Rumination in Posttraumatic Stress Disorder: A Systematic Review

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RUNNING HEAD: RUMINATION IN PTSD

Keywords: Rumination, repetitive thinking, PTSD, trauma

Abstract

Initial models and empirical investigations of rumination in the clinical literature were predominantly in the domain of depression. However, rumination is now well-established as a transdiagnostic cognitive process, including in the context of posttraumatic stress. To clarify the current understanding of rumination in posttraumatic stress, a systematic review of the empirical literature was conducted on rumination in posttraumatic stress disorder (PTSD). Six sub-groups of studies on this topic were identified; these addressed: (i) the frequency and nature of rumination, (ii) cross-sectional relationships between rumination and PTSD symptoms, (iii) the capacity of rumination to predict PTSD longitudinally, (iv) other processes associated with rumination, (v) neurobiological correlates of rumination, and (vi) whether treating PTSD reduces rumination. This review synthesizes these domains of research and identify key methodological limitations which limit causal inferences. This review points to important areas of future research to advance knowledge on rumination in PTSD.

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1. Introduction

Rumination is a type of perseverative cognition which involves repeated and unproductive dwelling on a particular theme – for example, replaying a past event or thinking over and over about one's emotions. In the clinical literature, rumination has been most studied in the context of depression, guided by the conceptually influential Response Styles Theory (Nolen-Hoeksema, 1991). However, more recent theoretical acknowledgment of, and empirical evidence for, rumination as a transdiagnostic construct which plays a maintaining role across a number of disorders (Ehring & Watkins, 2008b; see also McEvoy et al., 2010) has prompted investigations of the nature and role of rumination in other clinical conditions. Posttraumatic stress disorder (PTSD) is one such condition. In this paper, we present a systematic review of studies in the literature which have examined rumination in individuals with PTSD. We made the decision to focus our review on rumination, rather than broaden it to include other types of repetitive thinking, such as worry. Although future-oriented worry (e.g., about impending harm) is often a clinical feature of PTSD, we were interested in rumination about the traumatic event specifically, as well as whether the general tendency to ruminate may play a role in PTSD.

At the outset, we make the distinction between intrusive symptoms of PTSD and trauma-focused rumination. Intrusive symptoms include recurrent intrusive memories and nightmares, as well as prolonged distress in response to trauma-related cues (APA, 2013). Trauma-related rumination refers to perseverative thinking about the trauma and its consequences; such consequences may include an individual's PTSD symptoms (see Ehlers & Clark, 2000). A feature common to both rumination and re-experiencing symptoms is that they are difficult to control. Given the transdiagnostic nature of rumination, as well as the significant rate of comorbidity between depression and PTSD, we propose that rumination in

the context of PTSD is characterised by the same features (e.g., abstractness, repetitiveness, 'what if' questions) as rumination in other conditions such as depression. However, the content of ruminative thought differs in PTSD such that the focus is on the trauma and its consequences, including PTSD symptoms. For example, an individual with PTSD may repeatedly dwell on their actions during the trauma (*'why didn't I yell more loudly?'*), reasons they consider to be evidence they were responsible for the trauma ('*it was my fault for driving on the freeway in heavy rain*'), and their PTSD symptoms ('*I'll never get over this; I'll never live a normal life again*'). As highlighted in Ehlers and Clark's (2000) model, individuals with PTSD commonly ruminate about the meaning and consequences of their intrusive symptoms in particular (e.g., 'having unwanted memories come to mind means I'm going crazy'). In this way, intrusive symptoms can serve as a catalyst to rumination, and the two processes are thus strongly linked. However, the key distinction is that whilst intrusive symptoms are essentially recurrent 'flashes' of the trauma that are highly sensory and come to mind unbidden, rumination refers to abstract, perseverative chains of thinking about the traumatic event itself, as well as its antecedents and consequences. In this way, rumination in PTSD may well reflect a deliberate attempt to understand the traumatic event and 'work through' it, albeit unproductively. Over time, such a response may become a more automatic, default response.

Our goal in conducting this review is twofold. First, we seek to provide an overview of published empirical work which speaks to the nature, predictive capacity, and maintaining role of rumination in PTSD. We synthesise this literature by drawing out primary themes that have been investigated to date, and highlight the key findings which have emerged. Our second goal is to draw attention to what we identify as critical methodological issues which limit existing work in this area, and propose ways in which clinical researchers could potentially address these challenges in future work. As such, we seek to propose an agenda

for future clinical research on the role of rumination in PTSD. With these goals in mind, we adopt a narrative synthesis approach, which enables us to synthesise a broad body of evidence (from studies with a range of methodologies) and extract the themes that emerge, resulting in a framework to summarise the evidence to date and highlight important directions for future research.

In so doing, we acknowledge related (and relatively recent) systematic reviews on this topic and clarify how our review is distinct. In a meta-analysis, Seligowski et al. (2015) examined the relationship between posttraumatic stress symptoms and a range of emotion regulation strategies, including rumination. Their review included studies in which participants reported posttraumatic stress symptoms, but were not required to meet criteria for a diagnosis of PTSD. Moreover, the included studies were limited to examinations of the cross-sectional relationship between posttraumatic stress symptoms and emotion regulation. In another meta-analysis, Szabo et al. (2017) examined the association between rumination and posttraumatic stress symptoms, and identified moderators of this relationship, in studies of trauma-exposed adults. Again, the authors included studies in which participants endorsed PTSD symptoms without the restriction that they met diagnostic criteria for PTSD. In addition, the second review excluded studies with samples of children and adolescents.

Our synthesis differs from these reviews in a number of ways. First, we included studies with a range of designs (e.g., cross-sectional, prospective, randomised controlled trials) in order to provide a comprehensive review of rumination in PTSD. Our goal was to extend our knowledge in this area beyond an understanding of the association between rumination and symptom severity, and to summarise the evidence regarding the role of rumination as a maintaining mechanism in PTSD. In so doing, we sought to emulate the approach taken to the study of rumination in the depression literature (e.g., Watkins & Moulds, 2005; Werner-Seidler & Moulds, 2012). Second, as noted above, we included

studies in which participants met criteria for PTSD, rather than reported posttraumatic stress symptoms. Specifically, we included studies in which participants were either formally diagnosed with PTSD using a structured clinical interview, or in which the sample mean on a self-report diagnostic measure was above the clinical cut-off for PTSD in a trauma-exposed sample. Third, we did not impose any restrictions on the studies we included on the basis of participants' age, in light of key and informative investigations of rumination in PTSD in child and adolescent samples (Meiser-Stedman et al., 2009, 2014). Finally, a key objective of our review was to take the opportunity to highlight areas in which future work is needed to move the field forward and enable us to better understand, assess, and develop evidence-based treatments for rumination in PTSD. As such, we close with a detailed discussion of what we consider to be methodological issues in this literature, and propose key ways in which such challenges can be addressed and overcome in future work.

In Section 2, we present a brief overview of theoretical models of rumination – commencing with those developed in the depression literature, and then outlining relevant conceptual accounts which incorporate rumination in the maintenance of PTSD. In Section 3, we describe our literature search strategy, and the inclusion and exclusion criteria we adopted in compiling this review. Next, we present an overview of the empirical findings (Section 4), and summarise them according to the research question tested and approach adopted (e.g., cross-sectional, prospective) to understand the relationship between rumination and PTSD. In Section 5, we outline implications for theory and clinical practice. We consider issues that emerged in conducting this review, discuss challenges to investigating rumination in the context of posttraumatic stress, and propose directions for future research.

2. Theoretical Background

Given our goal to conduct a critical review of the empirical studies to date on rumination in PTSD, a detailed overview of existing theoretical models of rumination is

beyond the scope and objective of this paper. Nonetheless, in order to establish a conceptual basis and starting point for our review, we consider it critical to provide a theoretical context – commencing with a description of the dominant and arguably most influential model of rumination in the clinical literature, Response Styles Theory (Nolen-Hoeksema, 1991) and concluding with a discussion of a key cognitive model of PTSD (Ehlers & Clark, 2000), which includes rumination as a key cognitive process in the development and maintenance of the disorder.

Response Styles Theory (Nolen-Hoeksema, 1991; Nolen-Hoeksema et al., 2008) conceptualises depressive rumination as a trait-like way of responding to sad mood and depression symptoms which involves repeatedly thinking about and analysing their causes, meanings, and implications. As such, rumination is conceptualised as a passive response; a maladaptive alternative to employing active, instrumental responses such as engaging in distraction or employing problem-solving strategies in order to bolster mood and effectively change one's circumstances. Accordingly, Response Styles Theory holds that individuals who engage in depressive rumination in response to sadness or distress are more likely to become clinically depressed, and to remain depressed for longer.

A significant body of evidence has accrued in support of this account. For example, in a prospective study, trait rumination (self-reported prior to the Loma Prieta earthquake) predicted depression symptoms seven weeks after the earthquake, controlling for pre-quake symptoms. Interestingly, and of note for this review, rumination about the earthquake 10 days later predicted posttraumatic stress symptoms at seven weeks. In addition to being implicated in the onset of depression, there is also evidence that rumination predicts the duration of depressed mood, controlling for initial mood severity (Nolen-Hoeksema et al., 1993), as well as the maintenance of depressive symptoms in individuals with clinical depression (Kuehner & Weber, 1999; Nolen-Hoeksema, 2000). Further, experimental studies have demonstrated

that (relative to distraction) rumination drives a range of depression-related deficits; specifically, exacerbates sad mood (Nolen-Hoeksema & Morrow, 1993), facilitates the accessibility of negative memories (Lyubomirsky et al., 1998), maintains the recall of overgeneral memories (Watkins et al., 2000), and impairs problem-solving (Lyubomirsky & Nolen-Hoeksema, 1995).

More recently, theorists have focused on distinguishing subtypes of rumination. For example, Watkins (2004, 2008) contended that the mode of processing adopted during rumination is the key determinant of whether rumination yields adaptive or maladaptive consequences, and differentiated between abstract and concrete modes of ruminative processing. While abstract ruminative processing is analytical and evaluative, concrete rumination is characterised by a direct focus on experience. Supporting this distinction, there is experimental evidence that for depressed individuals, abstract rumination maintains poor problem solving, while concrete processing improves it (Watkins & Moulds, 2005). Similarly, abstract rumination maintains the recall of overgeneral memories, while concrete processing increases memory specificity (Watkins & Teasdale, 2001, 2004). There is also evidence that undergoing training which promotes abstract ruminative processing results in greater emotional reactivity to a stressor, relative to concrete processing (Watkins et al., 2008). Abstract rumination also has adverse consequences for memory: it enhances memory for negative, self-referent material (Moulds et al., 2007), increases intrusion-related distress (Williams & Moulds, 2010), and compromises the mood bolstering effects of recalling positive memories (Werner-Seidler & Moulds, 2012).

Whilst Response Styles Theory is arguably the theoretical account that has most influenced the study of rumination in depression, we acknowledge that this is by no means the only conceptual model of rumination in the literature. Other models have influenced the theoretical understanding of the onset and persistence of depression; notable examples

include the Impaired Disengagement Hypothesis (Koster et al., 2011), control theories (e.g., Martin & Tesser, 1989, 1996), and the Self-Regulation Executive Function model (Wells & Matthews, 1996). Further, leading commentators in the depression field have drawn on both Response Styles Theory and alternative accounts (e.g., control theory: Martin & Tesser, 1989, 1996; mode of processing account: Watkins, 2004, 2008) to propose more complex, elaborated conceptualisations of rumination, invoking both trait and state influences (e.g., rumination as a mental habit: Watkins & Nolen-Hoeksema, 2014).

As noted above, there is accruing evidence that rumination as a form of repetitive thinking is a transdiagnostic process, and is reported by individuals with anxiety as well as depression (Ehring & Watkins, 2008; see also Ehring et al., 2011; McEvoy et al., 2010). It is therefore surprising that when turning to PTSD, to our knowledge only one conceptual account in the published literature (i.e., Ehlers & Clark, 2000) includes explicit reference to rumination as a key cognitive process that contributes to the persistence of the disorder. Specifically, Ehlers and Clark (2000) propose that for individuals who develop PTSD, the trauma is encoded in a 'data-driven' manner in which perceptual elements of the experience preclude the memory being consolidated in a way that it becomes part of one's normal autobiographical memory base. As a result, trauma memories are relived with a sense of the event happening in the present. This model posits that this sense of ongoing threat is compounded by negative appraisals of the traumatic event and/or the individual's PTSD symptoms.

According to this account, such appraisals and memory disturbance persist when an individual employs maladaptive cognitive and behavioural strategies (e.g., rumination, safety behaviours, avoidance, thought suppression) which are intended to diminish the sense of current threat, but have the paradoxical effect of worsening rather than alleviating symptoms. For individuals with PTSD, Ehlers and Clark (2000) hypothesise that engaging in rumination

(e.g., about why the trauma happened, how it could have been prevented) is problematic because it strengthens unhelpful negative appraisals. They also predict that the process of rumination prevents the individual from focusing on the details of the trauma in a manner that would facilitate the development of a coherent trauma narrative. Finally, they propose that engaging in rumination may in turn fuel negative affect, as well as intrusive memories of the trauma. It is noteworthy that at the time of articulating their model, Ehlers and Clark (2000) emphasised that these were predictions, and that the mechanism/s by which rumination maintains PTSD were untested. Having provided some theoretical context, we turn now to an overview of the empirical literature on rumination in PTSD.

3. Method

3.1. Literature search strategy

We conducted a literature search using PsycINFO, Scopus, and PubMed databases, with "posttraumatic stress" OR "PTSD" OR "trauma" AND "rumination" OR "repetitive thinking" as search terms. This resulted in a list of 809 published journal articles following the removal of duplicate results. Titles and abstracts were used to screen articles for inclusion. The review was conducted in late 2019 and repeated in April 2020 to ensure the inclusion of all relevant published papers prior to submission. Figure 1 presents a flowchart summarizing our search strategy.

Insert Figure 1 about here

3.2 Inclusions and omissions

Articles were included if they were peer-reviewed, published in English, included a clinical sample (i.e., trauma-exposed participants diagnosed with PTSD), and included at least one psychometrically established measure of both rumination and PTSD symptoms.

Studies in which a self-reported diagnostic tool (rather than a structured clinical interview) was used to establish PTSD diagnostic status were only included if the sample mean was above the clinical cut-off for the diagnostic measure. Decisions about including prospective studies necessitated a different approach; such studies were included if they assessed the role of rumination in predicting a PTSD diagnosis in a trauma-exposed sample. We excluded uncontrolled pilot studies and case studies, articles that referred to the behaviour of rumination syndrome (i.e., regurgitation and re-chewing), and articles that did not report statistical analyses which included both a PTSD and a rumination measure (and thus did not directly examine their interrelationship). We also excluded work which was unpublished or published in non-peer reviewed journals. We did not place restrictions on studies in terms of participants' age, and thus included studies conducted with both adult and youth samples. Of the 217 articles that were identified for full-text screening, 41were eligible for inclusion.

4. Overview of Empirical Findings

In this section we present an overview of the published empirical studies in this area. For clarity and to facilitate comparison, we have summarised each paper included in the review in Table 1. We distinguished studies that tested the relationship between rumination and PTSD cross-sectionally from prospective studies which investigated the capacity of rumination to predict PTSD diagnosis. For each study, we note the sample employed (including N), self-report measure used to index rumination, measure of PTSD (symptoms or diagnostic status, as relevant) and key conclusions. We follow this with a description of the key findings of these studies, categorised broadly according to the nature of the research question addressed; specifically: (a) What do we know about the frequency and nature of rumination in PTSD? (b) Are rumination and PTSD related cross-sectionally? (c) Does rumination predict PTSD longitudinally? (d) Are other processes associated with rumination

in PTSD? (e) What are the neurobiological correlates of rumination in PTSD? (f) Does treating PTSD reduce rumination?

4.1. What do we know about the frequency and nature of rumination in PTSD?

Rumination is commonly reported by individuals with PTSD; in a recent study with treatment-seeking female veterans, up to 82.4% of participants indicated that they *sometimes*, and 34.1% indicated that they *often/always* engaged in rumination in response to experiencing intrusive trauma memories during the previous week (Arditte Hall et al., 2019). Across numerous studies, individuals with PTSD reported greater levels of rumination relative to trauma-exposed individuals without PTSD (Basharpoor et al., 2015; Cox & Olatunji, 2017; Halligan et al., 2006; Meiser-Stedman et al., 2014, 2019; Michael et al., 2007; Nagulendren & Jobson, 2020; Woodward et al., 2019), as well as non-trauma exposed controls (Jin et al., 2019). Notably, these differences were evident when rumination was conceptualised and measured in a variety of ways, including depressive rumination (e.g., Basharpoor et al., 2015; Jin et al., 2019), trauma-related rumination (e.g., Meiser-Stedman et al., 2014, 2019), pre-sleep rumination (Woodward et al., 2019) and when participants estimated the amount of time spent dwelling on their trauma (e.g., Halligan et al., 2006; Michael et al., 2007).

Some researchers have investigated rumination in the context of both depression and PTSD. For example, Woodward et al. (2019) found that individuals with PTSD reported more night-time (i.e., pre-sleep) rumination relative to those with depression (and no comorbid PTSD). Rosebrock et al. (2019) found that depressed veterans with and without comorbid PTSD did not differ in self-reported depressive rumination (notably, trauma-related rumination was not assessed), while Birrer and Michael (2011) reported that both participants with PTSD as well as depressed individuals with a history of trauma reported more trauma-related rumination than depressed individuals without a trauma history. However, the

possibility that the lack of differences between individuals with and without a diagnosis of PTSD in the latter two studies is an artefact of the way in which rumination was measured cannot be ruled out. On balance, the majority of the comparative studies identified in our review reported greater rumination in individuals with PTSD relative to trauma-exposed and healthy controls, suggesting that rumination is a common cognitive feature associated with PTSD symptomatology.

Our review identified only one study to have examined the phenomenological aspects of rumination in PTSD. Speckens et al. (2007) found that individuals with PTSD reported that their ruminative thinking typically focused on the past (73%) and the future (60%), but also involved the present (50%). Interestingly, approximately half of their sample reported that rumination was not restricted to thoughts, but rather included a variety of sensory experiences, including sounds, smells, and body sensations. When prompted to identify the themes of their rumination, trauma-specific content (e.g., long-term consequences of the traumatic event, what life would be like if the traumatic event had not happened) was reported more frequently than general content (e.g., the kind of person they are). Although the focus of ruminative thinking in this sample was predominantly trauma-specific, it is notable that participants also reported engaging in broader, more generalised ruminative thinking.

An interesting feature examined by Birrer and Michael (2011) is the extent to which individuals with PTSD experience rumination as deliberate and strategic, as opposed to an automatic process. They found that 96% of participants with PTSD stated that they rarely initiated rumination on purpose, indicative of its intrusive quality. Notably, comparable proportions of depressed individuals with a history of trauma (95%) and depressed individuals without a trauma history (90%) also rated rumination as rarely activated on purpose. In terms of consequences, individuals with PTSD reported that rumination triggered

the occurrence of intrusive memories (Birrer & Michael, 2011; Michael et al., 2007; Speckens et al., 2007). Further, they reported that engaging in rumination led to increased negative emotions (e.g., shame, anger, helplessness, guilt) during and/or after the ruminative episode, and the extent of such emotional change was associated with greater PTSD symptom severity (Birrer & Michael, 2011; Michael et al., 2007; Speckens et al., 2007). Taken together, these findings suggest that for individuals with PTSD, rumination is an automatic process which has the consequences of triggering further intrusions and exacerbating negative emotions.

4.2. Are rumination and PTSD related cross-sectionally?

Across multiple studies, we found evidence of an association between the degree to which individuals with PTSD engaged in rumination and PTSD symptom severity. Indeed, this association was observed across measures of trauma-related rumination (Qi et al., 2020; Zhou et al., 2015), rumination in response to intrusive trauma memories (Arditte Hall et al., 2019; Ehring et al., 2008; Nagulendren & Jobson, 2020), depressive rumination (Egan et al., 2014; Ehring et al., 2008; Nagulendren & Jobson, 2020; Pugach et al., 2020), self-focused rumination (Borders et al., 2012; Cox & Olatunji, 2017), rumination as an emotion regulation strategy (Lee et al., 2020), the general tendency to ruminate (Brown et al., 2018; Bravo et al., 2019; Buchholz et al., 2016; Hu et al., 2014), pre-sleep rumination (Woodward et al., 2019), as well as author-adapted measures (Lommen et al., 2009; Meiser-Stedman et al., 2014, 2019). Furthermore, this association remained significant even when other related cognitive processes (e.g., intrusive thoughts, negative post-trauma cognitions, depressive symptoms) were statistically controlled (e.g., Arditte Hall et al., 2019), suggesting an independent and robust relationship between rumination and PTSD.

In order to further understand this cross-sectional relationship, Michael et al. (2007) examined whether specific features of (e.g., ‘why’, ‘what-if’ questions) and processes

associated with (e.g., the compulsion to continue) rumination were associated with elevated PTSD symptoms in a trauma-exposed sample, both cross-sectionally and prospectively. PTSD symptoms at initial interview and again six months later were associated with the compulsion to continue ruminating, the use of "what if" and "why" questions, and unproductive thoughts during rumination (e.g., the thoughts repeat themselves). These findings raise the interesting clinical possibility that it may be the specific *features* of ruminative thinking, rather than the ruminative *content*, which best predicts the development of clinical levels of PTSD symptoms. This possibility accords with conceptual accounts in the depression literature (Watkins, 2004, 2008) which emphasise that it is the mode of processing adopted during rumination, rather than its content, which determines rumination's consequences. Further, such a proposal has implications for the clinical management of rumination in the treatment of PTSD – a point to which we return later in this review.

Extending our understanding of the association between rumination and PTSD, some studies have identified processes which mediate their relationship. In a trauma-exposed community sample, the relationship between rumination and PTSD symptoms was partially mediated by experiential avoidance (Bishop et al., 2018). In a study with survivors of interpersonal violence, the association between rumination and PTSD symptoms was mediated by perceived levels of stress, although this mediating effect did not persist when depression symptoms were controlled (Hu et al., 2014). The interrelationship of rumination and PTSD is thus well-established, however more work is needed to delineate the processes which mediate their association.

4.3. Does rumination predict PTSD longitudinally?

Building on the cross-sectional evidence described, a number of studies have established that engaging in rumination in the acute aftermath of a trauma predicts the later development of PTSD. In a prospective study of motor vehicle accident survivors, rumination

at 3 months post-trauma predicted PTSD diagnosis and symptom severity at one (Ehlers et al., 1998) and 3 years (Mayou et al., 2002). In their prospective study of road traffic survivors, Ehring et al. (2008) found that rumination (both depressive rumination and rumination in response to intrusive trauma memories) at 2 weeks post-trauma predicted PTSD symptoms at 6 months, over and above baseline symptom levels. Interestingly, PTSD symptoms at 6 months were more strongly predicted by the combination of level of self-reported rumination (in response to intrusions) and reduced concreteness of thinking (i.e., coded responses on a rumination interview) than by rumination alone. In a prospective study of victims of assault, rumination (in response to intrusions) at 2 weeks post-trauma predicted PTSD status at 6 months (Kleim et al., 2007).

In a longitudinal study of trauma-exposed children and adolescents, Meiser-Stedman et al. (2009) found that rumination (in response to fear) at 2-4 weeks post-trauma predicted PTSD diagnosis at 6 months, but this relationship disappeared when diagnostic status and symptom severity at baseline (i.e., 2-4 weeks post-trauma) were controlled. In another prospective longitudinal study of youth who attended the emergency room following a trauma, posttrauma rumination reported at 2-4 weeks was associated with both PTSD symptoms and PTSD diagnosis at 2 months (Meiser-Stedman et al., 2019), and rumination significantly predicted posttraumatic stress symptoms at 2 months posttrauma. Moreover, when participants were categorised according to their responses on the CPSS as ‘resilient’ (i.e., below PTSD cut-off at both assessment points), ‘recovered’ (above PTSD cut-off at the first but not second assessment), or ‘persistent’ (above cut-off at both assessments), rumination scores were significantly higher for participants in the persistent versus the recovery group, which was in turn higher than those in the resilient group. The authors conclude that rumination is associated with the persistence rather than the onset of PTSD symptoms. Finally, in a sample of adolescents who experienced an earthquake, intrusive

rumination (at 6 months and 12 months), and deliberate rumination (at 12 months) post-trauma predicted PTSD symptom severity at 18 months (Zhou & Wu, 2016).

Whilst important for understanding the capacity of rumination in the acute trauma aftermath to predict later PTSD, these studies leave open the question of whether the tendency to engage in rumination *prior* to trauma exposure elevates vulnerability to developing the disorder. Recent investigations have addressed this question and indexed rumination in samples at high risk of trauma exposure. In a study of student paramedics, rumination (in response to trauma memories) predicted an episode of PTSD within a 2 year follow-up period, even when controlling for psychiatric history and trauma exposure during training (Wild et al., 2016). Similar findings were obtained in a cohort sample of 2402 adults (Spinhoven et al., 2015), in which trait rumination (i.e., rumination about sadness) predicted a diagnosis of PTSD in the subsample (n = 359) who experienced a trauma within the 4 year follow-up period. Moreover, this predictive relationship was partially mediated by their cognitive appraisals of the trauma. The findings of these prospective and longitudinal studies highlight the clinical importance of targeting rumination in order to reduce the likelihood of PTSD emerging.

4.4. Are other processes associated with rumination in PTSD?

4.4.1. Associations between rumination and other variables.

In addition to the abovementioned links between rumination and PTSD, there is evidence that rumination is associated with other psychological processes (cognitive, physiological) within the context of PTSD. For instance, across a sample of veterans both with and without comorbid PTSD, rumination was linked to poor attentional control (Cox & Olatunji, 2017). In a sample comprised of survivors of physical and sexual assault, rumination was associated with reduced heart rate responding during trauma recall (Halligan

et al., 2006). In a sample of veterans with unipolar depression and comorbid PTSD, thought suppression was associated with depressive rumination (i.e., brooding and reflection subscales). Interestingly, no such relationship was evident for veterans with depression without comorbid PTSD (Rosebrock et al., 2019). Schönfeld and Ehlers (2006) reported that rumination (in response to intrusions) was correlated with overgeneral autobiographical memory recall in a sample of trauma-exposed individuals with and without PTSD, although this relationship did not reach significance when the PTSD subgroup alone was examined. In addition, rumination uniquely predicted overgeneral recall across the full sample. Pugach et al. (2020) found an association between rumination and emotion regulation difficulties in a trauma-exposed community sample.

4.4.2. Rumination mediates the associations between PTSD and other variables.

A number of studies have demonstrated that the extent to which individuals engage in rumination mediates the relationship between PTSD symptoms and a range of associated variables. For example, in a sample of female survivors of interpersonal trauma, rumination fully mediated the relationship between negative affect and PTSD symptoms (Brown et al., 2018). In a sample of veterans with and without comorbid PTSD, rumination partially mediated the association between attentional control and PTSD symptom severity (Cox & Olatunji, 2017), although it is noteworthy that this effect disappeared when depression was controlled. In another study with military veterans, Kelley et al. (2019) examined whether rumination mediated the impact of a traumatic experience on PTSD symptom severity. The authors assessed the impact of four different facets of rumination (Tanner et al., 2013; Brinker & Dozois, 2009); namely, problem-focused thoughts (causes, consequences, and symptoms of negative affect), counterfactual thinking (alternative outcomes or reality), repetitive thoughts (persistent reflection on negative affect), and anticipatory thoughts (focused on the future). Problem-focused thoughts and anticipatory rumination mediated the

association between killing in combat and PTSD severity. In a study with combat-wounded veterans which employed the same measure, Bravo et al. (2019) found that rumination (in particular, problem-focused thoughts facet of rumination) mediated the relationship between moral injury and PTSD symptoms. In a trauma-exposed community sample, the association between overall emotion regulation difficulties and PTSD was fully accounted for by rumination (Reyes et al., 2020). Moreover, this relationship emerged for specific aspects of emotion regulation; namely, non-acceptance of negative emotions, difficulties in impulse control and difficulties maintaining goal-oriented behaviour. In an online sample of community participants, Vanderveren et al. (2020) found that rumination mediated the indirect effect of autobiographical memory coherence on PTSD symptoms. In a trauma-exposed community sample, Pugach et al. (2020) found that the relationship between PTSD and emotion regulation difficulties was fully accounted for by rumination. Finally, in a sample of middle school students who experienced an earthquake 4.5 years earlier, rumination (i.e., 'intrusive' rumination) partially mediated the relationship between experiencing challenges to core beliefs and PTSD symptoms (Zhou et al., 2015).

4.4.3. Rumination moderates the associations between PTSD and other symptoms.

Only one study identified in our review examined whether rumination moderated the relationship between PTSD and depression symptoms. In a treatment-seeking community sample, Roley et al. (2015) found that both the repetitive thoughts and anticipatory thoughts facets of rumination moderated the association between the two types of symptoms.

In sum, the relationships between rumination and other cognitive and physiological processes in PTSD have been minimally studied to date. Moreover, in such investigations, researchers have often collapsed trauma-exposed samples with and without PTSD. Although such an approach has the advantage of maximising power, it leaves unanswered questions about relationships between rumination and other processes in the context of PTSD

specifically. Similarly, the extent to which rumination plays a mediating and moderating role in the context of PTSD has received little attention. Future studies which seek to disentangle the specific ways in which rumination interacts with and influences other risk and maintaining factors for PTSD will critically inform and refine our theoretical understanding of the disorder.

4.5. What are the neurobiological correlates of rumination in PTSD?

Only two studies to date have investigated the neurobiological correlates of rumination in PTSD. Buchholz et al. (2016) examined regional brain activation during an emotion interference task in which participants were required to either ignore or attend to fearful faces. Across the sample of females diagnosed with PTSD, trait rumination was associated with increased activation of the right inferior orbitofrontal cortex. As the orbitofrontal cortex has been implicated in inhibiting responding to emotional cues and particularly negatively-valenced information (Levens & Phelps, 2010; Rolls, 2004), the authors suggested that increased activation of this region was indicative of inefficient emotional inhibition. Jin et al. (2019) examined the relationship between the thickness of specific brain regions, the experience of childhood trauma, a genetic polymorphism of BDNF, PTSD symptoms, and rumination in both individuals with PTSD and healthy controls (notably, these associations were conducted across the total sample). Reduced thickness of the left fusiform gyrus and left transverse temporal gyrus was associated with higher levels of PTSD symptoms, rumination, and self-reported childhood trauma. Thus, although little work has been conducted to date, the brain regions involved in cognitive control appear to be compromised in PTSD.

4.6. Does treating PTSD reduce rumination?

Despite numerous treatments for PTSD which attribute treatment gains to reductions in unhelpful cognitive strategies, only one study to date has measured changes in rumination

following treatment for PTSD. In a sample of motor vehicle accident survivors diagnosed with PTSD, Wisco et al. (2013) assessed changes in the use of rumination as an emotion regulation strategy following written exposure therapy. As predicted, written exposure therapy resulted in a decrease in PTSD symptoms across treatment, and gains were maintained at 3-month follow-up. Changes in PTSD symptoms were not moderated by rumination at any time point. However, rumination decreased from post-treatment to 3-month follow-up. These findings raise the possibility that common mechanisms underlie posttraumatic stress symptoms and ruminative thinking, and that these mechanisms were successfully targeted by the intervention.

Table 1. Empirical studies of rumination in PTSD.

Article	Sample	Rumination measure/s	PTSD measure/s	Key findings
		Prospective Studies		
Ehlers et al., 1998	967 motor vehicle accident survivors	Participants rated "*how often they dwelled of memories of the accident*" and how often they thought "*why did it happen to me?*" from 0 (never) to 4 (always)	Posttraumatic Stress Symptom Scale (PSS; Foa et al., 1993)	Rumination at 3 months and 1 year predicted PTSD diagnosis and symptom severity at 1 year.
Ehring et al., 2008 (Study 2)	Road traffic accident survivors assessed at 2 weeks (n = 147) and 6 months (n = 140, n PTSD = 15)	Responses to Intrusions Questionnaire (RIQ; Clohessy & Ehlers, 1999) 10 item Ruminative Response Scale (RRS) of Response Style Questionnaire (RSQ; Nolen-Hoeksema & Morrow, 1991) Rumination Interview	Structured Clinical Interview for DSM-IV (SCID; First et al., 1996) Posttraumatic Diagnostic Scale (PDS; Foa et al., 1997)	Trauma-related rumination (not depressive rumination) at 2 weeks and 1 month post-trauma predicted PTSD symptom severity at 6 months. Predictive utility of rumination at 2 weeks for PTSD symptom severity at 6 months improved when reduced concreteness of ruminative thoughts was also entered as a predictor. Individuals diagnosed with PTSD at 6 months reported greater rumination at 2 weeks and 1 month.
Kleim et al., 2007	Assault survivors assessed at 2 weeks (n = 222) and 6 months (n = 205)	8 item RIQ (Clohessy & Ehlers, 1999)	SCID (First et al., 1996)	Rumination at 2 weeks predicted PTSD diagnosis at 6-months.
Mayou et al., 2002	546 road traffic accident survivors	Participants rated "*how often they dwelled of memories of the accident*" and how often they thought about "*why did it happen to me?*" from 0 (never) to 4 (always)	PSS (Foa et al., 1993)	Rumination at 3 month and 1 year post-trauma predicted PTSD diagnosis and symptom severity at 3 years.
Meiser-Stedman et al., 2009	59 child and adolescent survivors of physical assaults and motor vehicle accidents with (n = 9) and without (n = 50) PTSD	21 item adapted RRS – Child Version (Meiser-Stedman et al., 2007)	Anxiety Disorders Interview Schedule: Child Version (ADIS-C; Silverman & Albano, 1996)	Individuals diagnosed with PTSD at 6 months reported greater rumination at 2-4 weeks. Rumination at 2-4 weeks significantly correlated with PTSD diagnosis and symptom severity 6 months later (correlations non-significant when controlling for initial diagnostic status and symptom severity).

			Child Revised Impact of Event Scale (CRIES; Dyregov & Yule, 1995)	
Meiser-Stedman et al., 2019	Trauma-exposed youth assessed at 2-4 weeks (n = 226) and 2 months (n = 208) post-trauma	3 items assessing trauma-related rumination used in Meiser-Stedman et al. (2014)	Children's PTSD Inventory (Saigh et al., 2000) Children's PTSD Symptom Scale (Foa et al., 2001)	Rumination at 2-4 weeks was associated with both PTSD symptoms and diagnosis at 2 months. Post-trauma cognitive processing at 2-4 weeks, including rumination, accounted for unique variance in posttraumatic stress symptoms at 2 month follow-up.
Spinhoven et al., 2015	359 trauma-exposed individuals	6 item Rumination on Sadness subscale of the revised version of the Leiden Index of Depression Sensitivity (Van der Does, 2002)	PSS-I (Foa et al., 1993)	Rumination at baseline predicted a diagnosis of PTSD when a traumatic event was experienced in the 4 year follow-up period. Effect of trait rumination in predicting PTSD partially mediated by elevated self-reported trauma-related cognitions.
Wild et al., 2016	Student paramedics assessed at baseline (n = 453) and follow-up (n = 386)	7 item rumination subscale of the RIQ (Clohessy & Ehlers, 1999)	SCID (First et al., 1996)	Rumination at baseline predicted an episode of PTSD during 2 years of training, controlling for psychiatric history and trauma exposure.
Zhou & Wu, 2016	310 adolescents who experienced an earthquake [a b]	Chinese version of the 10 item Event Related Rumination Inventory (ERRI; Zhou et al., 2014)	Chinese version of the Child PTSD Symptom Scale (Ying et al., 2014)	Intrusive rumination at 6 months and 12 months post-earthquake, and deliberate rumination at 12 months post-quake were associated with PTSD symptom severity at 18 months. Association between intrusive rumination at 6 months and PTSD symptom severity at 18 months mediated by intrusive rumination at 12 months. Deliberate rumination at 12 months mediated the association between intrusive deliberation at 12 months and PTSD symptom severity at 18 months.
		Cross-sectional Studies		
Arditte Hall et al., 2019	91 trauma-exposed female veterans [a b]	8 item RIQ (Clohessy & Ehlers, 1999)	PTSD Checklist – DSM-5 (PCL-5; Weathers, Litz, et al., 2013)	Rumination frequently reported (82.4% sometimes, 34.1% often/ always). Trauma-related rumination predicted PTSD symptom severity.
Basharpoor et al., 2015	100 trauma-exposed individuals with (n = 47) or without (n = 52) PTSD	22 item RRS of RSQ (Nolen-Hoeksema & Morrow, 1991)	35 item Mississippi PTSD Scale (Keane et al., 1988)	Individuals with PTSD reported greater rumination.

			Structured clinical interview (nonspecific)	
Birrer & Michael, 2011	65 individuals, diagnosed with PTSD (*n* = 26), depression with trauma (*n* = 20), or depression without trauma (*n* = 19)	Rumination interview adapted to self-report scale (Michael et al., 2007) Rumination log	PDS (Foa et al., 1997)	Individuals with PTSD and depressed individuals with a history of trauma both reported more trauma-related rumination that depressed individuals without a trauma history. Individuals with PTSD reported that rumination was rarely initiated deliberately, and that rumination often/always triggered intrusive trauma memories. Rumination worsened feelings of anger, helplessness and guilt, and reduced feelings of contentment and calmness.
Bishop et al., 2018	193 trauma-exposed individuals [a]	19 item RIQ (Clohessy & Ehlers, 1999)	20 item PCL-5 (Weathers, Litz, et al., 2013)	Rumination was associated with self-reported experiential avoidance of trauma cues and PTSD symptom severity. Engaging in experiential avoidance partially mediated the effect of rumination on PTSD symptom severity.
Bravo et al., 2019	189 combat-wounded veterans [b]	15 item Ruminative Thought Style Questionnaire (RTSQ; Brinker & Dozois, 2009)	20 item Posttraumatic Stress Disorder Checklist for DSM-5 (Blevins et al., 2015)	Rumination was associated with PTSD symptom severity. Rumination (in particular, problem-focused thoughts facet) mediated the relationship between moral injury and PTSD symptoms.
Borders et al., 2012	91 treatment-seeking veterans [a b]	12 item rumination subscale of the Rumination and Reflection Questionnaire (RRQ; Trapnell & Campbell, 1999)	PCL (Blanchard et al., 1996)	Rumination was associated with engagement in risky behaviours and PTSD symptom severity.
Brown et al., 2018	65 female interpersonal trauma survivors diagnosed with PTSD	20 item RTSQ (Brinker & Dozois, 2009)	Clinician Administered PTSD Scale (CAPS; Blake et al., 1995) SCID (First et al., 2002)	Rumination was associated with PTSD symptom severity, and mediated the association between negative affect and PTSD symptoms.
Buchholz et al., 2016	39 females diagnosed with PTSD	20 item RTSQ (Brinker & Dozois, 2009)	CAPS (Blake et al., 1995) SCID (First et al., 2002)	Rumination was associated with PTSD symptom severity. On an emotion interference task, there was a positive association between trait rumination and activation in the right inferior orbitofrontal cortex when required to ignore (versus attend to) fearful faces.

Contractor et al., 2020	194 US military personnel	5 item brooding subscale of the RRS (Nolen-Hoeksema & Morrow, 1991)	PCL-5 (Weathers, Litz, et al., 2013)	Rumination significantly predicted high depression-low PTSD vs. high PTSD-low depression class membership. Compared to the low severity class, rumination was a significant predictor of the high severity class.
Cox & Olatunji, 2017	37 trauma-exposed veterans with (*n* = 21) or without (*n* = 16) PTSD	12 item rumination subscale of RRQ (Trapnell & Campbell, 1999)	PCL (Weathers et al., 1993)	Individuals with PTSD reported greater rumination; rumination was associated with PTSD symptom severity in the full sample. In the full sample, rumination partially mediated the association between attentional control and PTSD symptom severity.
Egan et al., 2013	30 sexual trauma-exposed individuals [a b]	10 item RRS from RSQ (Nolen-Hoeksema & Morrow, 1991)	PCL – Civilian Version (Weathers et al., 1993)	Rumination was associated with PTSD symptom severity. Rumination mediated the associations between perfectionism (clinical perfectionism, concern over mistakes) and PTSD symptom severity.
Halligan et al., 2006	61 trauma-exposed individuals with (*n* = 25) or without PTSD (*n* = 38)	Rumination interview, which indexed rumination as hours/ week spent ruminating (Michael et al., 2007)	PDS (Foa et al., 1997)	Individuals with PTSD reported greater rumination. Across the total sample, time spent ruminating was associated with lower heart rate response when recalling an assault. In individuals with PTSD, increased heart rate responding was associated with a greater reduction in symptoms 6-months later.
Hu et al., 2014	49 female assault survivors diagnosed with PTSD	20 item RTSQ (Brinker & Dozois, 2009)	CAPS (Weathers et al., 1990)	Rumination predicted PTSD symptom severity; association was partially mediated by self-reported levels of perceived stress.
Jin et al., 2019	216 individuals diagnosed with PTSD (*n* = 83) or healthy controls (*n* = 133)	Korean version of 19-item RRS from RSQ (Kim et al., 2010) 4 item rumination subscale of the Korean version of Cognitive Emotion Regulation Questionnaire (CERQ; Ahn et al., 2013)	Korean version of PCL-5 (Park et al., 2016)	Individuals with PTSD reported greater depressive rumination and focus on thought rumination as an emotion regulation strategy. Correlations between brain thickness and scores on the Childhood Trauma Questionnaire were differentially affected by the two measures of rumination used. Depressive rumination was associated with reduced thickness of the left fusiform gyrus and left transverse gyrus; greater use of ruminative emotion regulation was associated with reduced thickness of the left fusiform gyrus only.
Kashdan et al., 2012	54 veterans diagnosed with (*n* = 27) or without (*n* = 27) PTSD	5 items modified from the Responses to Depression Questionnaire (Nolen-Hoeksema & Morrow, 1991)	35 item Mississippi Scale for Combat-Related PTSD (Keane et al., 1988)	For individuals without PTSD, greater rumination on one day predicted less negative affect the following day. However, for those with PTSD, greater rumination on one day had no impact on negative affect the following day (i.e., negative affect persisted across days independently of rumination).

Kelley et al., 2019	283 veterans [a]	20 item RTSQ (Brinker & Dozois, 2009)	PCL-5 (Blevins et al., 2015)	Two types of rumination (i.e., problem-focused and anticipatory thoughts) mediated the association between killing in combat and PTSD symptom severity.
Lee et al., 2020	480 treatment-seeking individuals diagnosed with PTSD	2 item rumination subscale of CERQ-Short (Garnefski & Kraaij, 2006)	CAPS-5 (Weathers, Blake, et al., 2013)	Exploratory factor analysis of the CERQ-Short revealed that combining the rumination subscale with the 2 item catastrophising subscale to yield a general perseveration factor was more appropriate. Scores on the perseveration factor associated with PTSD symptom severity.
Lommen et al., 2009	113 tsunami survivors [b]	Rumination questionnaire designed by authors, adapted from RRQ	PDS (Foa et al., 1997)	Rumination was associated with a diagnosis of PTSD, but rumination did not predict PTSD diagnosis.
Meiser-Stedman et al., 2014	57 child and adolescent survivors of physical assaults and motor vehicle accidents with (*n* = 8) and without (*n* = 49) PTSD	Three item questionnaire based on existing adult measures (Ehlers et al., 1998)	ADIS-C (Silverman & Albano, 1996) CRIES (Dyregov & Yule, 1995)	Individuals with PTSD reported greater rumination; rumination was associated with increased likelihood of PTSD diagnosis and PTSD symptom severity. Rumination mediated the effect of thought control strategies (punishment and reappraisal) on PTSD symptom severity.
Michael et al., 2007 (Study 1)	81 assault survivors with (*n* = 32) and without (*n* = 49) PTSD	Rumination Interview (designed by authors)	PDS (Foa et al., 1997)	Individuals with PTSD reported engaging in rumination more frequently and for a longer duration. Rumination reportedly used to stop intrusive memories, and rumination triggered intrusive memories. Across total sample, several characteristics of rumination (e.g., compulsion to continue ruminating, "what if" and "why" questions, unproductive thoughts) and negative feelings during/ after ruminating were associated with PTSD symptom severity.
Nagulendren & Jobson, 2020	Caucasian Australian (*n* = 31) and East Asian Australian (*n* = 38) trauma survivors with and without PTSD	RRS of RSQ (Nolen-Hoeksema & Morrow, 1991) RIQ (Clohessy & Ehlers, 1999)	CAPS-5 (Weathers, Blake, et al., 2013)	Caucasian Australians with PTSD reported more rumination (both depressive rumination and trauma-related rumination) than those without PTSD. East Asian Australians with PTSD reported more rumination (both depressive rumination and trauma-related rumination) than those without PTSD. Across the full sample, and in both cultural groups, both types of rumination were associated with PTSD symptom severity.

Olatunji et al., 2015	43 individuals, veterans with PTSD (*n* = 21) and non-veterans without PTSD (*n* = 22)	12 item RRQ (Trapnell & Campbell, 1999)	Mini International Neuropsychiatric Interview (Sheehan et al., 1998)	Individuals with PTSD reported greater rumination and less attentional control.
Pugach et al. 2020	90 trauma-exposed community members [b]	5 item brooding subscale of the RRS (Nolen-Hoeksema & Morrow, 1991)	CAPS-5 (Weathers, Blake, et al., 2013)	Brooding was associated with PTSD symptom severity. Relationship between PTSD and emotion regulation difficulties was fully accounted for by rumination.
Qi et al., 2020	1114 adolescents who experienced an earthquake, with (*n* = 516) or without (*n* = 598) probable PTSD	20 item modified ERRI (Zhou et al., 2015)	Revised PTSD Checklist from DSM-5 (Zhou et al., 2017)	Intrusive rumination (but not deliberate rumination) was associated with an increased risk of PTSD symptoms.
Roley et al., 2015	45 trauma-exposed individuals [a b]	20 item RTSQ (Brinker & Dozois, 2009)	PCL-5 (Weathers, Litz, et al., 2013)	Greater engagement in two types of rumination (repetitive and anticipatory thoughts) moderated the association between PTSD symptom severity and depressive symptoms.
Rosebrock et al., 2019	80 veterans diagnosed with depression, with (*n* = 43) or without (*n* = 37) comorbid PTSD	22 item RRS from RSQ (Nolen-Hoeksema & Morrow, 1991)	PCL – Civilian Version (Weathers et al., 1994) SCID (First et al., 2002)	No differences in rumination subscales (brooding, reflection, depressive) between veterans with and without comorbid PTSD. In veterans with comorbid PTSD, thought suppression was associated with brooding and reflection subscales; association was not significant for those without PTSD. Thought suppression was associated with depression-related subscale in both veterans with and without comorbid PTSD.
Schönfeld & Ehlers, 2006	55 trauma survivors with (*n* = 29) or without (*n* = 26) PTSD	12 item RIQ (Clohessy & Ehlers, 1999)	PDS (Foa et al., 1997)	Across total sample, rumination was associated with overgeneral autobiographical memories; association was not significant when restricted to individuals with PTSD. Rumination uniquely predicted overgeneral memory recall.
Speckens et al., 2007	31 individuals with PTSD	Rumination Interview (designed by authors)	PDS (Foa et al., 1997)	In comparing the phenomenology of intrusive thoughts and rumination, rumination lasted significantly longer. 73% of individuals reported ruminating about the past; less reported ruminating about the future (60%) or present (50%). 40% of individuals reported that rumination involved sensory experiences (imagery, sounds, smells, body sensations).

				58% of individuals reported that rumination was a trigger for intrusive memories; 73% reported that rumination was triggered by intrusive memories.
Vanderveren et al., 2020	355 community participants, (*n* =53) met clinical cut-off for PTSD	Brooding subscale of 10 item RRS (Treynor et al., 2003)	PCL-5 (Weathers, Litz, et al., 2013)	Rumination mediated the indirect effect of autobiographical memory coherence on PTSD symptoms.
Wisco et al., 2013	40 individuals with PTSD	2 item rumination subscale of CERQ-Short (Garnefski & Kraaij, 2006)	CAPS (Weathers et al., 2001)	Receiving written exposure therapy decreased PTSD symptom severity. Treatment effects not moderated by rumination. Use of rumination decreased following written exposure therapy, specifically from post-treatment to 3 month follow-up.
Woodward et al., 2019	Individuals with PTSD (*n* = 57), depression without PTSD (*n* = 29), insomnia without depression or PTSD (*n* = 42), trauma-exposed controls (*n* = 77), non-trauma-exposed controls (*n* = 80)	Trauma-thoughts before sleep inventory (designed by authors)	PDS (Foa et al., 1997)	Individuals with PTSD reported more pre-sleep (i.e., night-time) rumination than the four remaining groups. For trauma survivors (*n* = 152), pre-sleep rumination was associated with PTSD symptom severity.
Zhou et al., 2015	354 adolescents who experienced an earthquake [a b]	Chinese version of the 10 item ERRI (Zhou et al., 2014)	Chinese version of the Child PTSD Symptom Scale (Ying et al., 2014)	4.5 years following an earthquake, greater intrusive and deliberate rumination were associated with increased PTSD symptom severity. Intrusive rumination was associated with greater deliberate rumination. Intrusive rumination mediated the relationship between challenges to core beliefs and PTSD symptom severity.

[a] Reported sample mean above cut-off for probable PTSD diagnosis on self-report measure.
[b] Over half of sample had a probable PTSD diagnosis.

5. Implications for Theory and Practice and Directions for Future Research

In this final section, we consider the findings to have emerged from our review, and their implications for theory and clinical practice. We also draw attention to gaps in the extant literature and propose directions for future research that we consider the key next steps necessary in order to move forward our understanding, conceptualisation and treatment of rumination in PTSD. Our objective is to lay out an agenda for future work in this area. We specify six areas in which further investigation is needed.

5.1. We need a refined theoretical understanding of rumination in PTSD, tested in experimental studies

As noted at the outset, Response Styles Theory is arguably the most influential model of rumination not only in the depression field, but in the wider clinical literature. This model has been the subject of significant empirical testing, and has also provided a critical platform from which other theorists have developed and refined theoretical knowledge of the rumination construct. As noted earlier, Watkins' (2004, 2008) distinction between subtypes of rumination prompted a series of experimental studies which dismantled and isolated specific components of rumination in order to determine their relative effects, and confirmed abstractness as the key maladaptive feature. The findings of this experimental program provided a fine-grained understanding of rumination which in turn led to the development of effective interventions which target rumination via reducing abstract thinking (e.g., Watkins et al., 2007, 2011).

Such a direct progression - from theory, to the laboratory, to clinical practice - is currently lacking in the domain of PTSD. Only one theoretical account of PTSD (Ehlers & Clark, 2000) specifies a role for rumination in the maintenance of the disorder. In the 20 years since its publication, no further theoretical accounts have been put forward in the trauma literature which identify rumination as a maintaining factor. Whilst no doubt a key

and influential theory in the trauma field, this cognitive model presents a relatively broad conceptualisation of rumination. Thus, rumination has not been theoretically 'unpacked' in the PTSD literature as it has in depression – that is, no model of PTSD has posited the critical process elements of ruminative thinking in order to isolate the component/s responsible for its pernicious effects. For example, one aspect of rumination that warrants study is the extent to which it initially reflects a deliberate attempt to understand the trauma and 'work through' it – and further, whether over time, rumination may become a more automatic, default response. Nonetheless, adopting a transdiagnostic stance, we argue that the abstract quality of rumination that is maladaptive in the context of depression would be similarly maladaptive in PTSD.

Indeed, experimental work in which investigators have drawn on theoretical accounts in the depression literature and experimentally investigated the impact of abstract processing in trauma-related rumination in analogue studies have confirmed its adverse consequences relative to concrete processing (e.g., Ehring et al., 2009; White & Wild, 2016). Given the transdiagnostic nature of rumination, we see immense value in this approach. However, we also see real need for refinements in our conceptual understanding of the nature and role of rumination in PTSD specifically, in order to generate theoretically driven hypotheses for examination in the laboratory. Such experimental work will be a critical step towards shedding light on key maintaining mechanisms and will inform the development of interventions to effectively target trauma-related rumination in PTSD.

5.2. We need to better measure rumination in PTSD

A key issue to emerge from our review is that the measurement of rumination in PTSD represents a major shortcoming of this literature. In many of the studies identified researchers employed the Ruminative Response Scale (RRS) to index trait rumination. This instrument measures rumination about depression symptoms specifically (i.e., instructions are

as follows: *People think and do many things when they feel depressed. Please read each of the items below and indicate* whether you never, sometimes, often, or always think each one when you feel sad, down, or depressed; Nolen-Hoeksema & Morrow, 1991). Whilst depression and PTSD are highly comorbid, and thus rumination about depression symptoms may be relevant for many traumatised individuals, the extent to which it is an appropriate and relevant index of trait rumination in PTSD sample is highly questionable. This is particularly the case given that in Ehlers and Clark's (2000) model – the only account to implicate rumination in the maintenance of PTSD – the content of rumination is explicitly about the trauma. That said, we note that Speckens et al. (2007) reported that although the focus of rumination in their sample was primarily trauma-specific, some participants also reported engaging in broader, more generalised rumination. Such a finding is theoretically informative, and suggests that models of PTSD maintenance could be broadened to consider rumination that is not limited to the trauma per se. Clinically, it raises the possibility that practitioners may consider administering measures of both trauma-specific as well as general/trait rumination, in order to understand the extent and breadth of this type of thinking in individuals with PTSD.

Another measurement issue of concern is the significant proportion of studies included in the review within which researchers developed bespoke measures of rumination for which psychometric properties had not been established. This practice compromises the capacity to draw meaningful comparisons between findings across studies and raises concerns about the degree to which the findings obtained with such instruments are reliable, valid, and potentially replicable. In addition, we note studies in the wider literature in which instruments that index other constructs (e.g., re-experiencing symptoms) are described as having measured rumination (e.g., Shim et al., 2017). While we excluded such studies from the current review given the absence of an appropriate measure of rumination, this issue

speaks to the need for validated measures to index trauma-related rumination. Also noteworthy is the fact that a number of the studies employed the rumination subscale of the Responses to Intrusions Questionnaire (RIQ) to index rumination. Whilst this instrument tests a key cognitive response of individuals with PTSD – i.e., the tendency to respond to intrusive memories with rumination – it is important to be mindful that this instrument indexes the tendency to ruminate in response to the occurrence of this re-experiencing symptom. As such, any conclusions about rumination in PTSD drawn from studies that included this measure need to be drawn with this wording in mind. Further, the possibility that the predictive capacity of the RIQ may, in part, be an artefact of measuring the intrusive symptoms themselves warrants consideration.

In sum, there is a clear and urgent need to develop and validate a self-report measure which assess rumination in individuals with PTSD. The lack of such a measure in the literature to date is likely attributable in part to the absence of a comprehensive theoretical account of rumination in PTSD, and thus a clear consensus on its definition. Such a measure will be an important inclusion in future research, and also facilitate the assessment of rumination in a clinical context. In addition, focusing on repetitive thinking more broadly, we see value in including transdiagnostic measures of repetitive thinking (e.g., Repetitive Thinking Questionnaire, RTQ, McEvoy et al., 2010; Perseverative Thinking Questionnaire, PTQ, Ehring et al., 2011) in studies with PTSD samples in order to yield normative data for this sub-group. These instruments are designed to be administered to participants irrespective of clinical diagnosis, and regardless of comorbidity. For example, the state version of RTQ measures repetitive thinking about an index event, and as such could be readily adapted to instruct participants to anchor responses to the trauma. None of the studies included in our review employed one of these transdiagnostic instruments. We argue that these measures

could be useful in tracking changes in repetitive thinking about the trauma; that is, as a process measure as well as an index of pre-post treatment change.

5.3. We need experimental studies conducted with clinical samples

A significant proportion of the studies in our review were either cross-sectional or examined the predictive role of rumination in PTSD in prospective and longitudinal designs. Such designs represent key first steps in establishing whether rumination is associated with PTSD symptomatology cross-sectionally, and/or predictive of the disorder over time. Once established, the important next step is to conduct experimental work to test the extent to which rumination maintains PTSD symptoms and related cognitive and behavioural features of the disorder. To date, the status of the field is such that there are currently no experimental investigations of the impact of rumination conducted with PTSD samples. That said, we note that some researchers have conducted laboratory studies with non-clinical samples utilising analogue trauma stimuli (e.g., White & Wild, 2016) to dismantle key aspects of rumination in the context of trauma. Whilst analogue studies are a critical initial step in testing predictions about the mechanisms of psychopathology, it is essential that they are followed up by studies conducted with clinical samples. Indeed, the next step towards generating meaningful clinical implications is to test whether such findings are replicated in clinical samples. This represents a significant gap in the literature, as controlled experiments which manipulate rumination in clinical samples are critically needed in order to identify the ways in which rumination functions as a maintaining factor in PTSD.

5.4. We need to study the content/themes of rumination in PTSD

Only one study included in our review (Speckens et al., 2007) examined the nature, content, and themes of rumination in PTSD. Indeed, this mirrors the rumination literature outside the domain of trauma more generally, such that the research focus has been primarily

on the process of rumination rather than content. However, developing an understanding of the content and themes which are common in trauma-related rumination has the potential to inform theoretical accounts and tailor interventions. Such an approach has been employed to better understand the content of rumination within the context of perinatal mental health (e.g., Newby et al., 2019), as well as depression (Newby & Moulds, 2012). Future studies which adopt a qualitative approach to identify the common themes of rumination in PTSD have the potential to identify rich experiential material which can then be used as examples to enhance treatment.

5.5. We need more studies of rumination in PTSD across the lifespan.

Our review identified a small number of studies (N = 4) conducted with samples of children and/or adolescents. All of these studies examined predictors of adjustment after trauma, thus identifying processes that predict the development of PTSD. Whilst no doubt informative, we note that none of the studies conducted with young people to date have specifically recruited clinical samples, leaving many questions about potential differences (e.g., in the nature, frequency and impact of rumination) between trauma-exposed children/adolescents without and without PTSD unanswered. Future studies, including those with experimental designs, are needed with samples of children and adolescents. In addition, the self-report instruments used to index rumination in these studies were all adapted from existing measures, rather than developed specifically for young people. In addition, not a single study examining rumination in older adults with PTSD was identified by our review. Given that significant milestones which take place later in life (e.g., bereavement following death of family, friends) have the potential to trigger rumination, it is critical that this line of research be extended to examine rumination in PTSD in older adults. Targeting ruminative processes related to trauma in older adults may well promote adjustment to other significant life events in this period (e.g., retirement from the workforce), a possibility that remains to be

investigated. Accordingly, further work is clearly needed across the lifespan at each research stage, including the development and validation of psychometric tools to index rumination, experimental studies with clinical samples, and intervention studies examining the effectiveness of addressing trauma-related rumination in the treatment of PTSD.

5.6. We need to target (and measure changes in) rumination in the treatment of PTSD

Our review has established that rumination is associated with PTSD symptoms and is predictive of symptoms over time. Such findings speak to the need to address rumination within the context of treating PTSD. However, extant treatment protocols for PTSD do not routinely target rumination; the cognitive therapy for PTSD (CT-PTSD) protocol of Ehlers et al. (Ehlers & Wild, in press) is a notable exception. In CT-PTSD, rumination is conceptualised as a maladaptive coping strategy that maintains the disorder. The therapist targets rumination in two ways: by addressing the process itself and by addressing cognitive themes that drive the content of rumination. The therapist guides clients to discover the unproductive nature of rumination and help them to engage with activities to disengage from rumination. The therapist may also guide the client to formulate answers to repetitive 'why' questions with the best available information that the therapist and client can come up with. This is written on a flashcard and the client is prompted to read the flashcard when repetitive questions about the trauma come to mind. The second way the therapist addresses rumination is by targeting cognitive themes, such as guilt, shame, and anger, as these themes appear to form the content of ruminative thinking. This is achieved through several CT-PTSD techniques, dependent on the cognitive theme. Surveys to gather information to normalise clients' concerns are almost always part of the process of addressing troubling cognitive themes.

Beyond including a treatment component to target rumination as part of a broader cognitive-behavioural intervention for PTSD, another clinical possibility would be to adapt rumination-specific protocols and develop versions specifically for PTSD (see also Pugach et al., 2020). These could potentially be delivered as an additional module (or modules), alongside existing evidence-based PTSD interventions. For example, rumination-focused CBT (RFCBT: Watkins, 2016) is an effective treatment for current and residual depression which focuses on reducing rumination. RFCBT overlaps with Behavioral Activation (Martell, 2003) in its conceptualisation of rumination as an avoidance strategy. In RFCBT, the therapist takes a functional analytic approach and aims to understand the context and function of rumination, including its antecedents/consequences, and encourages the replacement of rumination with more productive approach behaviours. In addition, RFCBT includes experiential/imagery exercises and behavioural experiments in which the client is encouraged to compare the experience of rumination with that of being completely immersed in activity.

Such exercises lend themselves well to adaptation as part of treating PTSD. For example, rumination in response to intrusive memories was strongly associated with and predictive of PTSD symptoms in several studies included in this review. Discussing with clients how engaging in rumination in response to intrusions potentially functions as an unhelpful avoidance strategy which then counterintuitively prolongs distress, identifying situations in which ruminating about intrusions is more likely, and problem-solving alternative ways of responding all represent possible ways of adapting RFCBT to manage rumination in response to intrusions. Studies which evaluate the efficacy of adapting RFCBT in this way, in combination with established evidence-based treatments for PTSD, may be a fruitful avenue for future treatment research. Studies which seek to understand the specific PTSD symptoms which are most improved by directly addressing rumination in treatment are also warranted. Lastly, considering the significant drop-out rates from trauma-focused

treatments, treating rumination first may enable the client to benefit more from subsequent processing memory processing techniques (e.g., imaginal exposure) by promoting engagement with the trauma memory.

Another interesting clinical direction would be to investigate whether directly targeting rumination prevents the onset of PTSD. Available evidence indicating that engaging in rumination pre-trauma confers risk to the later development of PTSD (Wild et al., 2016) highlights the importance of teaching strategies to combat the tendency to ruminate in individuals at high risk of trauma exposure, such as emergency service workers. Indeed, a trial is currently underway investigating the effectiveness of targeting rumination to reduce rates of PTSD in student paramedics (Wild et al., 2018), the results of which will shed light on the capacity to prevent PTSD by modifying predictive cognitive processes. Further, in terms of early intervention, future work could evaluate whether targeting rumination in the early weeks following trauma exposure may reduce the likelihood of developing chronic posttraumatic stress symptoms.

Depression and PTSD frequently co-occur (Creamer et al., 2001), prompting the suggestion that the significant rates of comorbidity between these disorders may, even in part, be attributable to shared psychological processes which predict their onset and drive their persistence. As a transdiagnostic process evident in both disorders, rumination has been proposed as one such candidate (Angelakis & Nixon, 2015), raising numerous as yet unanswered clinical questions. For instance, do individuals with comorbid PTSD and depression engage in more rumination that those with a diagnosis of PTSD only? Does targeting rumination effectively reduce both PTSD and depression in comorbid presentations? Does a PTSD protocol that includes strategies which directly target rumination benefit clients with PTSD and depression more than clients with PTSD alone? Future studies

which address these, and related questions, will inform the clinical management of individuals with comorbid PTSD and depression.

Our review identified only one PTSD treatment study in which a validated measure of rumination was included as an outcome (Wisco et al., 2013). Future studies which administer self-report measures of rumination will extend these findings by enabling researchers to examine changes in rumination across treatment, as well as gauge the extent by which reductions in rumination mediate improvements in PTSD symptoms. We do note, however, some studies in which behavioural indices of rumination (e.g., perseveration) were indexed across treatment via coding of therapy sessions (Brady et al., 2015; Hayes et al., 2017). For example, Brady et al. (2015) examined in-session predictors of outcome in good and poor responders to trauma-focused cognitive therapy. To do so, therapy sessions were recorded and perseveration was coded by independent raters across four indicators: (i) preoccupied with / frequent return to particular themes, (ii) asking unproductive "what if"/ "why" questions that do not lead to additional insight, (iii) not responding to therapist's attempts to change topic, (iv) excessive detail/multiple examples in response to therapist questions. Based on this coding, perseveration was found to be higher in individuals who responded poorly to treatment. The indexing of ruminative behavioural over the course of treatment with observational means represents a novel direction for the assessment of rumination beyond (or possibly complementary to) self-report measures in future treatment outcome studies.

6. Summary

Despite being acknowledged as a transdiagnostic process (Harvey et al., 2004), rumination remains relatively understudied in the context of PTSD. In this systematic review, we have highlighted areas in which more research is required. In order to progress the study of rumination in PTSD, we need systematic experimental work, more studies with clinical samples, more investigations of children and young people, better measures of rumination,

and to adapt effective treatments for rumination in depression to PTSD (particularly for treatment protocols which do not address rumination). Progress in each of these areas will advance our theoretical understanding of the role rumination plays in the maintenance of PTSD, and lead to an increased ability to meaningfully assess, and effectively target, rumination within the context of trauma.

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