioral Science (cum laude) and a Master in Clinical Psychology (cum laude). He also attended additional philosophy courses. During this period, he developed a strong interest in both working as a psychologist in clinical practice and conducting clinical research.

In 2017, Peter began his PhD research as an external candidate at Psychotraumacenter South Netherlands, part of mental health care institution Reinier van Arkel, in collaboration with the Behavioural Science Institute at Radboud University. Under the supervision of Prof. dr. mr. Elisa van Ee, Prof. dr. Toon Cillessen, and dr. Sabine Stoltz, he conducted research on social functioning and its treatment in patients diagnosed with posttraumatic stress disorder (PTSD) resulting from traumatic events. This dissertation is based on that research.

In addition to his research work, Peter has also been working as a psychologist since 2017, focusing on the diagnosis and treatment of PTSD. He is also involved as a therapist and supervisor in the ADAPT program, an intervention aimed at improving the social functioning of veterans and their families. In 2022, Peter began training as a licensed healthcare psychologist ("gezondheidszorgpsycholoog" or "GZ-psycholoog"), gaining experience with patients suffering from persistent physical and psychological complaints in a hospital setting, followed by work in rehabilitation care. In 2024, Peter obtained his license as a healthcare psychologist.

Since 2024, Peter has been employed as a licensed healthcare psychologist and scientific researcher at the Psychotraumacentrum.

Peter Janssen werd geboren op 28 maart 1990 in Oss. Na het behalen van zijn middelbare schooldiploma aan de Mavo Sint Jan, behaalde hij zijn mbo opleiding Sociaal Pedagogisch Werk aan de Leijgraaf in Oss. Tijdens diverse stages in de gehandicaptenzorg en psychiatrie deed Peter ervaring op als begeleider, waarbij zijn fascinatie voor het werken met mensen, en in het bijzonder de psychiatrie, groeide. Dit leidde ertoe dat hij Toegepaste Psychologie ging studeren in Nijmegen aan de Hogeschool Arnhem Nijmegen, waar hij zijn propedeuse behaalde.

Vervolgens verhuisde Peter naar Nijmegen om Psychologie te studeren aan de Radboud Universiteit. Daar behaalde hij zijn propedeuse (cum laude) en bachelor Psychologie (cum laude). Naast zijn bachelor volgde hij een Honoursprogramma. Aan dezelfde universiteit behaalde Peter tegelijkertijd zowel de Research Master Behavioural Science (cum laude) als de master Gezondheidszorgpsychologie (cum laude), en volgde hij aanvullende filosofielessen. Gedurende deze periode ontwikkelde hij een sterke interesse in zowel het werken als psycholoog in de klinische praktijk als het doen van klinisch wetenschappelijk onderzoek.

In 2017 begon Peter als PhD kandidaat (buitenpromovendus) bij GGZ instelling Reinier van Arkel, Psychotraumacentrum Zuid-Nederland, en het Behavioural Science Institute van de Radboud Universiteit. Onder supervisie van Prof. dr. mr. Elisa van Ee, Prof. dr. Toon Cillessen, en dr. Sabine Stoltz deed hij onderzoek naar sociaal functioneren en de behandeling hiervan bij patiënten gediagnosticeerd met een posttraumatische stressstoornis (PTSS) als gevolg van traumatische gebeurtenissen. Dit proefschrift is gebaseerd op dit onderzoek.

Naast zijn werk als onderzoeker is Peter sinds 2017 ook werkzaam als psycholoog, waar hij zich richt op de diagnostiek en behandeling van PTSS. Tevens is hij als supervisor betrokken bij het ADAPT programma, een interventie gericht op het verbeteren van het sociale functioneren van veteranen en hun gezinnen. In 2022 begon Peter aan de opleiding tot gezondheidszorgpsycholoog (GZ-psycholoog), waarbij hij ervaring opdeed in een ziekenhuissetting met patiënten met aanhoudende lichamelijke klachten en psychische klachten, gevolgd door werk in de revalidatiezorg. In 2024 behaalde Peter zijn licentie tot GZ-psycholoog.

Sinds 2024 is Peter werkzaam als GZ-psycholoog en wetenschappelijk onderzoeker bij het Psychotraumacentrum Zuid-Nederland.

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