Using Experience Sampling Methodology (ESM) to improve our understanding of day-to-day intrusion experiences and persistent post-trauma impacts in survivors of trauma.

By

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ABSTRACT

Cognitive theories of posttraumatic stress disorder (PTSD) that underpin the foundations of current psychological interventions have largely been investigated by comparing groups over extended time periods, leaving gaps in our understanding of the time scales and inter-individual processes that allow trauma reactions to persist. Researchers in the trauma field are increasingly employing intensive repeated measure designs, such as Experience Sampling Methodology (ESM), to explore these processes and test key tenets of their underlying theoretical base. This thesis adopts an intensive ESM, informed by Ehlers and Clark's (2000) cognitive model of PTSD, to examine intrusion related factors proposed to be integral to the development and maintenance of the disorder.

Study 1a captured 100 trauma exposed individuals' intrusions, related distress, negative appraisals of intrusions, and maladaptive coping over a 10-day ESM protocol. Using multi-level modelling this study found significant intra-personal contemporaneous relationships that supported Ehlers and Clark's (2000) model, representing the first, comprehensive demonstration of these relationships in an intensive time frame. Other key findings were that intrusion related distress was more strongly related to appraisals and maladaptive coping than intrusion frequency and unexpected cross-level interactions indicated that individuals with fewer maladaptive coping tendencies than others were more reactive to day-to-day changes in distress and coping.

Study 1b then used Random Intercept Cross Lagged Panel Modelling (RI-CLPM) to examine select Study 1a data in greater detail, focusing on the relationships surrounding intrusion related distress. Maladaptive coping was split to model avoidance coping and rumination separately, revealing different associations for each strategy that suggest they influence trauma reactions in diverse manners. These models also demonstrated that not all the contemporaneous relationships observed in Study 1a translated to consistent covariance in individual time-points, with negative appraisals of intrusions appearing more stable across a single day than related distress and coping.

Comparing models of Day 1, 5, and 10 data showed that the patterns of relationships between all factors of interest changed throughout the ESM assessment period.

Finally, Study 2 randomly assigned 64 trauma exposed individuals to either a brief online intervention aimed to improve intrusion appraisals and adaptive coping strategy engagement, or control period, prior to engaging in a 7-day ESM protocol. Overall, from baseline measures to post-ESM, participants reported significant improvements in symptoms of PTSD. The only significant group difference was that individuals who received the intervention reported significantly greater reductions in negative appraisals than individuals in the control group. Moreover negative-cross level interactions for avoidance coping replicated some interactions observed in Study 1a.

Ultimately these findings provided valuable insight to inter-individual relationships occurring day-to-day in trauma reactions, providing further robust testing of dominant cognitive models of PTSD (such as Ehlers & Clark, 2000) and a more nuanced understanding of individual factors (i.e., 'avoidance') often treated as a homogenous construct in previous research. Although this thesis demonstrated the utility of ESM in furthering our understanding of trauma reactions, continued examination of these mechanisms and the broader applications of ESM are needed, with substantial potential for future research as well as clinical applications.

DECLARATION

I certify that this thesis:

1. does not incorporate without acknowledgment any material previously submitted for a degree or diploma in any university

2. and the research within will not be submitted for any other future degree or diploma without the permission of Flinders University; and

3. to the best of my knowledge and belief, does not contain any material previously published or written by another person except where due reference is made in the text.

Alexandra Canty
26/04/2024

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CHAPTER ONE - OVERVIEW

Introduction

Potentially traumatic events are experiences in which an individual is exposed to the threat or actuality of; death, serious injury, or sexual violence (American Psychiatric Association [APA], 2013). One possible consequence of such experiences is posttraumatic stress disorder (PTSD), an extended adverse response to traumatic experiences that continues to cause significant distress and impairment long after the experience concludes (APA, 2013). While trauma exposure is common, with approximately 70-90% of adults being exposed to at least one experience with the potential to lead to the development of PTSD (Kilpatrick et al., 2013; Knipscheer et al., 2020; Mills et al., 2011), the 12-month prevalence rate of PTSD ranges between 1 and 6.9% dependent on country (Karam et al., 2014; Kilpatrick et al., 2013; Slade et al., 2009). The relatively low proportion of people who are exposed to traumatic experiences that go on to develop PTSD indicates that trauma alone does not necessarily cause PTSD, prompting great empirical curiosity in factors that may determine which individuals suffer lasting trauma reactions while most others recover naturally (e.g., Brewin et al., 2000; Ehlers & Steil, 1995; Rothbaum et al., 1992; Slade et al., 2009; Trickey et al., 2012).

The overarching aim of the present thesis was to provide a more in depth understanding of posttraumatic intrusions and day-to-day relationships within trauma reactions. Experience Sampling Methodology (ESM) was used throughout to investigate how key associations varied within individuals over time and differed between individuals. Study 1a aimed to explore intensive within-person relationships between intrusion frequency, related distress, negative interpretations, and maladaptive coping by engaging 100 individuals in an intensive 10-day diary observation. Study 1b then intended to dissect the key relationships of Study 1a in greater depth using more sophisticated model analyses. Finally Study 2 intended to provide practical context to these observed relationships by applying ESM assessment to explore intrusive symptom reactions following a targeted online intervention.

Posttraumatic Stress Disorder

A diagnosis of PTSD requires that an individual experiences: a potentially traumatic experience, intrusion symptoms associated with the traumatic experience(s) (e.g., unwanted thoughts/flashbacks of the experience), engagement in avoidance of stimuli associated with the traumatic experience(s) (e.g., avoiding situations that serve as a reminder), negative alterations in cognitions and mood associated with the traumatic experience(s) (e.g., inaccurate self-blame, persistent negative emotional state), and marked alterations in arousal and reactivity associated with the traumatic experience(s) (e.g., hypervigilance, exaggerated startle response, sleep disturbance; APA, 2013). The final criterion is that symptoms must cause significant impairment in the person's social, occupational or general functioning and persist for at least a month (APA, 2013).

PTSD symptoms and associated factors negatively impact mental health, physical health, and general functioning (APA, 2013). PTSD has been found to significantly increase the likelihood individuals will develop both depression and anxiety (Elhai et al., 2008; Franko et al., 2005; Ginzburg et al., 2010; Maes et al., 2000) with these comorbid diagnoses linked to higher levels of subjective distress and more severe symptoms than PTSD alone (Byllesby et al., 2017; Maes et al., 2000; Momartin et al., 2004). Individuals diagnosed with PTSD are also more likely to engage in the misuse or abuse of alcohol and illicit substances (Debell et al., 2014; McCauley et al., 2012) which is subsequently related to poorer prognoses, treatment outcomes, and overall quality of life (Fedele et al., 2018; McCauley et al., 2012; Tate et al., 2007). Furthermore, PTSD is associated with decreased cognitive function (e.g., reduced verbal memory and impaired executive functioning; Op den Kelder et al., 2018), and decreased physical health (Johnsen & Asbjørnsen, 2008; Pacella et al., 2013). Within the community PTSD has also been linked to substantially higher economic burdens placed on healthcare and welfare systems (Kessler, 2000; Sabes-Figuera et al., 2012) indicating that extended posttraumatic symptomology can negatively impact both individuals and their broader society.

Most individuals who experience trauma remain resilient or recover naturally after experiencing some acute symptoms (Bonanno, 2005; Galatzer-Levy et al., 2018; Rothbaum et al., 1992). The presence of some posttraumatic reactions is not inherently pathological (Galatzer-Levy et al., 2018) and has even been proposed as potentially adaptive in acute circumstances (Eberly et al., 1991; Ehlers & Steil, 1995), for example, intrusive memories allow for the consideration of different potential reactions to a stressor, increasing a person's likelihood of avoiding similar future experiences. Hence, PTSD is often characterised as a failure of natural recovery processes (Yehuda & LeDoux, 2007) where posttraumatic reactions that continue beyond the acute phase can severely impair an individual's quality of life (Ehlers & Steil, 1995; Kessler, 2000; Pagotto et al., 2015). The frequency of natural or spontaneous recovery in individuals who have experienced trauma suggests that traumatic events are necessary for, but not the sole cause of, PTSD development (Ehlers & Steil, 1995; Rothbaum et al., 1992). Hence, both the factors that may predispose individuals to maintain PTSD symptomology and post-event variables that influence individuals' adjustment have been the focus great empirical interest (e.g. Brewin et al., 2000; Pineles et al., 2011; Trickey, 2012). This research has been largely driven by cognitive and information processing models which continue to be the dominant explanation for the development and maintenance of PTSD (e.g. Brewin & Holmes, 2003; Ehlers & Clark, 2000; Foa & Kozak, 1986) as well as the basis for current recommended psychological interventions (see International Society for Traumatic Stress Studies [ISTSS], 2018; Kitchiner et al., 2019; Mavranezouli et al., 2020; National Institute for Health and Care Excellence [NICE], 2018; Phoenix Australia Centre for Posttraumatic Mental Health [PACPMH], 2021; Watts et al., 2013 for guidelines and meta-analyses). Although these theories have significant commonalities, Ehlers and Clark's (2000) cognitive model of PTSD has the most empirical support for the processes of interest in the present thesis.

Ehlers and Clark's Cognitive Model of PTSD

While there are a multitude of potential explanations for why some individuals develop PTSD following trauma, cognitive models such as Ehlers and Clark's (2000) have received

significant empirical support (Beierl et al., 2019; Gómez de La Cuesta et al., 2019) and provided the foundation for currently recommended cognitive behavioural therapies of PTSD (PACPMH, 2021). In short, the cognitive model of PTSD (Ehlers & Clark, 2000) proposes that posttraumatic symptoms persist when an individual processes their experience in a manner that leads to the perception of an ongoing and current threat to their wellbeing. This sense of ongoing danger is thought to drive hypervigilance symptoms and generate significant emotional distress that motivates individuals to employ coping strategies (Ehlers & Clark, 2000). Ehlers and Clark (2000) theorised that maladaptive coping strategies inhibit re-evaluation of trauma memories and interpretations, thus perpetuating the sense of threat and posttraumatic symptoms. Although Ehlers and Clark's (2000) cognitive model was developed prior to the current DSM-5 (APA, 2013) and ICD-11 (World Health Organization [WHO], 2019) conceptualisations of PTSD, empirical findings lend continued support of the model and proposed symptom relationships as summarised next.

Ehlers and Clark (2000) suggest that two cognitive factors, memory disruption and negative interpretations, determine which individuals develop a sense of current threat. The cognitive model first theorises that peri-traumatic disruptions to the proper incorporation of the experience into autobiographical memory enable intrusive re-experiencing (Ehlers & Clark, 2000). Re-experiencing traumatic events through intrusive memories, thoughts, and dreams is common following exposure to potentially traumatic events (Marks et al., 2018; Steil & Ehlers, 2000). Often generalised as intrusions, these re-experiencing episodes can consist of individual sensations or combinations of thoughts, visions, sounds, smells, emotions, and bodily sensations (Kleim et al., 2013). Intrusions are often involuntary, occurring 'out of the blue' or without any conscious attempt to retrieve the memory (Ehlers & Clark, 2000; Kleim et al., 2013; Marks et al., 2018). Ehlers and Clark (2000) suggest this is because the trauma memory is incorporated without complete context, enabling a generalisation of stimuli to trigger re-experiencing and the feeling that the events are occurring at that moment not in the past. Individuals with PTSD often report immersive or 'flashback' intrusions where they re-experience the traumatic event in a way that feels as though it is happening at that

moment and they lose context of where they actually are (Kleim et al., 2013; Marks et al., 2018). These flashback intrusions have been identified as distinct symptoms of PTSD compared to other stress and trauma related disorders (e.g. panic disorder, specific phobias, and generalised anxiety disorders; Bryant et al., 2011). Kleim et al., (2013) found that trauma exposed individuals with and without PTSD experienced similar amounts of intrusions, but the 'here and now' quality of intrusions and emotional distress was more common in individuals with PTSD. Studies have established a relationship between memory factors and intrusions as Ehlers and Clark (2000) proposed (see Marks et al., 2018 for review), but have also found that it reduced over time (Ehlers et al., 2003; Ehring et al., 2008; Meiser-Stedman et al., 2019). Interestingly, some studies have also indicated that intrusions can have adaptive qualities related to post-traumatic growth, such as prompting active reassessment of the event (Brooks et al., 2019). Hence, while intrusions are a hallmark symptom of PTSD likely enabled by disjointed memory, they are not necessarily pathological on their own (Brooks et al., 2019; Ehlers et al., 2003; Krans et al., 2009; Marks et al., 2018; Stallard & Smith, 2007; Steil & Ehlers, 2000).

The second cognitive factor that Ehlers and Clark (2000) propose drives the perception of a current threat is an individual's post-trauma interpretation of the traumatic event and sequelae. The uncontrollable and overwhelmingly negative nature of traumatic events can cause some individuals to adjust their regular cognitions and beliefs about themselves and the world (Park et al., 2010). Ehlers and Clark (2000) propositioned that these beliefs lead to excessively negative appraisals of the traumatic experience itself (e.g. a life-shattering occurrence), posttraumatic symptoms (e.g. I am going mad), and other sequelae of the trauma (e.g. my body is ruined) that shape trauma experiences as open-ended negative influences rather than discrete past events, therefore perpetuating the sense of a current threat. Numerous studies have since linked negative appraisals, perceptions of permanent change, and overgeneralising danger following trauma exposure to increased PTSD symptoms (Dunmore et al., 2001; Fairbrother & Rachman, 2006; Ponnamperuma & Nicolson, 2016; Salmon et al., 2007; Stallard & Smith, 2007). A recent meta-analysis (Gómez de

La Cuesta et al., 2019) summarised the findings of 135 studies that explored the relationship between negative or maladaptive interpretations following trauma exposure and PTSD symptoms, calculating a large effect overall. The key influence of trauma-based appraisals has also been demonstrated in the opposite function, where improvements in appraisals have generated reductions in symptoms (Brown et al., 2019; Kleim, Grey et al., 2013; Kumpula et al., 2011). While memory factors are thought to initiate intrusions (Ehlers & Clark, 2000), the persistence of intrusions and other post trauma symptoms may be attributable to negative appraisals (Kumpula et al., 2011; Marks et al., 2018; Meiser-Stedman et al., 2019). This well-established relationship between trauma related appraisals and clinical symptom duration does support the cognitive model (Ehlers & Clark, 2000) theory of *why* individuals develop a perception of a current threat, but there is more complexity to the proposed mechanisms of *how* this maintains posttraumatic symptoms.

According to the cognitive model one of the key mechanisms that emerges from a perceived sense of current threat is emotional distress (Ehlers & Clark, 2000). Distress is often explored as a response to intrusive symptoms where it has been significantly associated with PTSD (Dekel et al., 2013; Kleim et al., 2013; Marks et al., 2018; Micheal et al., 2005). Interestingly, despite the necessity of intrusive symptoms to generate intrusion related distress, distress has been highlighted as a better predictor of PTSD severity and poor mental health outcomes than intrusions alone (Bryant et al., 2011; Kleim et al., 2013; Marks et al., 2018, Michael et al., 2005). Zoellner et al. (2022) recently demonstrated that distress reduction in prolonged exposure therapy predicted subsequent PTSD symptom reduction. Additionally, this relationship was predicted by coping strategies and hypervigilance symptoms but had no significant relationship with re-experiencing (Zoellner et al., 2022), reinforcing theories that intrusions are involved in the development of PTSD but not integral to its persistence. However, negative appraisals and distress are not expected to maintain posttraumatic symptoms through emotions alone, but rather though individual's attempts to relieve and escape the unpleasant feelings (Ehlers & Clark, 2000).

Ehlers and Clark (2000) propose that maladaptive coping strategies, intended to reduce distress, perpetuate symptoms by preventing trauma exposed individuals from accurately re-evaluating the trauma and their appraisals, thus maintaining the root causes of PTSD. Although there is some contention regarding the specification of which strategies are maladaptive (Brooks et al., 2019; Littleton et al., 2007) avoidance coping and ruminative thought are generally considered to be problematic due to their positive association with PTSD symptoms (Miethe et al., 2023). In fact, Short et al. (2018) observed a bi-directional relationship in which baseline PTSD symptoms predicted thought suppression, avoidance, and rumination which in turn predicted momentary symptom changes.

Avoidance strategies are intended to immediately reduce distress by removing a perceived danger, and circumventing intrusions or potential reminders of the trauma (Badour et al., 2012; Littleton et al., 2007; Pineles et al., 2011). Common avoidance strategies in PTSD include thought suppression (actively 'pushing' thoughts out of mind), experiential avoidance (consciously avoiding places, people, and things that may remind them of the trauma or bring up difficult emotions), and safety behaviours (actions that decrease the likelihood of a feared event occurring e.g. carrying a knife to prevent assault) (Beierl et al., 2019; Ehlers & Clark, 2000; Seligowski et al., 2015). Specifically thought suppression is proposed to prevent adaptive consideration of the trauma and sequelae, while increasing awareness of and sensitivity to intrusions (Ehlers & Clark, 2000). In support of this theory subsequent studies have found that thought suppression is associated with increased intrusions, general PTSD severity, and negative cognitive reactions when suppression efforts 'fail' (Bennett et al., 2009; Miethe et al., 2023; Seligowski et al., 2015). Comparatively, experiential avoidance and safety behaviours theoretically prevent individuals from engaging in experiences and finding that the catastrophic event they anticipated, did not eventuate (e.g. A person getting in a car following a motor vehicle accident, anticipating that a crash will occur, and experiencing an entirely safe drive; Craske et al., 2014). While aspects of these strategies can have potentially adaptive elements (Brooks et al., 2019; Littleton et al., 2007) or provide temporary

relief, persistent use of avoidance coping strategies are associated with PTSD and have been found to maintain intrusive symptoms and distress (Badour et al., 2012; Littleton et al., 2007; Miethe et al., 2023; Pineles et al., 2011; Seligowski et al., 2015).

Despite not being a symptom of PTSD like avoidance, rumination is also considered to be a maladaptive coping mechanism and has been significantly associated with increased PTSD (Miethe et al., 2023; Moulds et al., 2020; Short et al., 2018). While repeatedly thinking about the traumatic event may initially sounds like it could facilitate updated interpretations, rumination tends to involve fixation on unanswerable or negative thoughts in the absence of concrete problem-solving (Ehring et al., 2009; Rimes & Watkins, 2005; Zetsche et al., 2009). Hence, rumination prevents individuals from incorporating accurate memories, impairs emotional processing, and strengthens negative interpretations of trauma (Ehring et al., 2009; Rimes & Watkins, 2005; Zetsche et al., 2009). There is some contention regarding the definitions and mechanisms by which rumination interacts with PTSD, as some researchers suggest it operates as a form of avoidance (e.g. Moulds et al., 2020; Orcutt et al., 2020; Watkins & Roberts, 2020) although it is considered a separate transdiagnostic variable, while others suggest that rumination may directly exacerbate symptoms through non-avoidant mechanisms (e.g. Schumm et al., 2022; Wisco et al., 2023).

As well as the evidence supporting isolated elements of Ehlers and Clark's (2000) cognitive model of PTSD Beierl et al. (2019) prospectively observed cognitive trauma reactions that reflected the proposed mechanisms. In a study observing 700 individuals Beierl et al. (2019) found that cognitive responses just after traumatic experiences accounted for over half the variance in PTSD severity six months later. Maladaptive interpretations and disjointed memories one month after trauma exposure were found to predict PTSD through coping mechanisms as the cognitive model proposed (Beierl et al., 2019). However, while many studies have observed relationships that fit with the cognitive model, the detail and interconnected dynamics of these relationships are not well established, and the subject of great curiosity.

Assessment Intervals in Posttraumatic Research

To date a vast majority of the research exploring PTSD has been *macro-longitudinal* in nature, separating symptom assessments by weeks, months, or years (e.g., Beierl et al., 2019; Dunmore et al., 2001; Halligan et al., 2003; Kumpula et al., 2011; Marx & Sloan, 2005). These macro-longitudinal studies have provided a wealth of information, forming the evidence base behind cognitive models of PTSD and guiding many recommended clinical therapies (ISTSS, 2018; Mavranezouli et al., 2020). However, by design macro-longitudinal studies consist of a small number of assessments separated by extended time periods; increasing the potential impact of memory biases, precluding fine-tuned inferences regarding temporal relationships, and limiting observations of individual change (Greene et al., 2018; Shiffman et al., 2008). For example, although Beierl et al. (2019) found that negative appraisals and coping strategies assessed one month after trauma exposure significantly predicted PTSD symptoms 5 months later, this finding is limited to retrospective participant reports analysed as a group with no detail of how these relationships progressed to the outcome. This is why most current theories of PTSD describe potential avenues of symptom development and persistence without specific timelines or temporal relationships (e.g., Brewin et al., 2010; Ehlers & Clark, 2000; Foa et al., 2008). Hence, treatment protocols approach PTSD with the assumption that symptoms interact in a consistent manner across hours, days, or weeks, and a limited understanding of specific mechanisms for change (Marks et al., 2018; Shubina, 2015; Watkins et al., 2018).

The emergence of more intensive observation schedules or *micro-longitudinal* research in PTSD has highlighted the importance of exploring transdiagnostic PTSD relationships in greater detail. Firstly, memory and recall biases present in individuals with PTSD present challenges for retrospective reporting, with individuals who have PTSD more likely to report greater traumatic exposure (Roemer et al., 1998; Naragon-Gainey et al., 2012) and symptomology (Harvey & Bryant, 2000; Nahleen et al., 2019) in subsequent assessments relative to their own baseline reports. Although Naragon-Gainey et al. (2012) and Greene et al. (2022) found reasonable similarity

between diary and retrospective (30 days post-baseline) reporting of PTSD symptoms, concordance was lower for some sub-scale measures such as avoidance and flashbacks indicating that more frequent assessments may be more accurate in investigating these variables. Comparatively Schuler et al. (2021) found that weekly retrospective reports somewhat overestimated symptom severity compared to micro-longitudinal diaries.

Intensive assessment schedules employed by micro-longitudinal studies also present opportunities for a more fine-grained exploration of effects than macro-longitudinal studies (Bolger & Laurenceau, 2013; Shiffman et al., 2008). Micro-longitudinal studies' frequent repeated measures allow researchers to better separate temporal and contemporaneous relationships as progressions of behaviour and cognitions can be observed (Bolger & Laurenceau, 2013; Epskamp et al., 2018). Resultingly, temporal relationships observed in micro-longitudinal studies are considered more indicative of causality than associations obtained in macro-longitudinal studies (Epskamp et al., 2018; Granger, 1969). Additionally, micro-longitudinal research in PTSD has already established that significant fluctuations in symptoms, cognitions, and emotions can occur within a few hours (Greene et al., 2018; Greene et al., 2020; Hoffart et al., 2019; Price et al., 2020; Schuler et al., 2021) that macro-longitudinal approaches would not capture.

Furthermore, the numerous repeated measures included in micro-longitudinal studies enable researchers to simultaneously explore variables at both the between-person (BP) and within-person (WP) levels (Bolger & Laurenceau, 2013; Epskamp et al., 2018). Most longitudinal studies consider variables at the BP level, comparing groups or averages and exploring the inter-individual factors that may lead to different outcomes (Epskamp et al., 2018). Comparatively, WP observations explore how an individual fluctuates over time, demonstrating intra-individual variable changes that are rarely examined in traditional methodologies (Bolger & Laurenceau, 2013; Epskamp et al., 2018). Hence micro-longitudinal research can better capture the complexity of symptom relationships in context for each person and could be used to develop individualised guidance for therapeutic interventions.

Experience Sampling Methodology

Experience sampling methodology (ESM), also known as ecological momentary assessment, is a type of micro-longitudinal study design gaining popularity in PTSD research (Greene et al., 2020; Myin-Germeys et al., 2018). Usually consisting of multiple brief assessments conducted each day over multiple consecutive days, ESM often employs online survey systems that allow participants to complete frequent assessments while carrying out their normal lives (Myin-Germeys et al., 2018; Shiffman et al., 2008). This methodology presents improved ecological validity and reduced retrospective reporting compared to macro-longitudinal approaches and daily diary studies (Bolger & Laurenceau, 2013; Myin-Germeys et al., 2018; Shiffman et al., 2008). Alongside the theoretical benefits of general micro-longitudinal research, completing an ESM protocol has been associated with slight but significant reductions in PTSD severity (Dewey et al., 2015; Possemato, et al., 2012).

ESM explorations of PTSD have already contributed to a more detailed understanding of PTSD, demonstrating that significant symptom relationships can occur in intensive time frames and how WP processes can differ from group level observations (e.g. Greene et al., 2018; Greene et al., 2020; Hoffart et al., 2019; Price et al., 2020). Nonetheless, the popularisation of micro-longitudinal research in PTSD has opened innumerable avenues for exploration and is yet to detail many mechanisms, such as the potential relationship between appraisals, intrusions, distress, and maladaptive coping. At present many PTSD ESM studies investigate a few variables in isolation (e.g. Kleindienst et al., 2017; Kleim et al., 2013; Short et al., 2017). Considering that current theories of PTSD suggest that multiple symptom clusters and transdiagnostic factors influence each other extensively (e.g., Ehlers & Clark, 2000; Foa et al., 2008), these focused designs have limited applicability to investigating potential cyclic relationships proposed to drive the development and persistence of PTSD. Some ESM studies have subsequently expanded to investigate multiple PTSD symptoms enabling complex network style explorations of PTSD symptom relationships (e.g. Greene, 2018; Greene et al., 2018; Gelkopf et al., 2019; Hoffart et al., 2019; Pickman et al., 2017;

Price et al., 2020; Short et al., 2018). For example, Price et al. (2020) found that emotional reactivity to trauma cues appeared to be the starting point in acute trauma responses from which subsequent avoidance and startle symptoms were predicted, while intrusions were less central and did not predict other symptoms alone.

While informative on some symptom dynamic details, most ESM measures (e.g. Greene et al., 2018; Kleim et al., 2013; Price et al., 2020) are based on clinical self-report assessments of PTSD. These established, well-known measures are advantageous for reliably assessing PTSD symptoms in an accessible manner but were designed to establish the presence of clinically significant symptoms, not necessarily delve into symptom characteristics and theoretical factors that may drive PTSD development (Norris & Hamblen, 2004). For example, the Posttraumatic Stress Disorder Checklist (PCL-5; Blevins et al., 2015) asks how much individuals have been "bothered by" symptoms, which conflates how frequently each experience occurred and how often it generated significant distress. Considering that cognitive theories of PTSD (Brewin & Holmes, 2003; Ehlers & Clark, 2000) and empirical evidence (see Marks et al., 2018 for review) suggest that emotional distress related to trauma sequelae like intrusions may be a driving factor in the development of PTSD beyond the simple occurrence of post-trauma reactions, assessing the frequency of these experiences and the resulting distress as distinct variables could substantially inform current mechanistic understandings of PTSD (Hoeboer et al., 2022).

Contributions of the Present Thesis

The present thesis explores proposed key post-trauma sequelae in detail using an intensive ESM protocol to provide a greater depth of understanding of the post-trauma mechanisms that may drive the development and maintenance of PTSD. Specifically, this thesis details three studies that were conducted to improve our understanding of critical relationships between intrusions, intrusion related distress, negative appraisals, and maladaptive coping strategies. Study 1a collected 10 days of ESM data from 100 participants with prior trauma exposure to explore the contemporaneous relationships surrounding intrusive symptoms and distress. Study 1b subsequently explored subsets

of the first study data pool with more advanced analyses to investigate potential temporal relationships and tease apart avoidance coping and rumination relationships. Finally, Study 2 assessed the key relationships from the prior studies by recruiting 64 participants with prior trauma exposure, 33 of which received a brief intervention, to explore the applicability of ESM observation to PTSD treatment.

CHAPTER TWO - STUDY 1A: AN ESM EXPLORATION OF CONTEMPORANEOUS RELATIONSHIPS BETWEEN NEGATIVE INTERPRETATIONS OF INTRUSIONS, INTRUSION FREQUENCY, RELATED DISTRESS, AND COPING.[1]

Chapter Abstract

Background and Objectives: Cognitive models of posttraumatic stress disorder (PTSD) suggest that appraisals of traumatic sequelae and subsequent distress drive the development and maintenance of PTSD. Posttraumatic research has relied heavily on macro-longitudinal designs, with weeks or months between assessments of trauma-related cognitions and symptoms. The present study uses experience sampling methodology (ESM) to better understand the day-to-day experiences of trauma exposed individuals.

Methods: One-hundred trauma exposed adults reported their posttraumatic symptoms, interpretations, and behaviours four times a day over a 10-day ESM period.

Results: As anticipated, within-person fluctuations in negative appraisals of intrusions and maladaptive coping strategies (e.g., thought suppression) were significantly positively associated with intrusion frequency and related distress. In all cases, the associations for negative appraisals and maladaptive coping were stronger with intrusion related distress than intrusion frequency.

Limitations: The observed contemporaneous associations only demonstrate that variables reliably fluctuated together and cannot indicate causality.

Conclusions: The findings demonstrate that day-to-day fluctuations in trauma related perceptions and sequelae are significant and should be explored alongside broader individual differences to advance our understanding of the development, maintenance, and treatment of PTSD.

[1] This chapter was also written as an independent manuscript and is now published (Canty, Windsor, & Nixon, 2024; https://doi.org/10.1016/j.jbtep.2023.101921). The structure and a majority of the published content of the journal article has been retained in the chapter and content added post-publication is identified in the present thesis. Alexandra Canty was involved in the design of the study, completed all participant meetings, data collection, and analysis, and wrote the first draft of the publication.

Introduction

Exposure to traumatic experiences is common, current estimates indicate that 70-90% of adults have been exposed to at least one experience with the potential to precipitate posttraumatic stress disorder (PTSD; Kilpatrick et al., 2013; Knipscheer et al., 2020; Mills et al., 2011). However, the 12-month PTSD prevalence rate ranges between 1 and 6.9% dependent on country (Karam et al., 2014; Kilpatrick et al., 2013; Slade et al., 2009) as most individuals recover naturally despite commonly experiencing some acute posttraumatic symptoms (Bonanno, 2005; Rothbaum et al., 1992; Yehuda & LeDoux, 2007). Hence, PTSD is often characterised as a failure of natural recovery processes (Yehuda & LeDoux, 2007) with the cause of this failure being a particular focus of empirical research (e.g., Brewin et al., 2000; Ehlers & Steil, 1995; Rothbaum et al., 1992; Slade et al., 2009; Trickey et al., 2012).

Among numerous theories developed to explain why some individuals develop PTSD after traumatic experiences, cognitive models of PTSD have garnered significant empirical support (Brewin & Holmes, 2003; Ehlers & Clark, 2000; Gómez de La Cuesta et al., 2019).

In the cognitive model of PTSD, Ehlers and Clark (2000) propose that a key determinant of which individuals develop persistent PTSD symptoms is their interpretation of the traumatic event and natural sequelae. Specifically, while the occurrence of intrusive re-experiencing is theorised to partially be the result of peri-traumatic memory-based mechanisms (Bisby et al., 2020; Brewin et al., 2010; Ehlers & Clark, 2000), posttraumatic symptoms are proposed to persist in individuals who appraise sequelae such as intrusions negatively, causing further distress and promoting engagement in maladaptive coping strategies. The present study dissected the role of intrusion *frequency* versus the *distress* caused by intrusions to answer recent calls to better understand these characteristics (e.g., Marks et al., 2018) and their post-trauma relationships with negative appraisals and maladaptive coping, processes theorised to maintain PTSD.

Substantial evidence has linked negative appraisals regarding trauma experiences with increased posttraumatic symptoms (Dunmore et al., 2001; Fairbrother & Rachman, 2006; Gómez de

La Cuesta et al., 2019; Halligan et al., 2003; Meiser-Stedman et al., 2019; Stallard & Smith, 2007). Recently, Kooistra et al. (2023) established that changes to trauma-related thoughts and appraisals predicted subsequent PTSD symptoms to a greater extent than the symptoms predicted changes in appraisals. This reflects Beierl et al.'s (2019) finding that cognitive responses just after traumatic experiences account for over half the variance in PTSD severity six months later in which negative appraisals predicted PTSD both directly, and indirectly through maladaptive coping strategies. Negative appraisals and resultant distress are thought to drive engagement in maladaptive coping strategies such as experiential avoidance, thought suppression, and rumination (Price et al., 2020; Short et al., 2018). Unfortunately, while intended to relieve distress, these strategies are generally considered to instead contribute to the maintenance of posttraumatic symptoms by preventing adaptive re-evaluations of traumatic events and sequelae (Badour et al., 2012; Ehring et al., 2009; Krause et al., 2008; Littleton et al., 2007; Pineles et al., 2011; Seligowski et al., 2015).

Distress resulting from intrusions appears as a qualifying component of the PTSD diagnostic criteria (DSM-5; American Psychiatric Association [APA], 2013) and a key catalyst in cognitive PTSD theories such as Ehlers and Clark's (2000). Recent clinical studies (e.g., Hoeboer et al., 2022; Zoellner et al., 2022) demonstrated that decreases in subjective distress throughout treatment can predict overall PTSD symptom reduction. Interestingly, few post trauma studies explore *distress* caused by intrusions independently from intrusion *frequency* (Marks et al., 2018). Most studies document posttraumatic symptoms using established clinically relevant self-report measures (e.g., Greene et al., 2018; Kleim, Grey, et al., 2013; Short et al., 2017) which are predominantly intended to measure PTSD symptoms, not to scrutinise symptom characteristics or experiences theorised to cause the development and maintenance of the disorder. For example, the Posttraumatic Stress Disorder Checklist (PCL-5; Blevins et al., 2015) asks how much individuals have been "bothered by" symptoms, which conflates how frequently the experience occurred and how often it generated significant distress. Other studies may include, but not analyse, explicit measures of intrusion related distress (e.g., Kleim et al., 2012). Of the few studies that explore intrusion frequency and

related distress as separate dependent variables, many are analogue film-based (Marks et al., 2018) with limited generalisability to real world trauma exposure. As distress caused by intrusions is proposed to be an individual factor that influences, and is influenced by, post-trauma symptoms (Ehlers & Clark, 2000), assessing it separately from intrusion frequency is particularly relevant in establishing the potential causal mechanisms of PTSD development (Hoeboer et al., 2022).

Furthermore, much of the research informing our current understanding of PTSD comprises of macro-longitudinal designs where weeks, months, or years pass between assessments (e.g., Beierl et al., 2019; Dunmore et al., 2001; Kumpula et al., 2011). Macro-longitudinal designs are practical for studying long-term sequelae and have provided substantial evidence associating interpersonal variation in negative appraisals and maladaptive coping tendencies with PTSD severity (Gómez de La Cuesta et al., 2019). However, infrequent observations increase the opportunity for memory bias to impact individuals' responses and do not capture short-term fluctuations in cognition, emotion, and behaviour that may be important drivers of PTSD (Greene et al., 2018; Shiffman et al., 2008). These limitations have prompted an increase in the use of micro-longitudinal designs, such as experience sampling methodology (ESM), which involve obtaining frequent brief reports from participants, often with multiple assessments each day for several consecutive days (Shiffman et al., 2008). ESM provides data that is less subject to memory bias and allows for the comparison of groups and averages (BP; between-person), while simultaneously examining the fluctuations of individuals over time (WP; within-person) (Epskamp et al., 2018).

The emerging popularity of ESM has generated avenues to explore trauma reactions in novel detail, demonstrating that significant trans-diagnostic and inter-symptom relationships occur in intensive time frames (Greene et al., 2018; Greene et al., 2020; Hoffart et al., 2019; Price et al., 2020) that can differ from macro-longitudinal observations. Nonetheless, many ESM studies focus on variable relationships in relative isolation or limit the recorded intrusions (e.g., Kleindienst et al., 2017; Kleim, Graham, et al., 2013; Short et al., 2017). As most theories of PTSD (e.g., Ehlers & Clark, 2000) propose that PTSD symptom clusters strongly influence each other, these focused

designs provide limited insight into the underlying mechanisms hypothesised to maintain posttraumatic symptoms cyclically. It is also common for ESM measures to rely on clinical questionnaires to observe PTSD symptoms which, as discussed above, limits the exploration of potential causal mechanisms. For example, Greene and colleagues investigated the relationships between posttraumatic symptoms in a peri-traumatic sample who completed PCL-5 assessments twice daily for 30 days (Greene et al., 2018). This study observed a feedback loop in which negative emotions predicted increases in negative beliefs, avoidance, and negative emotions themselves at subsequent time points. However, these findings only tell us that individuals were more 'bothered by' subsequent symptoms, where details such as whether an increase in negative appraisals preceded an increase in intrusion frequency or just in intrusion related distress would have substantial theoretical implications.

Although similar ESM designs have successfully investigated some PTSD symptom associations (e.g., Greene, 2018; Pickman et al., 2017; Short et al., 2018) the present study assesses post-trauma intrusion frequency and intrusion related distress independently to explore Ehlers and Clark's (2000) proposed mechanisms of PTSD maintenance in detail. Accordingly, the present study employed an intensive fixed-interval ESM design to provide a preliminary exploration of these relationships at both the WP and BP level. One hundred individuals who had experienced a Criterion A traumatic event (APA, 2013), completed a 10-day ESM protocol that administered four online self-report measures each day.

Several predictions were made to capture both intra-individual variability in proposed relationships (i.e., WP variability) as well as how these intra-individual relationships may be moderated by inter-individual factors (i.e., cross-level interactions of WP and BP factors). Although there is limited research exploring such cross-level interactions of post trauma reactions, we speculated these would occur based on prior evidence regarding inter-personal appraisal and coping tendencies (e.g., Beierl et al., 2019) as well as intra-personal symptom reinforcement (e.g., Green et al., 2018). Accordingly, it was expected that on occasions where an individual reported a greater

degree of negative appraisals of intrusions than was typical for them, this would be associated with greater concurrent (1) intrusion related or estimated distress and (2) intrusion frequency. Furthermore, these associations were anticipated to be stronger for individuals who reported more negative appraisals than participants who reported fewer negative appraisals. Similarly, it was expected that an individual engaging in more than their usual amount of maladaptive coping at a given time point would report greater concurrent (1) intrusion related or estimated distress and (2) intrusion frequency. These associations were also anticipated to be stronger for individuals who engaged in more maladaptive coping throughout the study than those who engaged in less maladaptive coping.[2]

Method

Participants

The final sample of 100 participants, who's demographic and trauma characteristics are summarised in Table 1, were passively recruited through electronic and hardcopy notices distributed through a range of settings (university, community centres, social media, and local hospital waiting rooms). The sample size of 100 and minimum inclusion requirement of 20 completed ESM surveys were decided in tandem based on the recommendations of Arend and Schäfer (2019). With 100 participants completing at least 20 assessments the present study had an estimated statistical power of ≥.80 capable of detecting direct effects larger than 0.11 and, provided there is medium variance between participant's responses, cross level-interactions larger than 0.34 (Arend & Schäfer, 2019). Inclusion criteria were: exposure to a Criterion A trauma as defined by the DSM-5 (APA, 2013), age greater than 18 years, owning a smartphone, and English language fluency. Eligibility for participation was carefully established via email and, where necessary or

[2] Due to significant COVID-19 related delays in data collection and the (initially) ambitious proposed analyses, these hypotheses were simplified from the pre-registration prior to data collection.

preferred by the participant, phone conversation[3]. Of the 105 participants initially entered in the study, three participants did not appropriately complete the minimum 20 ESM surveys, one later indicated their experience did not meet Criterion A, and another participant did not appropriately comply with instructions (data deemed invalid), thus these five participants were excluded.

[3] Each potential participant's experience was clarified personally with them prior to inclusion in the study to not only carefully establish that they did meet Criterion A of the DSM-5 for PTSD (APA, 2013) but also, in the case of multiple experiences, to ensure what was their index trauma so it was clear that their reporting during ESM was tied to the relevant traumatic experience.

Table 1

Sample Demographics and Index Trauma

Variable	*M (SD) or n*	% or range
Age	26.77 (10.17)	18 - 66
Years of formal education	13.78 (1.99)	11 - 19
Time since index trauma (years)	6.71 (8.33)	0.2 – 46.6
Participants with more than one traumatic experience	79	79.0
Gender		
Female	82	82.0
Male	16	16.0
Otherwise Identifying	2	2.0
Racial self-identification		
White Australian	67	67.0
Asian	10	10.0
Other	9	9.0
European	8	8.0
Middle Eastern	5	5.0
Aboriginal or Torres Strait Islander	1	1.0
Marital Status		
Single	44	44.0
In a relationship but not living together	25	25.0
In a relationship and living together	19	19.0
Married	7	7.0
Separated or divorced	5	5.0
Index Trauma Type		
Physical Assault	28	28.0
Automobile Accident	27	27.0
Sexual assault	25	25.0
Unexpected loss of a loved one	16	16.0
Otherwise life threatening experience	3	3.0
Military Combat Exposure	1	1.0
Index Trauma Exposure Type		
Direct involvement	73	73.0
Witnessed	13	13.0
Learnt about it as it occurred to loved one	13	13.0
Part of occupation	1	1.0

Note. $N = 100$

Procedure

Eligible participants attended an initial meeting (in person or via Zoom) to establish informed consent before completing baseline measures via an electronic platform (Qualtrics™). Participants were instructed on the appropriate completion of ESM surveys and began the ESM protocol the following day. During the ESM protocol participants received SMS links to the survey

(Qualtrics^{TM}) at 9am, 1pm, 5pm, and 9pm for 10 consecutive days, totalling 40 potential assessment time-points. Participants were sent an SMS reminder if they did not complete the survey within an hour, ESM surveys submitted more than two hours after the survey link was distributed were not included in analyses. This study procedure was approved by the Flinders University Human Research Ethics Committee (REF: 3996).

Measures

Baseline

To accompany the basic demographic and index trauma characteristic questions, the baseline survey included three established and validated measures. The Life Events Checklist (LEC; Blake et al., 1990) documented participants' lifetime trauma exposure through self-report items exploring 17 traumatic experience types (e.g., *Fire or explosion*) and levels of exposure (e.g., *Witnessed it*). The PCL-5 (Blevins et al., 2015) measured PTSD symptom severity via 20 self-report items in which participants indicate how much various symptoms bothered them in the past month on a *0* (*Not at all*) to *4* (*Extremely*) scale. The PCL-5 generates a summed score between 0 and 80 where higher scores indicate greater PTSD severity. Internal reliability (Cronbach's α) was .95 in the present study. Finally, the Depression Anxiety and Stress Scale (DASS-21; Lovibond & Lovibond, 1995) was included to capture common mental health symptoms. This self-report measure comprises 21 statements (e.g., *I found it hard to wind down*) for individuals to self-rate applicability over the past week on a *0* (*Did not apply to me at all*) to *3* (*Applied to me very much or most of the time*) scale. In the present study this generated a summed score between 0 and 63 with greater scores indicating more severe symptoms; internal reliability = .94.

Electronic ESM survey

Participants received the ESM survey links four times per day during the 10-day ESM period. Each ESM survey included all measures listed in the subsections below while the 9pm survey also included a compliance question where participants self-reported their response accuracy

on a 0-4 scale ("*Please rate how accurately you have rated your intrusions today*") where *0 = Not accurately at all*, and *4 = Extremely accurately*.[4]

Intrusion Frequency and Related Distress. Participants indicated their number of intrusions since the previous survey by selecting one tick box from eleven options ranging from 0 to '10+' intrusions. Participants that reported at least one intrusion subsequently indicated their intrusion-related distress on a single-item 0 (*not at all distressing*) to 10 (*extremely distressing*) self-report scale. Participants who reported no intrusions in this time were instead asked how distressing they would have considered an intrusion to be ("*If you had experienced an intrusion since the last survey, how distressing do you think it would have been?*") using the same 0 to 10 scale. This enabled examination of perceptions of intrusion related distress across time points that did not include an intrusion occurrence defined as the 'estimated distress' variable.

Negative Appraisals of Intrusions. The Negative Interpretation of Intrusive Thoughts (NIIT; Nixon et al., 2009) is a 9-item self-report measure that asks individuals to indicate their current agreement with presented statements on a 7-point scale from 1 (*totally disagree*) to 7 (*totally agree*). In the ESM survey negative appraisals were indexed using 3-items from the NIIT that correlated most with the overall measure ("*I have a psychological problem*", "*My intrusion/memory shows that I am a lousy coper*" and "*I will not be able to tolerate my intrusion/memory about the traumatic event and I will fall apart"*; Nixon et al., 2009). This provided a summed score between 3 and 21 where greater scores indicate a greater tendency to interpret intrusions negatively with excellent internal reliability ($\alpha = .92$).

Maladaptive Coping Strategy Engagement. Maladaptive coping strategy engagement was indexed using 4-items where participants reported how much they had utilised thought suppression, thought substitution, distraction, and rumination in response to their most recent intrusion on an 11-point scale (0 = *not at all*, to 10 = *extremely*). The four items were summed to generate a score

[4] The baseline and ESM surveys also included other items (e.g., circumstances surrounding intrusions) and a post-ESM survey re-administered much of the baseline measures, however these were not analysed as they extended beyond the scope of the present study.

between 0 and 40 for each time point with greater scores representing greater maladaptive coping strategy engagement with very good internal reliability in the present study (α = .89).

Statistical Analyses

As ESM data are inherently hierarchical, with time-points (Level 1) nested within individuals (Level 2), multi-level models that account for the clustering of assessments (Hox et al., 2017) and accommodate missing data (Schafer & Graham, 2002) are frequently used in ESM analysis. The present study employed unstructured linear-mixed model analyses with restricted maximum likelihood estimation using the IBM SPSS 28.0 statistical package. The data for negative appraisals and maladaptive coping were dis-aggregated into BP (person-specific means across all available assessments) and WP (occasion-specific deviations from the person-mean) components. All BP components and appropriate baseline values were subsequently mean centred. Bi-variate correlations between predictors revealed coefficients between r = .23 and r = .58 within the acceptable range (Tabachnick et al., 2013), except for the correlation between negative appraisals and baseline PCL (r = .68). Excluding baseline PCL did not result in substantial changes in the standard errors associated with the coefficient for negative appraisals, suggesting that multicollinearity was not unduly biasing the estimates; we therefore retained baseline PCL in the analyses.

Initially, three null models were run to estimate the proportion of variance occurring BP (variance of the intercept) and WP (residual variance) in each outcome variable; intrusion related distress, estimated intrusion related distress, and intrusion frequency. Subsequent models included relevant predictor variables, cross-product terms, and covariates in stages to establish significant effects and changes to variance explained. Each model included participant age, years of formal education, and time since trauma as covariates to control confounding effects as prior research has

indicated these factors influence PTSD development and symptoms[5] (Brewin et al., 2000; Knipscheer et al., 2020; Michael et al., 2005). Initial posttraumatic stress symptom severity (PCL-5 score) was also included as a covariate to ensure observed BP relationships existed beyond baseline variation. On most occasions significant covariates slightly shifted estimate values without changing the pattern of model results. When including covariates in analyses resulted in more substantial impacts on the model parameters, this was documented in the Results. When initial models indicated that the BP and WP cross-product terms were not statistically significant they were removed to simplify interpretation of main effects. Final modelling included random slopes for the relevant WP independent variable and intercept-slope covariance. The proportion change in variance components was calculated as an index of *Pseudo* R^2 (Singer & Willett, 2003).

To illustrate the cross-level interaction relationships, the regression equation of each model with significant cross-product terms was solved at different combinations of 'high' (one standard deviation above the mean), and 'low', (one standard deviation below the mean), values of the relevant variables. Predicted values generated from this process were plotted to create the figures.

Results

Sample Characteristics and ESM Compliance

Baseline PCL-5 scores ranged from 0 to 75 (M = 33.56, SD = 18.70) with 50% of the sample meeting or exceeding the clinical cut off score of 31 that indicates probable PTSD status (Blevins et al., 2015). The sample average score on the DASS-21 was 25.32 (SD = 14. 40) with 53% of the sample presenting at least 'moderate' depressive symptoms and 29% reporting 'severe' depressive symptoms.

The final sample of 100 participants resulted in a dataset of 3682 valid ESM surveys completed. Participants completed an average of 92% ESM surveys, with only 14 included

[5] Gender presented an unforeseen difficulty in these analyses as two participants indicated that they did not identify with the male or female binary categories. Due to this small number, gender could not be meaningfully analysed unless all data for those participants was removed. Preliminary models showed no significant effects of gender for five of the six analyses conducted hence gender was only included in one final model which is identified later.

participants completing less than 85% of surveys appropriately. Participants rated the accuracy of their responses as being ‘very’ or ‘extremely’ accurate on 80% of survey occasions, with less than 1% of occasions being rated by participants as ‘inaccurate’.

Outcome Variable Variance Proportions

The null model for intrusion related distress indicated that approximately 64% of the variance occurred BP, whereas 36% was WP. Variance in estimated intrusion related distress was mostly accounted for at the BP level (86%), while variance in intrusion frequency was more evenly distributed across the WP (45%) and BP levels (55%).

Negative Intrusion Appraisals

Our first hypothesis, that individual changes in negative appraisals would be significantly positively associated with intrusion related distress, estimated distress, and intrusion frequency, was supported. As shown in Table 2, greater negative appraisals both BP and WP were significantly associated with higher intrusion related distress. The positive WP association indicates that on occasions where participants reported more negative appraisals relative to their own average, intrusion related distress also tended to be higher. The BP association shows that participants who expressed more negative appraisals reported generally higher intrusion related distress than participants who reported fewer negative appraisals. There was no significant interaction between WP and BP negative appraisals, indicating that increased negative appraisals of intrusions at any time were associated with similar increases in distress, regardless of a persons’ negative appraisal tendency compared to others.

Table 2

Linear Mixed Model Exploring the Associations of Negative Intrusion Appraisals with Intrusion Related Distress.

	Estimate	*SE*	95% CI		*p*
			LL	*UL*	
Fixed Effects					
Intercept	1.63	0.86	-0.07	3.34	.060
BP Negative Appraisal	0.11	0.05	0.02	0.21	.016
WP Negative Appraisal	0.13	0.05	0.02	0.23	.016
Gender	1.07	0.46	0.16	1.98	.021
Age	0.02	0.02	-0.01	0.06	.225
Years of Education	-0.08	0.08	-0.25	0.08	.310
Time Since Trauma	-0.06	0.02	-0.10	-0.02	.006
Baseline PCL	0.05	0.01	0.02	0.07	<.001

Note. BP = Between-person WP = Within-person; *CI* = confidence interval, *LL* = lower limit, *UL*= upper limit.

Negative appraisals accounted for an additional 13.74% of the WP variance in intrusion related distress, this medium effect indicates a reasonably strong relationship exists between changes in an individual's appraisals of intrusions and the amount of distress experienced. This model was the only analysis that demonstrated a significant effect of gender, with females reporting greater intrusion related distress. Although not the relationships of interest, findings that more recent trauma exposure and higher baseline PTSD symptoms were associated with more distress were not unexpected. The pattern of model results was unchanged by the inclusion of these significant covariates, indicating that the observed relationships between negative appraisals and distress remain significant and positive when accounting for differences in participant gender, time since trauma, and baseline PCL.

Similar results were found on occasions when individuals did not report any intrusions but were asked to consider their distress at that time if they were to have an intrusion. As shown in Table 3 increased negative appraisals were significantly associated with increased *estimated* intrusion related distress both BP and WP. In this case negative appraisals explained a small but

significant amount (1.58%) of the WP variance in estimated distress. A positive association was observed with age, indicating that older individuals were slightly more likely to express greater estimated intrusion distress, however none of the included covariates changed the pattern of findings related to the predictors of substantive interest.

Table 3

Linear Mixed Model Exploring the Associations of Negative Intrusion Appraisals with Estimated Intrusion Related Distress.

	Estimate	***SE***	**95% CI**		***p***
			LL	***UL***	
Fixed Effects					
Intercept	2.18	0.23	1.73	2.64	<.001
BP Negative Appraisal	0.20	0.07	0.06	0.33	.005
WP Negative Appraisal	0.10	0.04	0.02	0.17	.011
Age	0.06	0.03	0.01	0.11	.032
Years of Education	-0.06	0.12	-0.29	0.18	.634
Time Since Trauma	-0.05	0.03	-0.11	0.02	.137
Baseline PCL	0.02	0.02	-0.01	0.06	.205

Note. BP = Between-person WP = Within-person; *CI* = confidence interval, *LL* = lower limit, *UL*= upper limit.

In relation to intrusion frequency, as expected and shown in Table 4, WP negative appraisals generated a positive relationship as well as an interaction with BP negative appraisals (see Figure 1). Specifically, while individuals who had *lower* levels of negative appraisals than others (BP Low Neg. Appraisal) consistently reported a similar number of intrusions regardless of fluctuations in their negative appraisals, individuals who had *more* negative appraisals than others (BP High Neg. Appraisal) reported relatively increased intrusions when their appraisals were more negative than usual. Negative appraisals accounted for a modest but significant 2.78% of the WP variance explained in intrusion frequency, demonstrating a small effect. Although no included covariates demonstrated a significant direct effect, the initial model did produce a significant BP effect of negative appraisals on intrusion frequency which was reduced to non-significance with the inclusion of baseline PCL covariance. This indicates that inter-personal variation in appraisals were

not significantly associated with individuals' day to day intrusions independently of general PTSD severity.

Table 4

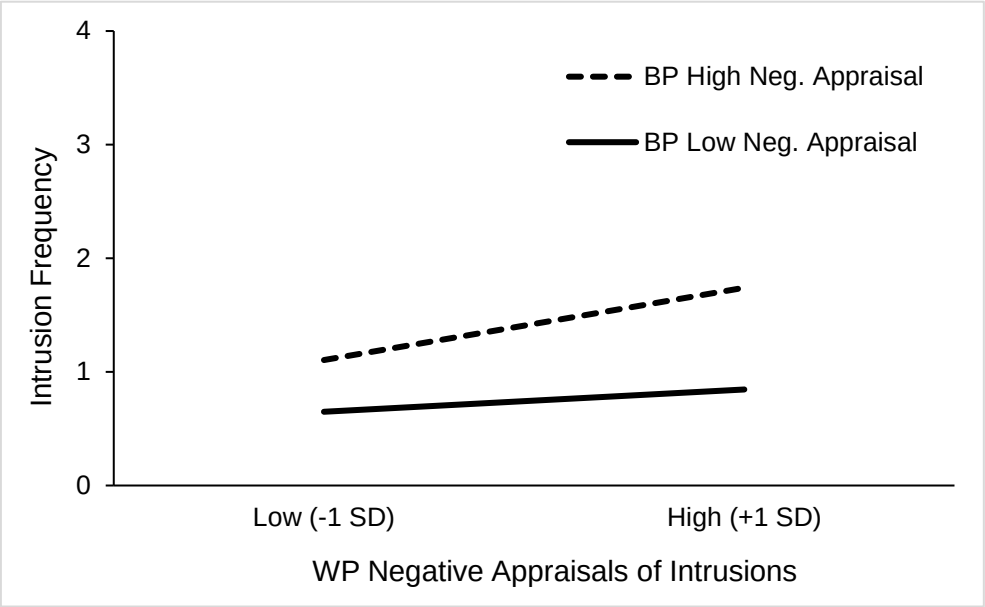
Linear Mixed Model Exploring the Associations of Negative Intrusion Appraisals with Intrusion Frequency.

	Estimate	***SE***	**95% CI**		***p***
			LL	***UL***	
Fixed Effects					
Intercept	1.08	0.14	0.81	1.36	<.001
BP Negative Appraisal	0.07	0.04	-0.01	0.15	.083
WP Negative Appraisal	0.14	0.04	0.07	0.21	<.001
BP × WP Negative Appraisal	0.02	0.01	0.001	0.03	.041
Age	-0.01	0.02	-0.04	0.02	.607
Years of Education	0.10	0.07	-0.04	0.24	.145
Time Since Trauma	-0.02	0.02	-0.06	0.01	.212
Baseline PCL	0.02	0.01	-0.00	0.04	.058

Note. BP = Between-person WP = Within-person; *CI* = confidence interval, *LL* = lower limit, *UL*= upper limit.

Figure 1

The Association of Between (BP) and Within-Person (WP) Variation in Negative Appraisals of Intrusions with Intrusion Frequency. Low and high BP and WP values represent 1 S.D. above and below the mean, respectively.



Maladaptive Coping Strategy Engagement

The prediction that individuals who reported engaging in more maladaptive coping strategies than their usual amount would report a corresponding increase in intrusion frequency and related distress, was also supported. As shown in Table 5, maladaptive coping was positively associated with both levels of intrusion related distress, but this was qualified by a significant *negative* interaction between the BP and WP effects. Figure 2 illustrates that individuals who reported *lower* engagement in maladaptive coping than others experienced a *stronger* positive relationship between their day-to-day maladaptive coping and intrusion related distress. WP variance in maladaptive coping accounted for approximately 12.15% of the variance in distress, demonstrating a medium effect. Consistent with the negative appraisal and distress analysis in section 3.3, maladaptive coping was negatively associated with time since trauma and positively associated with baseline symptom severity, although the pattern of results remained unchanged with these covariates included in the model.

Table 5

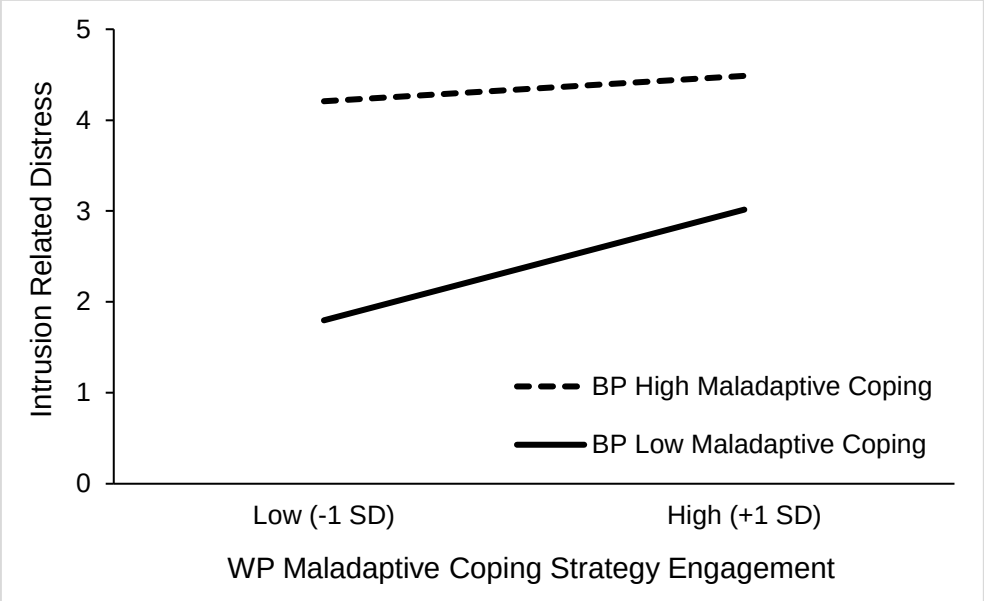
Linear Mixed Model Exploring the Associations of Maladaptive Coping Strategy Engagement with Intrusion Related Distress.

	Estimate	*SE*	95% CI		*p*
			LL	*UL*	
Fixed Effects					
Intercept	3.38	0.16	3.05	3.70	<.001
BP Maladaptive Coping	0.09	0.02	0.06	0.13	<.001
WP Maladaptive Coping	0.06	0.01	0.04	0.09	<.001
BP × WP Maladaptive Coping	-0.004	0.001	-0.01	-0.001	.011
Age	0.02	0.02	-0.02	0.05	.285
Years of Education	0.08	0.08	-0.09	0.24	.357
Time since trauma	-0.05	0.02	-0.09	-0.01	.025
Baseline PCL	0.06	0.01	0.04	0.07	<.001

Note. BP = Between-person WP = Within-person; *CI* = confidence interval, *LL* = lower limit, *UL*= upper limit.

Figure 2

The Association of Between (BP) and Within-Person (WP) Variation in Maladaptive Coping Strategy Engagement with Intrusion Related Distress. Low and high BP and WP values represent 1 S.D. above and below the mean, respectively.



Similarly, significant positive associations at both levels between maladaptive coping and *estimated* intrusion related distress were observed (Table 6), which were qualified by a significant negative cross-level interaction. As depicted in Figure 3, participants who engaged in more maladaptive coping at a given time point also reported more estimated distress than their usual levels at that time, but this relationship was *stronger* for individuals who engaged in *less* maladaptive coping than others throughout the study. Interestingly, while the strength and direction of interaction effects for actual and *estimated* intrusion related distress appear similar, WP variations in maladaptive coping accounted for approximately 3.91% of the variance in *estimated* distress, a modest amount compared to actual intrusion distress.

Table 6

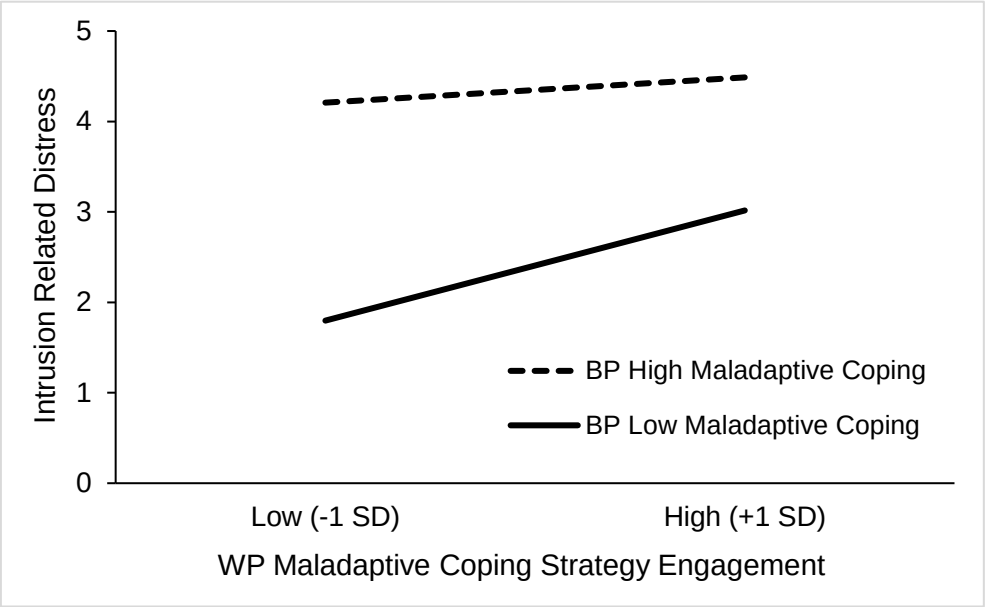
Linear Mixed Model Exploring the Associations of Maladaptive Coping Strategy Engagement with Estimated Intrusion Related Distress.

	Estimate	***SE***	**95% CI**		***p***
			LL	***UL***	
Fixed Effects					
Intercept	2.40	0.21	1.98	2.82	<.001
BP Maladaptive Coping	0.10	0.02	0.06	0.15	<.001
WP Maladaptive Coping	0.07	0.01	0.05	0.09	<.001
BP × WP Maladaptive Coping	-0.003	0.001	-0.01	-0.001	.002
Age	0.04	0.02	-0.01	0.09	.094
Years of Education	0.06	0.11	-0.16	0.29	.569
Time since trauma	-0.03	0.03	-0.09	0.03	.315
Baseline PCL	0.03	0.01	0.01	0.06	.009

Note. BP = Between-person WP = Within-person; *CI* = confidence interval, *LL* = lower limit, *UL*= upper limit.

Figure 3

The Association of Between (BP) and Within-Person (WP) Variation in Maladaptive Coping Strategy Engagement with Estimated Intrusion Related Distress. Low and high BP and WP values represent 1 S.D. above and below the mean, respectively.



Finally, the anticipated positive WP association between maladaptive coping and intrusion frequency was significant (see Table 7). The maladaptive coping BP effect was nonsignificant but did form a negative cross-level interaction with WP maladaptive coping illustrated in Figure 4. This indicates that WP variation in maladaptive coping, accounting for approximately 0.99% of the variance explained, is slightly *more strongly* associated with intrusion frequency among individuals who report *less* maladaptive coping than others. Inclusion of the covariates showed that baseline PCL was associated with greater intrusion frequency; inclusion of baseline PCL in the model also resulted in an attenuation of the BP maladaptive coping association, which became non-significant.

Table 7

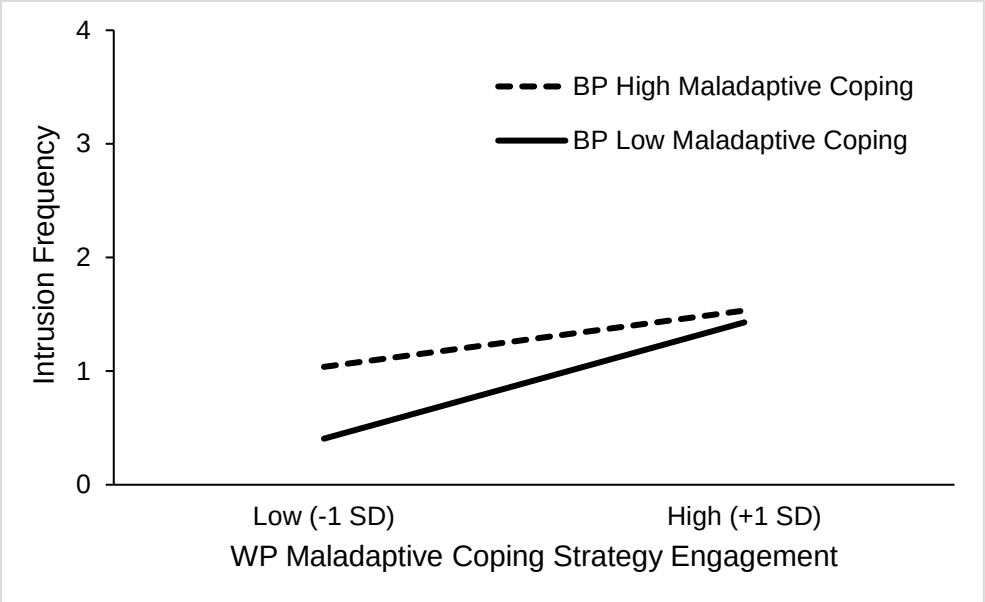
Linear Mixed Model Exploring the Associations of Maladaptive Coping Strategy Engagement with Intrusion Frequency.

	Estimate	*SE*	95% CI		*p*
			LL	*UL*	
Fixed Effects					
Intercept	1.10	0.14	0.82	1.38	<.001
BP Maladaptive coping	0.02	0.02	-0.01	0.05	.254
WP Maladaptive coping	0.07	0.01	0.05	0.08	<.001
BP × WP Maladaptive Coping	-0.002	0.001	-0.003	-0.001	.001
Age	0.001	0.02	-0.03	0.03	.964
Years of Education	0.09	0.07	-0.05	0.23	.205
Time since trauma	-0.03	0.02	-0.07	0.01	.112
Baseline PCL	0.02	0.01	0.01	0.04	.008

Note. BP = Between-person WP = Within-person; *CI* = confidence interval, *LL* = lower limit, *UL*= upper limit.

Figure 4

The Association of Between (BP) and Within-Person (WP) Variation in Maladaptive Coping Strategy Engagement with Intrusion Frequency. Low and high BP and WP values represent 1 S.D. above and below the mean, respectively.



Discussion

The present study demonstrated that day-to-day variation in negative appraisals of intrusions and maladaptive coping strategy engagement is associated with individuals' intrusion frequency and related distress. These concurrent fluctuations reflect the relationships proposed and observed in prior research (Beierl et al., 2019; Dekel et al., 2013; Hoffart et al., 2019; Price et al., 2020; Stallard & Smith, 2007). The main finding of this study was that while all WP associations were significant and consistent with expectations, intrusion related distress reliably generated greater effect sizes than intrusion frequency.

As predicted, both negative appraisals and maladaptive coping generated significant positive WP associations with intrusion frequency and related distress. However, these associations explained less than 3% of the variance in intrusion frequency and around 12% of the variance in related distress. This effect size discrepancy indicates that a person's level of distress regarding intrusions is subject to greater day-to-day fluctuation with appraisals and coping than the intrusions themselves. Additionally, while significant positive BP relationships with intrusion related distress were consistent with previous research (Dunmore et al., 1999; Fairbrother & Rachman, 2006; Michael et al., 2005) neither greater than average negative appraisals nor maladaptive coping were independently associated with intrusive symptom frequency. One potential explanation for these findings is that intrusive symptoms are mainly relevant to appraisals and coping through the distress caused and are generated by separate mechanisms not explored in the present study, such as memory encoding (Beierl et al., 2019; Brewin et al., 2010; Marks et al., 2018; Nixon et al., 2009). These findings reflect the theoretical key role (Ehlers & Clark, 2000), and emerging evidence (Marks et al., 2018; Michael et al., 2005; Zoellner et al., 2022), of intrusion related distress as a driving factor in PTSD maintenance beyond intrusion frequency.

As expected, both negative appraisals and maladaptive coping also showed significant positive WP associations with *estimated* intrusion related distress (Ehlers & Clark, 2000; Halligan et al., 2003; Price et al., 2020; Short et al., 2018). Interestingly, the amount of variance explained in

estimated distress was modest compared to effect sizes observed for actual distress. The relatively small proportion of variance explained by WP effects may indicate that *estimated* distress is more dependent upon intrinsic or stable variables (i.e., BP factors), while actual distress is more subject to day-to-day fluctuations. Previous research has shown that people's schemas or core beliefs are relatively stable, and that maladaptive schemas are associated with numerous psychological disorders including PTSD (Bourdon et al., 2021; Leahy, 2007; Renner et al., 2012). Hence, *estimated* distress, observed in the absence of intrusions, may reflect participants' consistent core beliefs regarding their posttraumatic symptoms and self. Comparatively, actual distress may reflect variation in other associated transient factors, like the 'here and now' quality of intrusions (Kleim, Graham, et al., 2013; Michael et al., 2005). This study is only a preliminary exploration of the relationships between intrusion related distress and PTSD maintenance but poses interesting avenues of investigation for future research such as whether the more stable nature of estimated distress presents different challenges when implementing intervention strategies. Relatedly, given estimated distress was measured at the same time as the other measurements, whether these relationships hold when timing of this variable varies (e.g., asking a participant to anticipate their expected or possible distress several hours in advance) remains an empirical question.

Some of the observed associations were further contextualised by significant cross-level interactions. For instance, while people with greater negative interpretations than others did not necessarily have more intrusions, the significant cross-level interaction indicates that these individuals are impacted slightly more by day-to-day changes in their intrusion frequency or appraisals than others. Given that individuals with greater negative appraisals than others also expressed more intrusion related distress generally, this interaction could indicate that the observed WP association between appraisals and intrusion frequency may depend on intrusion related distress. Contrastingly, participants who reported more maladaptive coping than others, expressed a weaker association between changes in their maladaptive coping behaviour and co-occurring intrusion frequency and related distress. The unexpected direction of the cross-level maladaptive

coping interactions may reflect the limited measurement of coping strategies. While maladaptive strategies have been identified in PTSD (Badour et al., 2012; Krause et al., 2008; Pineles et al., 2011), some aspects of these strategies are argued to be potentially adaptive in certain contexts (Helbig-Lang & Petermann, 2010; Kirk et al., 2019; Littleton et al., 2007). Additionally, Zang et al. (2017) showed that both maladaptive and adaptive coping decreased with symptom severity. Hence, it's possible that adaptive strategies not explored in the present study may influence this relationship, slightly reducing variability for individuals who generally engage in more coping than others.

The findings of this study are an important step to not only clarifying the theoretical relationships between appraisals, coping, intrusions, and related distress, but also in demonstrating the clinical importance of day-to-day variation in symptoms. For instance, although clinicians treating PTSD sufferers using a range of therapeutic modalities might discuss the unhelpful nature of catastrophising symptoms or teach methods to help contextualise intrusive experiences (i.e., not the same as actually experiencing the trauma again; Kleim, Grey, et al., 2013), the present findings illustrate that clinicians could highlight the importance of putting these practices into place 'in the moment', given the strong association between how individuals think about and react to intrusive symptoms within the day. Similarly, clients might benefit from education that when they have a tendency in general to have negative interpretations of intrusive experiences, this makes them somewhat more vulnerable (or possibly sensitised) to day-to-day fluctuations of intrusion frequency (and appraisals). This could strengthen the therapeutic rationales given when helping clients learn techniques to respond to such symptoms.

We acknowledge some limitations to interpreting our findings. First, although ESM provides a greater understanding of WP symptom variation, these analyses only demonstrate that variable fluctuations reliably occurred together and cannot indicate causality or lagged effects. Additionally, given its preliminary nature, the present study captured limited representations of some variables under study, for example, the ESM variable indexing coping was relatively

simplistic. To expand on the basic contemporaneous relationships established in the present study, future studies could incorporate more detailed variable measures, advanced statistical analyses, and experimental manipulations of key variables. Furthermore, the sample was predominantly female, white, well-educated students, and included a greater number of young adults than the general population. Although student samples have demonstrated comparable trauma exposure, rates of clinical disorders, and symptom characteristics to non-student samples (Boals et al., 2020), caution needs to be exercised when interpreting and extrapolating the results of this study to other contexts. Finally, all PTSD severity and fluctuations were exclusively measured by self-report. This approach was appropriate given the specific ESM study aims and resources, but replication of the present results with treatment seeking individuals and supplemental objective measures is encouraged. Despite these caveats, the study possessed several strengths. The micro-longitudinal design enabled exploration of trans-diagnostic relationships not only between-participants but within their day-to-day experiences. Statistical power was good with this large, trauma-exposed sample, and the mobile nature of the study allowed for good ecological validity. The findings of this study provide a strong guide to areas of future research by indexing contemporaneous relationships that can be further investigated using causal relationship-based designs.

Conclusions

The present study demonstrated that individual fluctuations in negative appraisals of intrusions and maladaptive coping strategy engagement are significantly associated with intrusion frequency and related distress. These contemporaneous relationships observed in a trauma exposed sample highlight intrusion related distress as a potentially more important driving factor in PTSD symptom maintenance than intrusion frequency. These findings add to increasing evidence of the importance of individual symptom perceptions, distress, and how this might influence PTSD development and maintenance.

CHAPTER THREE - STUDY 1B: A RANDOM-INTERCEPT CROSS LAGGED PANEL MODEL EXPLORATION OF THE INTENSIVE RELATIONSHIPS BETWEEN NEGATIVE APPRAISALS OF INTRUSIONS, INTRUSION RELATED DISTRESS, AND MALADAPTIVE COPING.

Chapter Abstract

Background and Objectives: Intensive Experience Sampling Methodology (ESM) explorations of post-trauma transdiagnostic factors have demonstrated that significant fluctuations in individual traumatic intrusion reactions and related factors. As diary type studies of posttraumatic stress symptoms increase in popularity, explorations of increasingly advanced analytic techniques present avenues for a greater depth of understanding in micro-longitudinal relationships. The present study employs Random Intercept Cross Lagged Panel Modelling (RI-CLPM) to examine the temporal relationships, as well as covariances, that occur between intrusion related appraisals, distress, avoidance coping strategy engagement, and rumination.

Methods: RI-CLPM was used to analyse select data from a prior 10-day ESM study in which 100 trauma exposed adults reported their negative appraisals of intrusions, intrusion related distress, and maladaptive coping strategy engagement.

Results: Most hypotheses were not supported as fewer temporal paths between the variables of interest were observed than anticipated, however numerous significant relationships involving intrusion related distress reinforced perspectives of its theoretical importance in post-trauma reactions. Negative appraisals appeared more closely linked to ruminative thought than avoidant coping and patterns of significant associations changed substantially from the Day 1 modelled data to the Day 5 and Day 10 data sets.

Limitations: Analyses were restricted to examine data from individual days of the ESM period due to the complexity of RI-CLPM and some scores in key trauma related variables from this non-clinical sample showed limited variability.

Conclusions: The findings of the present study reinforced prior observations of contemporaneous

relationships in trauma-specific and transdiagnostic trauma related factors with added temporal context and demonstrated the differing mechanisms operating within maladaptive avoidant coping and rumination. Furthermore, comparisons of models across days illustrated change in individual intrusion related distress, negative appraisals, and coping that reflect potentially beneficial assessment reactivity effects.

Introduction

Over the years both theoretical accounts and empirical investigations of the development and maintenance of posttraumatic stress disorder (PTSD) have considered the role of a multitude of variables (Marks et al., 2018; Trickey et al., 2012). Studies have consistently demonstrated the importance of cognitive factors surrounding trauma exposure and trauma sequelae in PTSD (Beierl et al., 2019; Dekel et al., 2013; Marks et al., 2018). One dominant theory, Ehlers and Clark's (2000) cognitive model of PTSD, argues that following trauma exposure, individuals who perceive the experience and their natural response to it as particularly negative and threatening are at significant risk of developing PTSD. Subsequent studies have found significant support for the key mechanisms and relationships proposed in the model, linking negative interpretations of traumatic events, emotional distress, and maladaptive coping strategy engagement with greater posttraumatic symptoms (Badour et al., 2012; Beierl et al., 2019; Byllesby et al., 2017; Dekel et al., 2013; Gómez de La Cuesta et al., 2019; Seligowski et al., 2015). Although these studies provide an excellent foundation of research, most were undertaken within macro-longitudinal designs, demonstrating that these variables are related over intervals of weeks or months, but not how appraisals, emotions, and coping strategies may interact in more acute time frames (e.g., daily) to ultimately develop into potentially long-lasting associations.

One area of particular relevance is maladaptive coping strategies which cognitive and emotional processing models of PTSD have long considered to be key to the persistence of PTSD (e.g., Brewin et al., 2010; Ehlers & Clark, 2000; Foa et al., 1989). Although intended to reduce distress, avoidance coping and rumination are commonly considered to be maladaptive in PTSD as

these strategies prevent appropriate re-appraisals of trauma related experiences, hence maintaining the disorder (Ehlers & Clark, 2000; Littleton et al., 2007; Orcutt et al., 2020). Substantial evidence has linked cognitive and behavioural avoidance strategies, such as thought suppression and experiential avoidance, with PTSD development and maintenance (Badour et al., 2012; Beierl et al., 2019; Gil & Weinberg, 2015; Littleton et al., 2007; Miethe et al., 2023; Pineles et al., 2011). While rumination is a transdiagnostic cognitive process arguably operating with different mechanisms to avoidance, PTSD research has consistently established strong associations between symptoms and rumination (Beierl et al., 2019; Miethe et al., 2023; Moulds et al., 2020). However, the exact pathways through which avoidant and ruminative coping strategies impact post trauma symptoms are still not fully understood (Marks et al., 2018; Moulds et al., 2020; Orcutt et al., 2020) as most current evidence is limited to documenting bi-directional relationships between PTSD, avoidant coping, and rumination from retrospective reports (Ehlers & Clark, 2000; Moulds et al., 2020; Miethe et al., 2023).

Researchers are increasingly employing micro-longitudinal designs such as experience sampling methodology (ESM) to tease out the interplay between varying PTSD symptoms and, occasionally, the potential underlying mechanisms driving the disorder. In these ESM studies, participants complete numerous brief observations over an intensive time frame (e.g., Greene, 2018; Kleindienst et al., 2017; Kleim et al., 2013; Pickman et al., 2017; Short et al., 2018). ESM studies have the advantage of collecting repeated measures, so that variables can be simultaneously compared at the group level (BP; Between-person) and at the individual level (WP; Within-person) (Bolger & Laurenceau, 2013). Additionally, the intensive time frame of micro-longitudinal studies can indicate whether variable changes occur together (contemporaneous relationship) or precede one another (temporal relationship), which can provide stronger evidence for causal relationships than macro-longitudinal studies (Epskamp et al., 2018; Granger, 1969; Greene, 2018). ESM studies of trauma exposed individuals such as Greene et al. (2018), Hoffart et al. (2019), and Price et al. (2020) have mapped the contemporaneous and temporal relationships between PTSD symptoms,

demonstrating how inter-symptom relationships in each moment do not necessarily reflect lasting effects. For example, Price et al. (2020) found strong positive associations between intrusions, emotional reactivity, and avoidance each day but intrusion occurrence on one day did not predict reactivity or avoidance on subsequent days.

Although micro-longitudinal studies of PTSD have greatly contributed to our current knowledge base, most have observed PTSD using brief symptom instruments (e.g., Greene et al., 2018; Hoffart et al., 2019; Kleim, Grey, et al., 2013; Short et al., 2017) which index clinical symptom severity rather than more detailed measurement of symptoms *and* other variables proposed to underly PTSD maintenance. Hence, ESM studies have observed strong contemporaneous, temporal, and BP relationships between symptoms like avoidance (Green et al., 2018; Price et al., 2020) but there is little exploration of trans-diagnostic variables such as distress and rumination. As detailed in Chapter 2, I established the presence of significant positive contemporaneous associations between individual participants' negative appraisals of intrusive memories and maladaptive coping strategies with co-occurring intrusion frequency and related distress. This ESM study not only provided further support for the cognitive model of PTSD (Ehlers & Clark, 2000), but it notably found stronger within-person associations for intrusion related *distress* than intrusive symptom frequency, two factors that are often conflated in diagnostic measures. These findings add weight to more recent calls for research to focus on the distress component of intrusive experiences versus simply frequency considerations (see Marks et al., 2018).

Improved understanding the strength and directionality of the relationships between PTSD, avoidant coping, and rumination would provide valuable insight as to how PTSD develops and may assist future research investigating how it can be most optimally treated (Ehlers & Clark, 2000; Moulds et al., 2020; Miethe et al., 2023). Greater knowledge of these processes also has valuable conceptual implications. For example, although abstract-type rumination (e.g., dwelling on questions that cannot be answered) is sometimes considered a form of avoidance (Bishop et al.,

2018; Orcutt et al., 2020; Watkins & Roberts, 2020), there is conflicting evidence as to whether it directly drives PTSD symptoms (Ehring et al., 2009; Moulds et al., 2020; Schumm et al., 2022; Wisco et al., 2023). Intensive repeated observations employed in ESM research present a clinically relevant opportunity to understand the factors that influence individual adjustment and day-to-day fluctuations of these processes, resulting in a more nuanced picture of modifiable targets that could ultimately be used to refine therapeutic processes. Accordingly, adopting an ESM design, the present study examined the temporal relationships and potential mediating factors between individual-level changes in negative interpretations of intrusive symptoms, associated distress, and coping.

The present study investigated the data collected in Study 1a in greater depth by employing an advanced statistical approach. While Chapter 2 examined contemporaneous relationships involved intrusion frequency and related distress that had not previously been dissected in an intensive measurement design, the focus of the present study was to explore *temporal* WP relationships between the key variables of interest. In addition, the previous maladaptive coping variable was deconstructed to explore the unique roles of avoidance and rumination given the potential of each factor having differential influences on the key dependant variables of interest. The sample comprised the original 100 adults reported on in the previous chapter.

As the intensive and temporal nature of the present study is a relatively novel investigation of WP relationships between negative appraisals of intrusions, distress, avoidance coping and rumination, the analyses undertaken represented a preliminary exploration of the research questions with a modest number of specific predictions. Generally, I anticipated that the pattern of results would reflect the mechanisms Ehlers and Clark (2000) describe in the cognitive model of PTSD. Some exploratory predictions regarding specific temporal intra-individual (WP) relationships of interest were formed based on prior theory (Brewin et al., 2010; Ehlers & Clark, 2000), empirical work (Beierl et al., 2019; Kooistra et al., 2023; Price et al., 2020), and the findings reported in Chapter 2. Hence, I anticipated that negative appraisals of intrusions would have a stronger

relationship with subsequent related distress than distress with subsequent appraisals. In models exploring the associations between negative interpretations, distress, and avoidance coping specifically, I expected that greater levels of distress at a given time-point would be associated with greater engagement in avoidance coping strategies at the subsequent time point. I also expected to see significant positive associations at the BP level between negative interpretations, distress, and either avoidance or rumination, reflecting the findings of prior macro-longitudinal research, although these BP associations were not the foci of the present study.

Method

Participants

The present study explored the data of 100 trauma exposed Australian adults collected for Study 1a whose recruitment and demographic information is detailed in Table 1 of Chapter 2. All participants had previously been exposed to a Criterion A traumatic event as defined by the DSM-5 (APA, 2013), owned a smartphone and were sufficiently fluent in English to understand the study requirements. Initially 105 participants were recruited but five were not included in the final sample; three individuals who did not complete the minimum 20 ESM surveys appropriately, one who later accounted that their experience a did not meet Criterion A, and one who failed to follow study instructions appropriately.

Procedure

Once eligibility was established through email or telephone correspondence with the researcher, participants were invited to attend an initial meeting to establish informed consent and complete the baseline survey online (via Qualtrics^{TM}). Participants were then instructed on the optimal completion of ESM surveys, including the importance of expeditious responses, and began the protocol the following day. During the 10-day ESM protocol participants received a link to the ESM survey via SMS at 9am (T1), 1pm (T2), 5pm (T3), and 9pm (T4). If participants had not completed an ESM survey within an hour of distribution, they were sent an SMS reminder.

Responses completed two or more hours after distribution were not included in the final dataset to limit retrospective reporting.

Measures

Baseline Survey

The same baseline survey was used for the present study as Study 1a, described in detail in Chapter 2. This included basic demographic and trauma characteristic questions, as well as the LEC, PCL-5, and DASS-21.

ESM survey

The ESM surveys administered at 4-hourly intervals each day for the 10-day protocol included several single item measures as well as abbreviated forms of some baseline measures. While all surveys had the same base content, the 9pm survey also contained an honesty measure where participants indicated their response accuracy throughout the day on a 0 = *Not accurately at all* to 4 = *Extremely accurately* scale.

Intrusion Frequency and Related Distress. Participants were asked to indicate how many intrusive symptoms they had experienced since the last survey in an 11-item tick box question, with options ranging from 0 (*no intrusive symptoms*) to 10+. On occasions where participants endorsed experiencing at least one intrusive symptom they were asked to indicate how distressing they found their intrusive symptom(s) since the last survey on a scale from 0 (*not at all distressing*) to 10 (*extremely distressing*). Conversely, when participants indicated that they had experienced no intrusions since the previous survey they were instead asked "*If you had experienced an intrusion since the last survey, how distressing do you think it would have been?*" and provided the same 0-10 distress scale to indicate their anticipated distress. This question enabled the exploration of perceptions and distress surrounding intrusive symptoms in their absence. In order to provide a cohesive index of intrusion related distress over time, reported distress related to an intrusion and distress reported in the absence of intrusions were merged into a single variable that was utilised in

the final analyses. This enabled the final models to explore how distress may be maintained by, or remain as a persistent factor influencing, negative appraisals and maladaptive coping.

Negative Appraisals of Intrusive Symptoms. Three items of the NIIT that correlated most with the overall measure ("*I have a psychological problem*", "*My intrusion/memory shows that I am a lousy coper*" and "*I will not be able to tolerate my intrusion/memory about the traumatic event and I will fall apart"*; Nixon et al., 2009) were included to index negative appraisals. This abbreviated form used the same 7-point scale as the full measure and provided a score between 3 and 21 where higher scores indicated greater endorsement of negative appraisals.

Maladaptive Coping Strategy Engagement. At face value participants were asked to indicate how much they engaged in four common maladaptive coping strategies (thought suppression, thought substitution, distraction, and rumination) in response to their intrusive symptom(s) on an 11-point scale from 0 = *not at all*, to 10 = *extremely*. Three-item abbreviated forms of the RTQ-10 (McEvoy et al., 2010) and AAQ-II (Bond et al. 2011), as determined by the highest item correlations with the overall measure, were included to further assess individuals' maladaptive tendencies. The abbreviated measures used the same rating scale as at baseline, generating a 0-15 score on the RTQ and a 0-21 score on the AAQ, with higher scores indicating greater ruminative and psychological inflexibility regarding intrusions respectively.

Statistical Analyses and Results[6]

To explore potential temporal effects while accounting for the nested nature of the intensive micro-longitudinal data generated by ESM the present study employed random intercept cross

[6] This section summarises the statistical analyses undertaken and processes relevant to the final approach and models included in this thesis, however, in the process of investigating advanced statistical techniques that could be applied to this ESM data I spent significant time researching several alternative avenues and methods not captured in this summary. This included learning the use of the Mplus statistical program, multi-level structural equation modelling, and dynamic structural equation modelling, as well as CLPM and RI-CLPM. As these advanced modelling techniques are constantly evolving, cutting-edge approaches in psychological research, there are limited plain language resources and rapidly changing best-practice guidelines that are often quite contested. I spent an 18-month period, quite independently investigating and learning about the optimal methods (and controversies) of analysing ESM data. This included testing whether new, relatively untried methods would provide further advantages to my data, before finalising the approach adopted in my thesis which was guided, in part, through consultation with external experts researching the latest methods of analysing ESM data. Hence, substantial time, educational development, and skill acquisition also occurred throughout the undertaking of this study beyond what the present thesis details.

lagged panel modelling (RI-CLPM). The structure of RI-CLPM estimates and partials out the BP effects which allows for the examination of WP temporary deviations in each construct from the 'trait' BP value similarly to standard multi-level modelling, however the value of RI-CLPM is that cross-lagged paths also estimate the longitudinal effects of that deviation on other constructs (Orth et al., 2021). Hence, the present study was able to investigate contemporaneous variables as Study 1a did, with the added capability of analysing autoregressive and cross-lagged effects that indicate how a variable may predict its own value and the value of a different variable at the next time point respectively (Orth et al., 2021). For example, the model could show that participants who report more negative *thinking* about their intrusions than their usual amount will express more *distress* than their usual amount at the subsequent time point.

In the present study, RI-CLPM was used to analyse the cross-lagged, auto-regressive, and contemporaneous paths between negative appraisals of intrusions, intrusion related distress, and either avoidance strategy or ruminative thought at the WP level. To limit the models to a reasonable number of parameters for the sample size, each model included the data from a single day with four time points. For each outcome variable, the data for Days 1, 5, and 10 were chosen for modelling as it was felt these assessment points provided a representation of the symptom relationships across the study duration. RI-CLPMs were conducted with restricted maximum likelihood estimation using the Mplus statistical package version 8.4 (Muthén & Muthén, 1998-2017) following the associated input structure as well as Hamaker (2018).

As detailed in Chapter 2 the mean scores for the final sample of 100 participants 33.56 (*SD* = 18.70) on the PCL-5 and 25.32 (*SD* = 14. 40) for the DASS-21. Table 8 summarises the amount of data available and the average reported value for each variable at each time point.

Table 8

Data Characteristics of the Data Set for Each Day.

Variable		***Day 1***		***Day 5***		***Day 10***	
Time	***Range***	***N***	***M (SD)***	***N***	***M (SD)***	***N***	***M (SD)***
Negative Appraisals	3-19						
1		94	9.21 (4.45)	87	9.11 (5.31)	86	9.15 (5.19)
2		92	8.85 (4.56)	97	9.03 (5.12)	94	9.11 (5.34)
3		91	8.66 (4.87)	92	8.98 (5.04)	96	8.97 (5.10)
4		94	8.69 (4.79)	96	9.04 (5.24)	88	9.02 (5.06)
Intrusion Distress	0-10						
1		86	3.49 (2.81)	82	2.84 (2.90)	80	2.84 (2.77)
2		85	3.51 (2.83)	90	3.02 (2.82)	87	2.74 (2.90)
3		87	3.18 (2.70)	83	2.99 (2.87)	90	3.09 (3.01)
4		86	2.95 (2.94)	92	3.10 (2.83)	84	2.88 (3.02)
Avoidance Coping	0-10						
1		94	4.90 (2.96)	96	3.69 (3.46)	84	3.65 (3.19)
2		91	4.75 (3.32)	94	3.93 (3.39)	90	3.97 (3.33)
3		90	4.45 (3.39)	88	4.00 (3.58)	92	3.88 (3.56)
4		93	4.07 (3.66)	93	3.92 (3.67)	95	3.60 (3.40)
Rumination	0-10						
1		94	3.72 (3.17)	86	2.40 (2.98)	83	2.72 (3.17)
2		91	3.66 (3.19)	93	2.51 (2.88)	90	2.61 (2.99)
3		88	2.73 (2.89)	88	2.55 (3.04)	92	2.27 (2.83)
4		93	2.67 (3.06)	92	2.42 (3.05)	85	2.44 (2.91)

Note. N = number of valid responses out of 100 on a given variable at that time

Base Cross Lagged Panel Models

First, a standard cross-lagged panel model (CLPM) was run for each RI-CLPM and tests of stationarity were conducted. A vast majority of the compared auto-regressive and cross-lagged paths returned non-significant results, indicating that the nature of these paths did not change significantly across the day and could be appropriately constrained. Interestingly, just three cross-lagged path comparisons did return a significant result; one in each of the Day 5 models indicating that a specific relationship path from Time 2 (1pm) to Time 3 (5pm) may differ from that same path between Times 3 (5pm) and 4 (9pm), and one in the Day 10 model of rumination indicating that a path between Time 1 (9am) and 2 (1pm) may differ from the same path between Times 3 and 4. As these specific paths did not meet stationarity assumptions further model comparisons were conducted to explore model fit. Three initial CLPMs were conducted for these data sets in which the non-stationary paths were left free while all other paths were constrained, and the fit indices for these models were compared to models that constrained all paths. Subsequent model comparisons chi-square difference tests (stationarity; Cole & Maxwell, 2003) indicated that there was no statistical difference between the partially and fully constrained CLPMs, hence the fully constrained models that present greater parsimony and statistical power were retained. Thus, all auto-regressive and cross-lagged paths were constrained to be invariant over time in the six final CLPMs detailed in Appendix B Figures S.1 – S.6.

Random Intercept Cross-Lagged Panel Models

Random intercepts were then added to the base CLPMs, allowing for the exploration of WP variance. The fit indices of the base CLPMs and final RI-CLPMs are detailed in Table 9, in all instances the chi-square difference tests demonstrated that the RI-CLPMs provided an improved model fit to the data when compared with the CLPM (Satorra & Bentler, 2010).

Table 9

Description and Fit Statistics for the Models using Day 1 and Day 5 data.

Data Subset	Outcome variable	Model	χ^2 (df), *p*	CFI	RMSEA [90% CI]	SRMR
Day 1	Avoidance	CLPM	58.129 (45) *p* = .091	0.979	0.054 [.000, .091]	.067
		RI-CLPM	35.618 (39) *p* = .625	1.000	0.000 [.000, .060]	.057
		Δ^2 Change	$\Delta\chi^2$ (6) = 14.760, *p* = .002			
Day 5	Avoidance	CLPM	126.457 (45) p = 0.00	0.889	0.135 [.107, .163]	.069
		RI-CLPM	23.988 (39) *p* = .972	1.000	.000 [.000, .000]	.036
		Δ^2 Change	$\Delta\chi^2$ (6) = 44.961, *p* = .000			
Day 10	Avoidance	CLPM	187.716 (45) *p* = .000	0.845	0.179 [.153, .206]	.066
		RI-CLPM	49.108 (39) *p* = .129	0.990	0.051 [.000, .091]	.042
		Δ^2 Change	$\Delta\chi^2$ (6) = 56.719, *p* = .000			
Day 1	Rumination	CLPM	63.972 (45) *p* = .033	0.967	0.065 [.019, .099]	.062
		RI-CLPM	34.31 (39) *p* = .684	1.000	0.000 [.000, .057]	.049

		Δ^2 Change	$\Delta\chi^2$ (6) = 17.943, *p* = .010			
Day 5	Rumination	CLPM	144.770 (45) p = .000 (1.3599)	0.868	0.149 [.122, .228]	.076
		RI-CLPM	44.360 (39) *p* = .256 (1.1631)	0.993	0.037 [.000, .082]	.044
		Δ^2 Change	$\Delta\chi^2$ (6) = 55.048, *p* = .000			
Day 10	Rumination	CLPM	137.247 (45) p = .000	0.884	0.144 [.117, .172]	.081
		RI-CLPM	55.136 (39) *p* = .065	0.983	0.061 [.000, .093]	.050
		Δ^2 Change	$\Delta\chi^2$ (6) = 37.302, *p* = .000			

Note. χ^2 = Chi Square statistic, used in cross-lagged models as a simple accept or reject value in which a *p* value greater than 0.05 indicates a suitable model fit. CFI = comparative fit index, an index of model fit bound between values 0 – 1 in which values greater than .9 demonstrate a good fit. RMSEA = root mean square error approximation, an index of model fit in which values below .05 are considered to indicate a good model fit. SRMR = standardized root mean square residual, an index of model fit where values lower than .08 are indicative of good model fit. (Baribeau et al., 2022; Zheng & Valente, 2023).

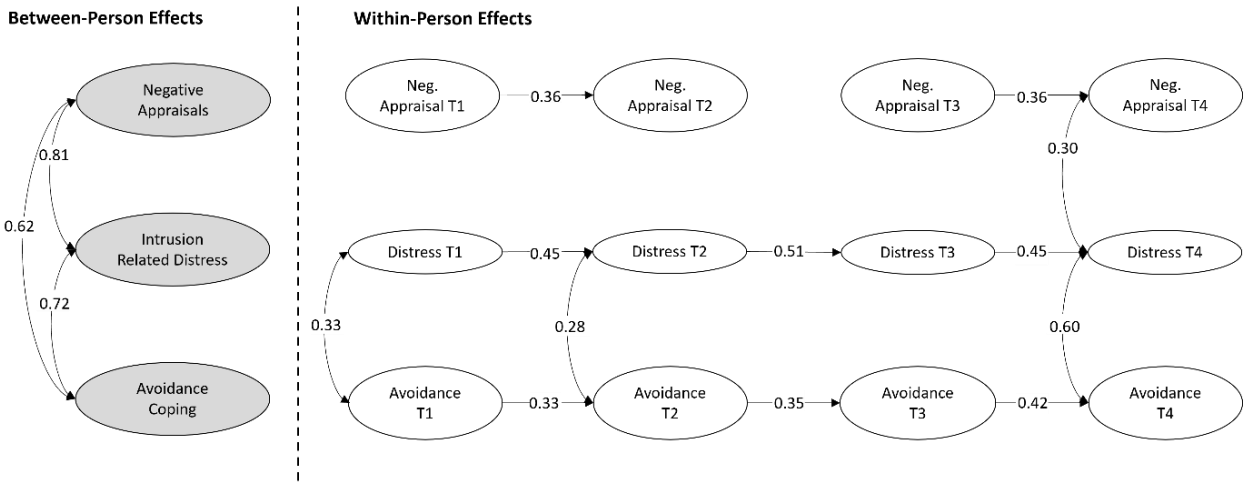
In contrast to my predictions, none of the RI-CLPMs conducted using Day 1 data generated significant cross-lagged relationships. Although some cross-lagged paths were present in models using data from Day 5 and 10, given the lack of consistency in these results, there was not strong evidence for the causal WP mechanisms between the variables of interest. Hence, the exploratory hypotheses for the present study were not supported, however, the significant RI-CLPM paths that were observed, detailed in the following sections, present interesting insight to potential transdiagnostic mechanisms in PTSD and diary observations.

Avoidance

As shown in Figure 5, the RI-CLPM analysing the Day 1 data for negative appraisals of intrusions, related distress, and avoidance coping revealed numerous significant auto-regressive and correlational relationships at the WP level. The positive significant auto-regressive path for intrusion related distress indicated that a person's level of intrusion related distress at one time point predicted their level of distress at the next, hence greater than normal levels of distress at one time would predict greater subsequent distress. Similarly, across the day a small but significant auto-regressive path was evident for avoidance coping, which suggests that the amount of avoidance coping an individual engages in at any given time point predicted greater engagement in avoidant strategies at later times. Interestingly there were also two significant auto-regressive relationships between negative appraisals measured at Time 1 (9am) and 2 (1pm), then between Times 3 (5pm) and 4 (9pm), but not between Times 2 and 3. This indicates that, on Day 1, individuals who reported greater negative appraisals in the morning were likely to report greater negative appraisals at 1pm, but those negative appraisals at 1pm did not significantly predict their appraisals in the evening.

Figure 5

Standardized Coefficients for the RI-CLPM Testing the Micro-longitudinal Effects of Negative Appraisals of Intrusions on Related Distress and Avoidance Coping Strategy Engagement Using Day 1 Data.



Note. Figure does not include paths where p > .05.

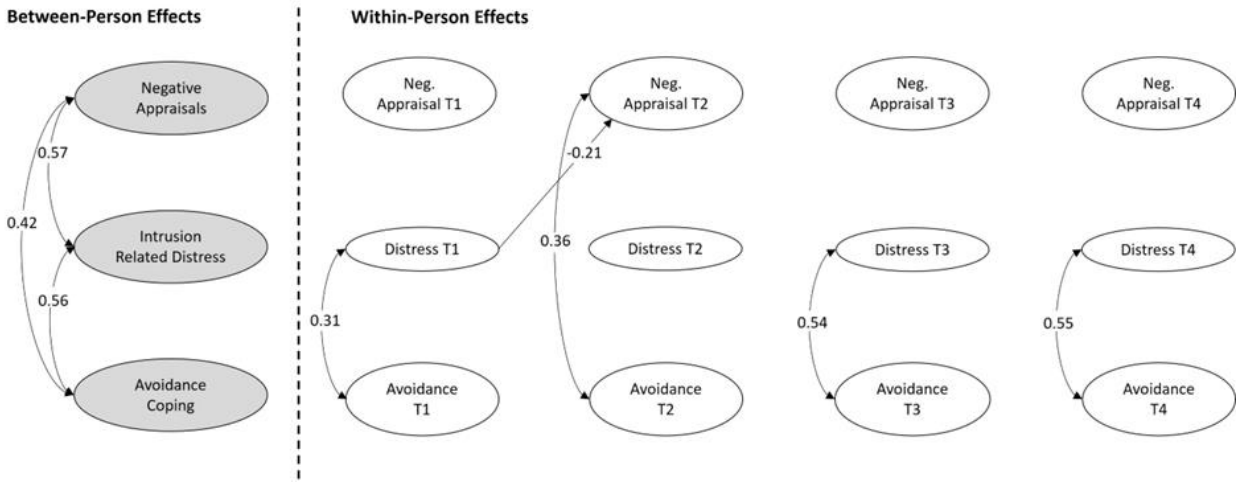
The significant positive correlations between intrusion related distress and avoidance coping indicated that a contemporaneous WP relationship exists between these key variables even when accounting for the auto-regressive paths. Hence, on occasions that an individual reported more distress than their usual amount, they also reported greater engagement in avoidance coping than normal for them. At Time 4 (9pm) the correlation between distress and avoidance coping appeared stronger than earlier time points and a significant correlation between negative appraisals and distress also appeared. As anticipated, there were significant positive BP associations between all three variables which reflect the group level observations of previous studies that linked greater negative intrusion appraisals, greater distress, and greater avoidance coping. These BP associations remained constant across all three avoidance models.

When the same RI-CLPM was conducted using the data from Day 5, as Figure 6 shows, far fewer significant paths were evident. Notably the auto-regressive paths for both distress and avoidance coping strategies disappeared, while the correlation between these factors remained significant for most time points. The most substantial diversion from the Day 1 pattern of results

was the emergence of a single negative cross-lagged path from distress to negative appraisals. This suggests that when an individual reported greater distress than their normal amount in the morning, they were likely to report slightly lower negative appraisals at 1pm. However, given that this path only appears once across all the days modelled, it is likely not a robust effect.

Figure 6

Standardized Coefficients for the RI-CLPM Testing the Micro-longitudinal Effects of Negative Appraisals of Intrusions on Related Distress and Avoidance Coping Strategy Engagement Using Day 5 Data.

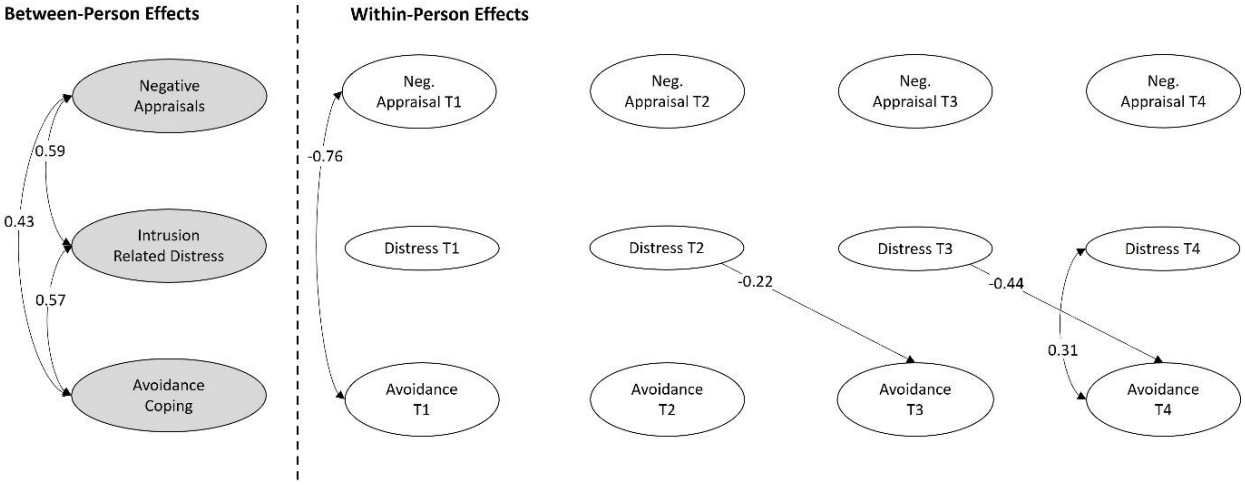


Note. Figure does not include paths where p > .05.

The Day 10 data RI-CLPM detailed in Figure 7 presented even fewer paths, with only four appearing as statistically significant. Interestingly, in contrast to any predictions, three of these paths are negative, with two negative cross-lagged paths between intrusion related distress and avoidance coping indicating that greater distress in the afternoon predicts a later decrease in avoidance.

Figure 7

Standardized Coefficients for the RI-CLPM Testing the Micro-longitudinal Effects of Negative Appraisals of Intrusions on Related Distress and Avoidance Coping Strategy Engagement Using Day 10 Data.



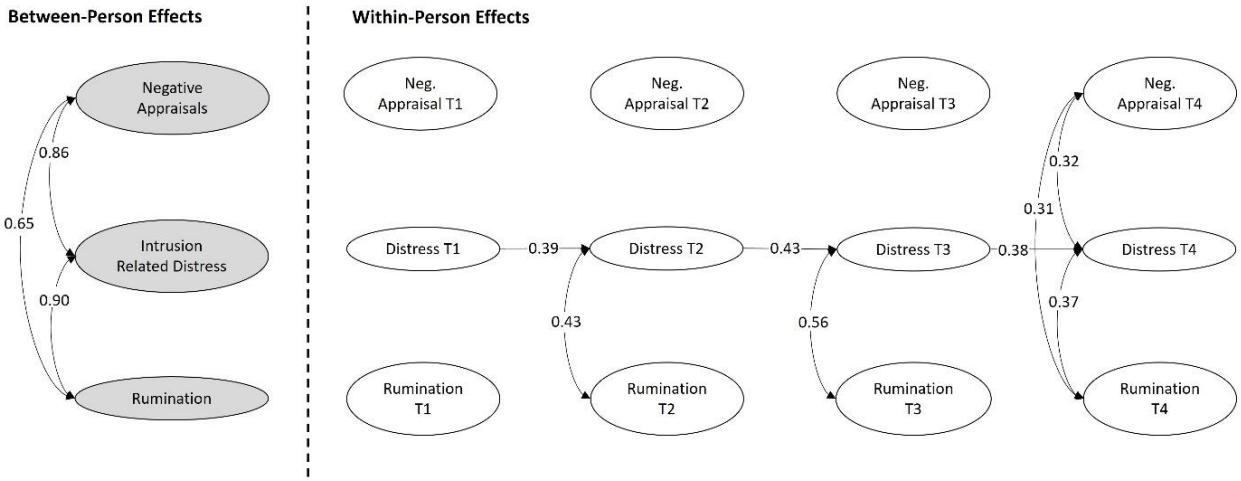
Note. Figure does not include paths where p > .05.

Rumination

Figure 8 depicts the RI-CLPM conducted to explore the relationships between negative appraisals of intrusions, distress, and ruminative thinking using the Day 1 data. In similar fashion to the Day 1 model that examined the role of avoidance, a significant positive autoregressive path was present for distress, however in this instance there was no significant autoregression effect for rumination. This suggests that intrusion related distress was likely to drive future distress regardless of coping strategy involvement, but greater ruminative thinking than normal did not necessarily predict greater ruminative thinking at a subsequent time points. There were also three significant positive correlations between distress and rumination, which suggests that on occasions where a person reported greater distress than their normal amount, they also reported more ruminative thinking than usual. Once again positive correlation effects appeared at Time 4 that did not appear earlier in the day. Negative appraisals of intrusions, distress, and rumination were also strongly associated at the BP level. These positive BP associations remained consistent for Days 5 and 10.

Figure 8

Standardized Coefficients for the RI-CLPM Testing the Micro-longitudinal Effects of Negative Appraisals of Intrusions on Related Distress and Rumination Engagement Using Day 1 Data.

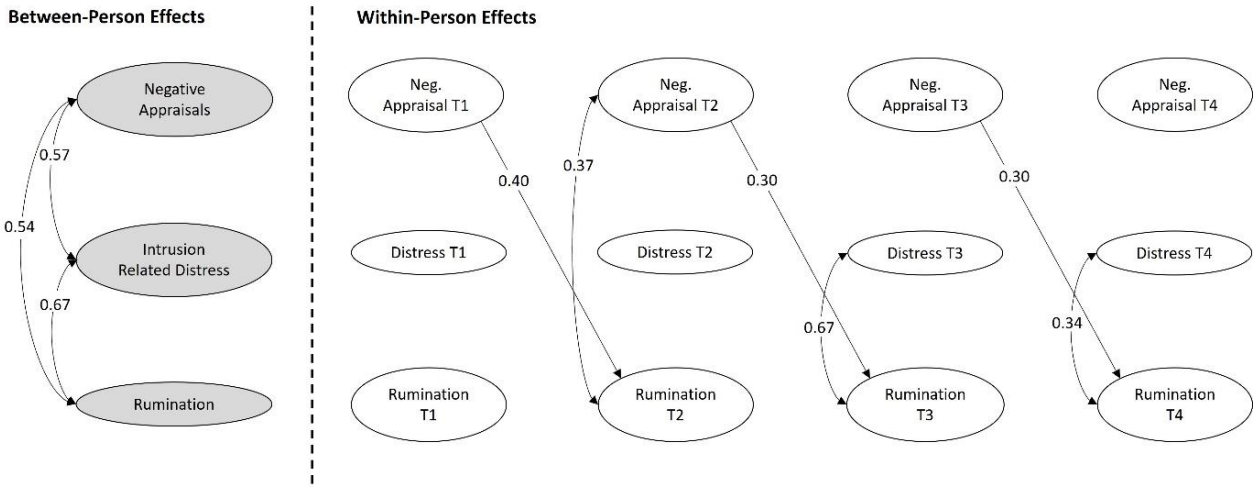


Note. Figure does not include paths where p > .05.

As evident in Figure 9, the RI-CLPM including rumination produced substantially different paths in the Day 5 data compared with using Day 1 data. No autoregressive paths were significant and several previously unobserved significant cross-lagged effects between negative appraisals and subsequent rumination engagement became apparent. These positive cross-lagged paths suggest that an individual who reported greater negative appraisals than usual at a given time point is likely to report increased rumination at the next time point. The correlational paths in this model were more similar to the Day 1 model, with several significant positive covariances between rumination and distress or negative appraisals. At Time 2 (1pm) a positive correlation suggests that greater than normal reports of negative appraisals were linked to greater than usual rumination at that time, while two correlational paths indicate that people who reported more distress than their normal amount would also report more rumination at Times 3 (5pm) and 4 (9pm).

Figure 9

Standardized Coefficients for the RI-CLPM Testing the Micro-longitudinal Effects of Negative Appraisals of Intrusions on Related Distress and Rumination Engagement Using Day 5 Data.

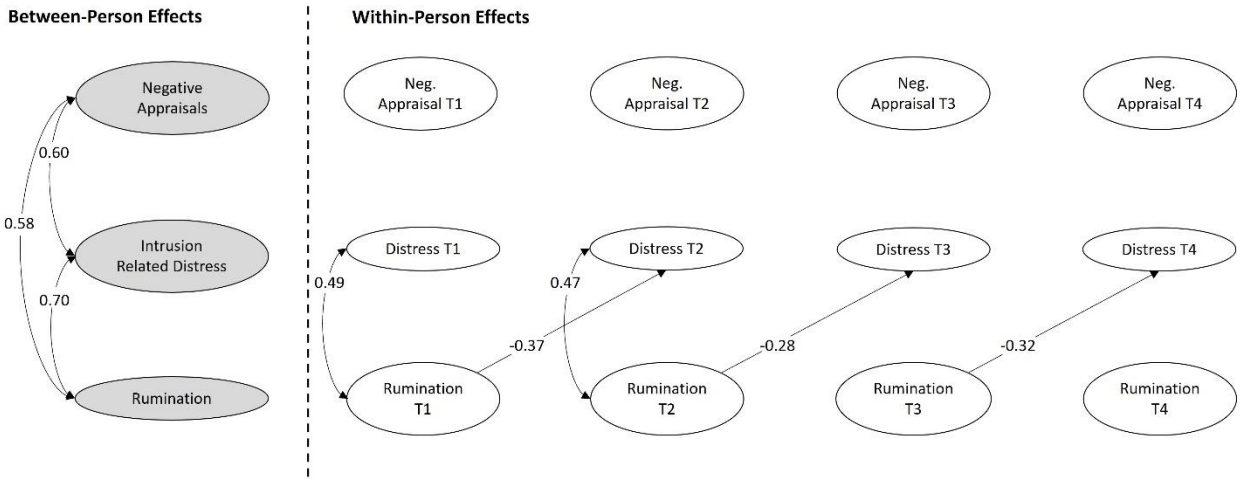


Note. Figure does not include paths where p > .05.

Finally, the Day 10 RI-CLPM of appraisals, distress, and rumination displayed in Figure 10 demonstrated unexpected negative relationships. Three significant negative cross-lagged paths between rumination and intrusion related distress indicated that an individual who reported greater levels of rumination than normal at one time point would likely report less intrusion distress than usual at the next time point. However, in more similar fashion to the Day 1 and 5 models, positive correlations at Times 1 and 2 indicate that greater levels of rumination were associated with greater distress at that same time. Interestingly WP negative appraisals appeared to have no significant association with either distress or rumination in the Day 10 model although the BP association remained significant.

Figure 10

Standardized Coefficients for the RI-CLPM Testing the Micro-longitudinal Effects of Negative Appraisals of Intrusions on Related Distress and Rumination Engagement Using Day 10 Data.



Note. Figure does not include paths where p > .05.

Discussion

Extrapolating the data from Study 1a using a more sophisticated analytical approach allowed the present study to examine intensive temporal relationships between key variables theorised to underpin the maintenance of intrusion distress in trauma exposed individuals, namely levels of negative appraisals of intrusions and varying maladaptive coping strategies. Although the cross-lagged relationships observed did not consistently fit the predicted patterns, these findings did reveal several relationships that support aspects of cognitive models of PTSD in novel detail, in particular, reinforcing the relevance of daily intrusion related distress. Similarly, the separation of rumination and avoidance from generalised maladaptive coping behaviours appeared fruitful as did the exploration of data over three separate days, given different day-to-day patterns of findings from these analyses. Ultimately this intensive approach presents interesting new avenues of research to advance our understanding of the changing daily relationships between intrusion-related distress and associated correlates.

Across the six RI-CLPMs detailed in the present study, the most consistently observed paths and relationships involved intrusion-related distress, reinforcing its critical role in PTSD as outlined

by previous theoretical and empirical work (Ehlers & Clark, 2000; Hoeboer et al., 2022; Marks et al., 2018). These models showed that on occasions when individuals reported greater intrusion related distress relative to their typical levels, they often also reported greater engagement in avoidance coping and ruminative thought. These correlations reinforce the contemporaneous relationships observed in Study 1a, demonstrating that the relationships continue to be significant when accounting for temporal effects. Although none of the anticipated cross-lagged paths involving intrusion related distress eventuated, the Day 1 models revealed significant positive auto-regressive paths for intrusion related distress indicating that an individual's subjective level of distress regarding intrusions partially predicts their subsequent distress beyond appraisals and coping behaviours. This autoregressive potential for distress and contemporaneous links to maladaptive coping behaviours matches previous indications that reductions in intrusion-related distress can predict reductions in PTSD symptoms (e.g., Hoeboer et al., 2022; Zoellner et al., 2022).

Expanding on the Study 1a findings, the present study dissected maladaptive coping into separately modelled factors for avoidance coping and rumination which revealed differences between the key relationships of these strategies. For one, negative appraisals of intrusions were rarely significantly associated with either distress or avoidance at the WP level but produced positive cross-lagged prediction paths for rumination in the Day 5 model. This is interesting as both Day 1 models show autoregressive change in distress throughout the day, but when this path was no longer significant in the Day 5 models, the avoidance model only included correlational paths with no evidence of change over time, while the Day 5 *rumination* model indicated that negative appraisals predicted subsequent rumination engagement. Thus, day-to-day fluctuations in negative appraisals may play a role in maintaining rumination outside its association with intrusion related distress, indicating that rumination is not necessarily a reaction to distress. These results provide important context to the contemporaneous intra-individual relationships observed in Study 1a as the previously significant associations between momentary negative appraisal fluctuations and distress were largely absent once autoregressive and covariance relationships with maladaptive coping

variables were modelled. As such, negative appraisals appear somewhat separate from the daily processes between intrusion distress and avoidance but may be a potential driving force in ruminative thought even when accounting for positive covariance relationships between rumination and distress. The divergent paths within these models demonstrate the importance of exploring avoidance and rumination separately, supporting the argument that rumination impacts PTSD symptoms through different mechanisms to avoidance (Wisco et al., 2023) rather than by acting as a global form of avoidance and distraction (Orcutt et al., 2020).

In comparing the characteristics of the models conducted using data sets from Day 1, 5, and 10 of the ESM period, several differences become apparent. For example, the Day 1 models presented more significant paths than Day 5 and 10 models. Notably, although all initial CLPMs showed significant auto-regressive paths, these paths only remained significant at the WP level in Day 1 models. This suggests that WP variability, namely in intrusion related distress, significantly impacted later reactions for the first day of the study, but four days later there was little evidence of this change throughout the day, suggesting individuals' intrusion reactions were more stable. Additionally, unexpected negative paths were most prevalent in the Day 10 models, with only one negative path present in the Day 5 avoidance model, and none in the Day 1 models. This indicates that by the last day in the study, individuals experiencing relatively more intrusion related distress than normal engaged in less avoidance coping at the next time point and individuals engaging in more rumination than normal reported less subsequent distress. Given that at the start of the study increases in any given variable were associated with increases in other variables, but relationships of the opposite nature were seen at the end of the study period (indicating participants responded to some increases with later decreases), this could indicate that the way individuals responded to their own fluctuations changed over the study period.

Given that few studies have explored the key variables investigated in this study using intensive ESM or utilised RI-CLPM to do, so there is little empirical guidance to guide predictions of how these relationships *should* appear over a 10-day assessment period, hence explanations for

these changes are largely speculative but do provide avenues for further investigation. One potential reason for the different patterns of results across modelled days may be measurement reactivity, the phenomenon where assessing or observing a particular behaviour in research may impact the self-reports of participants (Eisele et al. 2023). Currently research suggests that the impact of measurement reactivity can vary based on assessment methodologies, constructs of interest, and individual differences (e.g. Buu et al., 2020; Eisele et al. 2023). Hence there is no clear expectation for how this effect could impact the present study but there is preliminary evidence for ESM protocols having beneficial impacts on PTSD symptoms (Ehlers et al., 2003; Dewey et al., 2015; Possemato et al., 2012; Tarrier et al., 1999). ESM-related improvements in some psychological disorders have been theorised to result from a beneficial form of measurement reactivity, in which the self-assessment prompt greater awareness of maladaptive processes and lead to subsequent change in coping approaches (e.g. Dewey et al., 2015; Snippe et al., 2016). The changes in modelled paths from Day 1 to 10 may well represent slight but actual improvements in how an individual's appraisals, distress, and maladaptive responses interacted over a 10-day period or could equally represent participant reactivity to assessment that began at a heightened point and habituated over time.

Despite the stationarity and constraint procedures undertaken in the present study there was evidence for some autoregressive and cross-legged paths that did not appear consistently over a day. One obvious example of this was the single negative path between distress at Time 1 and negative appraisals at Time 2 in the Day 5 model of avoidance that was not significant at Times 2 to 3 or 3 to 4. Given all paths were consistent across the initial CLPMs and the RI-CLPM temporal paths were constrained to be the same within each day, inconsistencies are likely the result of WP variation which was not explicitly constrained by the present analytic approach (Mulder & Hamaker, 2021). Hence, paths that appear between one set of time points in a model, but not the next, represent WP associations that reached statistical significance at a given time but not to the extent that the time point significantly differed from other times. This may indicate that other paths between the same

variables were approaching significance, or that the significant path is a small effect that does not substantially diverge from the other time points.

As predicted the modelled inter-individual relationships showed significant positive associations between negative appraisals of intrusions, intrusion related distress, and both maladaptive coping factors. These findings reflect macro-longitudinal understandings of PTSD (Beierl et al., 2019; Marks et al., 2018; Miethe et al., 2023; Moulds et al., 2020) and indicate that the BP relationships observed in Study 1a remain significant when exploring the data for singular days. Although changes in negative appraisals over the four-hourly assessment time-points were associated with intra-personal changes in distress and avoidance coping, consistently medium to large BP effects indicate that people with greater tendencies towards negative intrusion appraisals than others are also likely to report greater distress and avoidance than others. Taken together these observations may suggest that negative appraisals contribute to PTSD symptoms through an alternative WP avenue or that the effects of appraisals are long developing and not evident in such an intensive assessment time frame with a non-acute/clinical sample.

Although the RI-CLPMs generated in the present study do present useful and detailed insights to these trauma response variable relationships, the novel nature of this exploration presents some difficulties for the overall interpretation of results. As few studies have investigated these variables in such intensive detail there is little research to guide which paths reflect true variable relationships or may simply be a feature of the study design. For example, in many instances where cross lagged relationships were anticipated between variables these paths were not observed but contemporaneous paths were. Work published after initiation of the present study has found that significant dynamic changes in emotions and appraisals can occur within two hours for individuals with PTSD (e.g., Simons et al., 2021). Thus, given the 4-hour intervals between assessments, ‘contemporaneous’ relationships captured in the present study might conceivably include causal relationships between distress and maladaptive coping that require a shorter measurement window for indexing (see Epskamp et al., 2018, for discussion of this issue).

While the present use of RI-CLPM offered the opportunity to examine temporal associations of multiple variables simultaneously in a manner that prior multilevel models could not, the more complex nature of RI-CLPM presents different limitations for data analysis. The key difference being that multilevel modelling, as used in Study 1a, allows for the analysis of contemporaneous variable associations across all time points to produce a summation of general variable associations, whereas RI-CLPM examines the autoregressive, cross-lagged, and contemporaneous relationships between individual time points (Hamaker, 2018). As the initial study design and data collection was undertaken prior to consideration of RI-CLPM technique it should be recognised that some pragmatic concessions were made in employing this technique. For one, given each time point had a maximum of 100 responses (the total sample size), the statistical power of these RI-CLPMs was lower than the analyses used in Study 1a, possibly leading difficulty in detecting some relationships (Mulder, 2023). The present models were also restricted to four time points within each day to maintain reasonable model complexity relative to the available sample (Zheng & Valente, 2023). As a result, present analyses explored the intensive mechanisms operating between key variables within individual days but precluded the exploration of carry over effects from previous days which have been observed in diary studies with less frequent assessments (e.g. Weiss et al., 2019). Finally, to balance study resource allocation with suitable exploration of potential change over the 10-day ESM period Days 1, 5, and 10 were modelled to capture variable relationships over the span of the study.

Despite these limitations the present study illustrates new preliminary findings regarding how key intrusion related processes interact within the day for an individual and highlights areas for future investigation. As far as I am aware this is the first study to explore potential temporal relationships between intrusion related distress, negative appraisals, and maladaptive coping in such intensive time frames. These results reiterate the significance of intrusion related distress as a potential driving factor in symptom maintenance and points to how this relationship may change under observation. For clinicians, these findings could ultimately inform methods to optimise

trauma related treatment (e.g. identifying which associations may be key targets at various stages of therapy) and offer therapeutic guidance for clients (e.g., strategies for addressing increased distress to reduce subsequent distress). The investigation of avoidance coping and rumination as separate factors also added a micro-longitudinal perspective to current discussions of maladaptive coping mechanisms in trauma reactions (see Moulds et al., 2020), indicating the interactions of rumination with appraisals and distress are distinct from avoidance.

Conclusions

With the above caveats in mind, by adopting a sophisticated analytical method the present study afforded the opportunity to better test within-person variation in relation to variables long argued to be influential on PTSD adjustment, but that have to date largely only been studied either in isolation or within macro-longitudinal designs. A consistent finding was the importance of intrusion-related distress in relation to maladaptive coping strategies, as well as observation of differing relationships between key components of the cognitive model of PTSD and factors such as avoidance coping, compared to ruminative thought. Changes in the patterns of associations between negative appraisals, intrusion related distress, avoidance coping, and rumination from Day 1 to 10 also presented initial indications of how day-to-day relationships in trauma reactions may change throughout intensive assessment. These findings should prompt further intensive exploration of these key variables, and as such, the next chapter presents an application of ESM to assess the mechanisms operating between intrusion related distress, negative appraisals, avoidance, and rumination following a targeted trauma analogue intervention to address these variables.

CHAPTER FOUR - STUDY 2: USING EXPERIENCE SAMPLING METHODOLOGY (ESM) TO ASSESS THE INFLUENCE OF COGNITIVE TECHNIQUES ADDRESSING TRAUMATIC INTRUSIONS

Chapter Abstract

Background and Objectives: Micro-longitudinal research has substantially advanced our understanding of the day-to-day relationships between key posttraumatic symptoms and associated reactions, specifically highlighting the intensive time frames in which significant change can occur. To date few studies have investigated intentional intervention-based change in post-trauma variables in such intensive assessment windows, leaving questions as to which rapid mechanisms may drive therapeutic improvement, and how. Study 2 employed Experience Sampling Methodology (ESM) to examine change in trauma exposed individuals' responses on these variables of interest following a brief online trauma analogue intervention.

Methods: Sixty-four trauma exposed individuals were randomly assigned to either receive a brief online intervention intended to reduce intrusion related distress or a control condition prior to engaging in a 7-day ESM protocol. Group differences and interactions in intrusion related distress, negative appraisals of intrusions, avoidance coping, and rumination were tested through multi-level modelling.

Results: Post-ESM the intervention group reported significantly lower negative intrusion appraisals than the control group, however no other ESM observations or baseline-to-final assessment changes differed significantly between groups. Significant contemporaneous relationships linked within-person intrusion related distress with negative appraisals, avoidance, and rumination as expected. Both negative appraisals and avoidance coping engagement also demonstrated significant negative cross-level interactions.

Limitations: The low intensity intervention and non-clinical sample may have restricted the amount of potential observable change in key variables.

Conclusions: Significant improvements in across both groups point to the potential clinical utility

of ESM in PTSD as not only a tool for accurate client monitoring, but also as a potentially beneficial intervention element. Changes in intrusion related appraisals for the intervention group demonstrated that simple, accessible interventions can significantly affect post-trauma reactions and within-person covariances of intrusion related distress, negative appraisals, avoidance coping, and rumination replicated previous research. Ultimately the present study provided an initial insight to the potential value of ESM in PTSD treatment methods and identified specific avenues for future explorations of studying PTSD mechanisms intensively.

Introduction

As highlighted in Chapter 1, posttraumatic stress disorder (PTSD) is a complex and multifaceted mental health condition with substantial impacts on an individual's quality of life. Over a number of years researchers and clinicians alike have made substantial progress in establishing efficacious psychological treatments for PTSD, producing a range of first-line recommended therapies (see ISTSS, 2018; Kitchiner et al., 2019; Mavranezouli et al., 2020; NICE, 2018; PACPMH, 2021; Watts et al., 2013 for guidelines and meta-analyses). However, even first-line recommended treatments can have substantial drop-out rates (approximately 16-24.2%: Edwards-Stewart et al., 2021; Lewis et al., 2020; Varker et al., 2021) and not all individuals experience significant improvement. As many of the high-quality randomised studies that form the PTSD intervention evidence-base occur under controlled settings, with highly supervised therapists and participant selection criteria that might not match routine mental health care, clinical non-response has been argued to be an even larger issue in real-world practice (Lewis et al., 2020; Najavits, 2015).

One potential approach to improving treatment responses is increasing the precision of PTSD treatment to target each individual's areas of concern more effectively, not only in terms of an overall treatment protocol, but during therapy in response individual reactions to treatment (Herzog & Kaiser, 2022; Kehle-Forbes et al., 2022), which ultimately could lead to more efficient delivery of therapy. Micro-longitudinal approaches, such as Experience Sampling Methodology

(ESM), can be used not only to study key variables thought to result in and maintain PTSD, but also to build on efforts to better understand optimal methods to direct PTSD treatments. Accordingly, Study 2 used the combination of an experimental (analogue) design and ESM to examine day-to-day effects of an intervention based on several therapeutic techniques drawn from trauma-focused cognitive-behavioural therapy methods. Building on the work presented in preceding chapters, intrusion-related distress was the target symptom presentation to be addressed, with the therapeutic techniques (addressing appraisals of intrusions, avoidance, and rumination) chosen to attempt to influence the observed maladaptive coping – cognition – intrusion relationships observed in my prior studies.

As discussed previously, macro-longitudinal studies form the bulk of research conducted to explore the symptom development and maintenance in PTSD (e.g., Beierl et al., 2019; Dunmore et al., 2001; Kumpula et al., 2011). Although practical for investigating the long-term impacts of trauma, extended measurement intervals limit observations to retrospective accounts and outcomes without fine-grained temporal detail of how changes, if any, occurred, which is especially relevant to rapidly changing variables such as emotions (Greene et al., 2020). Hence, most theories of PTSD present outlines of how symptoms may develop and persist without specific timelines (e.g., Brewin et al., 2010; Ehlers & Clark, 2000; Foa et al., 2008), from which treatment protocols were developed with the assumption that symptoms will act and interact consistently for every person at any given time, with limited understanding of specific dynamics of the time course of mechanisms for change (Marks et al., 2018; Shubina, 2015; Watkins et al., 2018).

Researchers are now increasingly employing micro-longitudinal approaches to study PTSD, such as ESM (Myin-Germeys et al., 2018) where brief repeated observations are taken at short intervals to explore inter-symptom and trans-diagnostic associations in more detail (e.g., Greene, 2018; Hoffart et al., 2019; Kleindienst et al., 2017; Kleim et al., 2013; Pickman et al., 2017; Short et al., 2017). As detailed in the previous chapters, Studies 1a and 1b extended prior research, focusing on intrusive symptom phenomena and theorised mechanisms, to demonstrate positive within-person

(WP) associations between negative interpretations of intrusions, maladaptive coping, and distress. Although some of these findings reflected those found in prior macro-longitudinal research (e.g., Beierl et al., 2019), Study 1a demonstrated that a person's intrusion related distress is more strongly associated with negative interpretations and maladaptive coping behaviour than the frequency of intrusions. Study 1b then scrutinized the temporal nature of these WP associations and noted the unique dynamics of the relationships of intrusion appraisals and distress with avoidance coping and rumination.

Both my earlier studies and prior work have demonstrated that many mechanisms influencing PTSD symptoms are transitory, with not only different *inter*-personal (BP; between-person), but significant *intra*-personal (WP; within-person) associations evident moment to moment (Epskamp et al., 2018; Greene et al., 2018; Greene et al., 2020; Hoffart et al., 2019; Price et al., 2020). For example, in twice-daily assessments Green et al. (2018) found no significant contemporaneous association between negative beliefs and cognitive avoidance as they did not reliably increase or decrease at the same time points, however negative beliefs did temporally *predict* cognitive avoidance at subsequent time points. When participants record such experiences as totals in a daily diary, potentially similar predictive effects may appear as a contemporaneous relationship (Bolger & Laurenceau, 2013; Epskamp et al., 2018), demonstrating the detail lost in less frequent observations of fast-acting symptom relationships, let alone in macro-longitudinal assessments that generalise over weeks or months.

Although intensive ESM has not been used comprehensively to understand mechanisms of change in PTSD treatment, prior research has undertaken regular monitoring of both symptoms and candidate variables (e.g., Held et al., 2021; Hoeboer et al., 2022; Kooistra et al., 2023; Zoellner et al., 2022). Some of these studies have explored relationships of proposed mechanisms such as how improvements in weekly treatment measures of trauma related appraisals (Kleim, Grey, et al., 2013) and distress (Hoeboer et al., 2022) predict symptom severity reduction. To date, more comprehensive, fine-grained data acquired from ESM has not been analysed within PTSD treatment

studies, however such research in other clinical domains (e.g., depression, psychosis) has illustrated potential benefits of this approach (see Myin-Germeys et al., 2018; Van Os et al., 2017 for review). For example, Snippe et al. (2016) found that fluctuations in daily behaviours such as physical activity significantly predicted end of day depressive symptoms, and that individuals engaging in ESM were more likely to improve their daily behaviours over time than those receiving treatment as usual. As well as providing detailed within-person data with reduced recall bias, observations in Study 1a and evidence in non-intervention-based PTSD research has indicated that ESM is well tolerated by trauma exposed individuals (Possemato, et al., 2012; Scheer et al., 2023) and may even provide some benefits in terms of symptom reduction (Dewey et al., 2015; Tarrier et al., 1999).

Trauma-Focused Cognitive Behavioural Therapy (TF-CBT) can be considered an umbrella term that describes a number of therapies which represent first-line recommended treatments for PTSD (ISTSS, 2018; NICE, 2018; PACPMH, 2021) such as Prolonged Exposure (PE; Foa et al., 2008), Cognitive Processing Therapy (CPT; Resick et al., 2016) and Cognitive Therapy for PTSD (CT-PTSD; Ehlers et al., 2005; Ehlers & Wild, 2020). The protocols of these well-established therapies generally encompass several techniques including elements of cognitive therapy, exposure (imaginal and in vivo), and related aspects to address various proposed mechanisms of symptom maintenance. Clinicians are encouraged to adapt intervention approaches based on case formulation however, as interventions are often studied in their entirety, there is relatively little research or guidance informing clinicians on which specific components of these interventions may work best for an individual (Shubina, 2015). Identifying direct mechanisms for change in post trauma symptoms through intensive observations such as ESM would contribute to the evidence guiding personalised approaches, such as those used in CBT, and has the potential to improve clinical retention and symptom reduction (Herzog & Kaiser, 2022; Kehle-Forbes et al., 2022; Myin-Germeys et al., 2018). Following the findings of Studies 1a and 1b presented in previous Chapters 2 and 3, the present study drew upon key TF-CBT principals to create a brief online intervention that

presents psychoeducational content regarding intrusive symptoms, avoidance, trigger discrimination, and rumination intended to reduce intrusion related distress.

To explore the application of ESM to better understand underlying processes in PTSD maintenance the present pilot study comprised an analogue intervention to address distress associated with traumatic intrusions. Sixty-four trauma exposed individuals with current intrusive symptoms were randomly allocated to either complete a 7-day ESM protocol as normal (control) or receive a brief CBT-based online intervention prior to the ESM diary period. The micro-longitudinal measurement of intrusive symptom related distress, negative trauma related cognitions, and maladaptive coping strategy engagement enabled detailed exploration of intensive intra-individual (WP) relationships of interest, as well as inter-individual (BP) moderators of these relationships. Baseline and post-ESM measures were also taken to explore BP differences at the group level.

I had several predictions regarding the WP relationships between key variables, as well as the BP impact of the intervention. These were somewhat speculative given that to date ESM has not been used to study processes during PTSD interventions, however these predictions are based on current evidence of WP contemporaneous relationships (Canty et al., 2023) and more general symptom reduction patterns observed in prior CBT-based internet interventions for PTSD (Ehlers et al., 2023; Lewis et al., 2019; Wild et al., 2020). Hence it was first hypothesised that individuals who report greater than their usual degree of negative interpretations of intrusive symptoms at a given ESM time point would also express more distress than their usual amount at that same time point. Furthermore, the magnitude of this WP association (an index of reactivity) was expected to differ between groups. Additionally, it was anticipated that individuals in the control group would report overall greater negative appraisals than individuals in the intervention group. Furthermore, on occasions where individuals report greater engagement in maladaptive coping strategies (avoidance and rumination) than their average, they would also express greater distress than usual. Individuals in the intervention group were also expected to report lower engagement in maladaptive coping than

individuals in the control group. Although not the primary time points of interest in the present study, analyses comparing baseline and post-ESM scores were anticipated to show significant interactions, that is, decreases in the intervention group's PTSD symptoms and negative trauma related cognitions relative to controls (mimicking the standard pre- to post-treatment change seen in non-ESM assessments of interventions).

Method

Design

The present study was a mixed design (Group: Intervention, Control) × (Time: ESM timepoints) with repeated measures on the second factor. Block randomisation (blocks of six) was used to allocate participants to group in equal proportions. This study was pre-registered on the Open Science Framework (https://osf.io/kf6v9) and approved by the Flinders University Human Research Ethics Committee (REF: 5969).

Sample

The present study passively recruited 66 Australian adults, whose demographic information is summarised in Table 10, through various print and online advertisements. Participants had to be 18 years or older, with exposure to at least one a potentially traumatic experience (as guided by the DSM-5 and ICD-11 definitions) that was resulting in current intrusive symptoms. Participants were also required to indicate that these intrusive symptoms 'bothered' them to at least a level of four on a scale from one (*very little*) to 10 (*extremely*). Exclusion criteria pertained to adequate ESM completion, two control participants were removed from the final sample as they withdrew from the study prior to engaging in the ESM protocol. The sample size of 64 participants balanced reasonable power for an ESM design (Arend & Schäfer, 2019) with the timeline constraints of a Doctor of Philosophy degree. Participants had to complete a minimum of 16 ESM surveys to be included in analyses, allowing the detection of direct effects larger than 0.15 and cross-level interactions greater than 0.45 with power ≥ .80 (Arend & Schäfer, 2019).

Table 10

Sample Demographics and Index Trauma by Group

	Control Group		Intervention Group	
Variable	***M (SD) or n***	**% or range**	***M (SD) or n***	**% or range**
Age	32.58 (13.29)	18 - 67	31.24 (11.98)	18 - 60
Years of formal education	14.53 (2.52)	10 - 20	14.33 (2.34)	10 - 18
Time since index trauma (years)	8.77 (11.36)	0.7 – 46.85	6.94 (8.83)	0.1 – 45.40
Participants with more than one traumatic experience	22	71.0	24	72.7
Gender				
Female	24	77.4	26	78.8
Male	7	22.6	7	21.2
Otherwise Identifying	-	0.0	-	0.0
Racial self-identification				
White Australian	22	71.0	23	69.7
Asian	8	25.8	6	18.2
European	1	3.2	1	3.0
Middle Eastern	-	0.0	1	3.0
Aboriginal or Torres Strait Islander	-	0.0	1	3.0
Other	-	0.0	1	3.0
Marital Status				
Single	16	51.6	15	45.4
In a relationship but not living together	2	6.5	6	18.2
In a relationship and living together	4	12.9	2	6.1
Married	6	19.4	6	18.2
Separated or divorced	3	9.7	4	12.1

Index Trauma Type				
Sexual Assault	9	29.0	9	27.3
Physical Assault	5	16.1	5	15.2
Automobile Accident	7	22.6	12	36.4
Unexpected loss of a loved one	3	9.7	1	3.0
Otherwise life threatening accident or inury	3	9.7	2	6.1
Serious Illness	4	12.9	4	12.1
Index Trauma Exposure Type				
Direct involvement	22	71.0	27	81.8
Witnessed	7	22.6	6	18.2
Learnt about it as it occurred to loved one	2	6.5	-	0.0

Note. Sample N = 64 (Control N = 31 and Intervention N = 33)

Procedure

Participant eligibility was determined via email or phone conversation with the principal researcher prior to providing informed consent. The principal researcher then used a 6-block randomised spreadsheet to assign participants to their group. All questionnaires, ESM surveys, and the intervention were conducted using Qualtrics™ online survey software. The baseline survey link was provided via email and all participants completed the baseline survey before being informed of their group allocation. Participants in the control group were provided with instruction on the appropriate completion of their ESM diary surveys and began the diary phase within 48 hours of baseline completion. Intervention group participants were asked to complete the online intervention prior to receiving the same ESM instruction and beginning the diary phase. All participants received ESM diary links at 9am, 1pm, 5pm, and 9pm for 7 consecutive days. SMS reminders were sent if surveys were not completed within an hour of distribution and survey responses completed more than 2-hours after distribution were removed from the final dataset. All participants received the final survey in the morning immediately following their diary phase completion before being debriefed. Control group participants were subsequently given access to the intervention.

Intervention

The brief online intervention was designed for use in the present study with the intent to reduce individuals' negative cognitions and maladaptive coping strategy engagement in response to post trauma intrusive symptoms using cognitive-behavioural techniques (and guided by the theoretical framework of Ehlers & Clark, 2000). The intervention, accessible in Appendix A3, was constructed using elements from Wild et al.'s (2016) online cognitive therapy program to form a single informative module containing four sub-sections detailed below. Information about intrusive thoughts and the impact of thought suppression, 'Then vs Now' for unwanted memories, how to increase helpful/flexible thinking styles, and 'Then vs Now' for rumination. The intervention, administered via Qualtrics™, included four activities intended to reinforce the key techniques and to check participants' engagement with the material. The activities require completion to progress in

the intervention and basic, automatic feedback based on was provided participants' answers. At the end of the intervention the key elements of the intervention were summarised, and participants were presented with the opportunity to download the content.

Information about intrusive thoughts and the impact of thought suppression

This component of the intervention presented a basic explanation of what intrusive memories are and why they may occur. Participants are informed that intrusive symptoms are common and not necessarily pathological. Triggers are explained as sensory or environmental cues that may bring unwanted memories of stressful events to mind and participants are presented with an activity that involves matching potential triggers with hypothetical experiences. Information is presented which outlines how avoidance (cognitive and behavioural) is a common response to unpleasant experiences and how this can apply to intrusive thoughts and unwanted memories. This includes a video exercise in which participants are instructed to not think of a green rabbit, which demonstrates potential rebound effects of thought suppression.

Then vs Now for unwanted memories

Then vs Now is a cognitive strategy to assist individuals in discriminating triggers that may prompt intrusions related to the experience 'then' before focusing on how their circumstances are different 'now' to break the link between triggers and memories (Wild et al., 2020). This component of the intervention explains the process of Then vs Now and outlines how it is a more beneficial strategy than avoidance. Participants are then presented with a hypothetical situation activity where they are asked to identify a character's trigger and list three differences between her experience and current situation.

How to increase helpful/flexible thinking styles

This part of the intervention defines helpful and unhelpful thinking, specifically with reference to descriptions of maladaptive trauma-related rumination. Three questions to spot rumination are outlined before participants are presented with four hypothetical situations and asked

to identify which ones describe ruminating. Ways to re-frame ruminative thoughts into more positive or helpful approaches are described.

Then vs Now for rumination

The final section of the intervention presents three steps of Then vs Now intended to mitigate rumination and promote engaging with life as it is 'now'. The three key points for this approach are for the person to remind themselves that the situation is in the past and cannot cause further harm or change, to focus on what they can see and hear now, and finally to do something practical to help their situation whether that be just moving around or practically problem solving. Finally, the key points of the intervention are reiterated.

Measures

Baseline

The baseline survey included several demographic questions and established measures to document potentially relevant BP factors and initial symptom severity. The Life Events Checklist (LEC; Blake et al., 1990) was included to index individual's trauma exposure beyond initial Criterion A establishment. Baseline posttraumatic symptoms were measured using the Posttraumatic Stress Disorder Checklist (PCL-5; Blevins et al., 2015) which aligns with both the DSM-5 (APA, 2013) and the ICD-11 (WHO, 2018). Depression Anxiety and Stress Scale (DASS-21; Lovibond & Lovibond, 1995) was used to characterise the samples' depressive, anxious, and stress symptoms. Maladaptive coping strategies were assessed using the 10-item version of the Repetitive Thought Questionnaire (RTQ-10; McEvoy et al., 2010), to explore rumination, and the Acceptance and Action Questionnaire–II (AAQ-II; Bond et al., 2011), for tendencies to avoid or suppress experiences. Both the RTQ-10 (McEvoy et al., 2010) and AAQ (Bond et al., 2011) ask individuals to indicate their agreement with relevant statements, on a 5-point (0 = *not at all true* to 5 = *Very true)* and 7-point (1 = *never true,* 7 = *Always true*) scale respectively. Negative appraisals of intrusive symptoms were indexed using the Negative Interpretation of Intrusive Thoughts (NIIT; Nixon et al., 2009). The NIIT asks individuals to identify how much they agree with nine

statements (e.g. *My intrusion/memory shows that I am a lousy coper*) on a 1 = *totally disagree* to 7 = *totally agree* scale and demonstrated excellent internal reliability (α = .92) in the present study.

Online ESM Survey

Throughout the 7-day diary phase SMS survey links were distributed to participants at four set times (9am, 1pm, 5pm, and 9pm) each day. In the present study participants were asked to answer 'yes' or 'no' to '*Did you receive the online intervention*' to identify participants in the intervention group who receive an additional subset of questions regarding their use of the intervention. Intervention participants are asked to identify how much they thought about the information presented and how much they used the strategies of the intervention on a 11-point continuum from 0 (*not at all*) to 10 (*very much*). Using the same scale, intervention group participants were then asked to indicate how much they had found the information presented in the intervention helpful, practical, and made them feel less distressed since the last survey.

Every survey included the items outlined in detail in the measures section of Chapter 2 to capture intrusive symptom frequency, related distress, negative interpretations, and maladaptive coping strategy engagement. The measures of intrusion related distress for time-points where an intrusion did occur and time-points where distress was measured in the absence of intrusions were combined in the same manner as Study 1b. This created an 11-point continuous index of participant's distress associated with intrusions throughout the study where 0 = *not at all distressing* and 10 = *extremely distressing*. Each 9pm survey for all participants also included a question asking them "*Please rate how accurately you have rated your intrusions today*" where participants self-reported their response accuracy on a 0-4 scale where *0 = Not accurately at all*, and *4 = Extremely accurately*.

Post-diary Survey

The post-diary survey was distributed via SMS at 9am the day after participants completed their ESM diary phase of the study. This survey re-administered the PCL-5 and DASS to index potential changes in posttraumatic symptoms severity and general mental wellbeing over the

duration of the study. Participants were once more asked to identify whether they received the online intervention or not, and intervention group participants were provided with five additional items intended to gauge final perceptions of the intervention. The first additional item asked intervention group participants to rank the four subsections of the intervention (*Then vs Now for unwanted memories, Then vs Now for rumination, Information about intrusive thoughts and the impact of thought suppression,* and *How to increase helpful/flexible thinking styles*) in order of helpfulness using a 4-point scale (1 = most helpful, 4 = least helpful). The remaining four questions for the intervention group asked participants to indicate how helpful they found each subsection on a scale where *0 = Not at all* and *10 = Very Much.*

Experimental Group Condition

In all data sets collected for the present study experimental group condition was indexed as a dichotomous variable on which *0 = Control group* and *1 = Intervention group*.

Statistical Analysis

All analyses in the present study were conducted using the IBM SPSS 28.0 statistical package. To investigate the primary hypotheses multi-level model analyses were conducted to accommodate the micro-longitudinal diary data and explore both levels (i.e., BP at Level 2, and WP at Level 1) of relevant effects (Hox et al., 2017; Schafer & Graham, 2002). Prior to model analysis the data for negative appraisals, distress, and maladaptive coping was dis-aggregated into BP (person-specific means across all available assessments) and WP (occasion-specific deviations from the person-mean) components. All BP components and additional baseline covariates were subsequently centred around the sample mean to facilitate the interpretation of observations relative to the group average.

Initial null models were fitted to partition the variance in intrusion related distress, negative appraisals, avoidance, and rumination. Results indicated that approximately 51.3% of the variance in distress occurred BP, while 48.7% occurred WP. A substantial 91.9% of the variance in negative appraisals occurred BP leaving just 8.10% of the variance at the WP level. Comparatively

avoidance and rumination were more evenly split with WP fluctuations accounting for 42.2% (BP 57.8%) and 34.1% (BP 65.9%) of the variance respectively. From here subsequent models were built to successively include the relevant predictor variables, cross-product terms, group allocation, covariates, and random slopes. These stages of model building allow for observation of significant changes to patterns of results, variance explained, and model fit attributable to each variable. The selected covariates of gender, age, years of formal education, time since trauma, and baseline PCL-5 score were individually included in model building to account for common potential confounding effects of pre-existing factors shown to impact post-trauma reactions (Brewin et al., 2000; Knipscheer et al., 2020; Michael et al., 2005). Survey ID was also included in each model as an initial covariate to explore potential effects of time throughout the ESM assessments. To simplify interpretations of main effects and improve model fit, cross-product terms and covariates that were not significant were excluded from the final models. On occasions where included covariates impacted model parameters significantly, this is reported. The results presented are based on the final multi-level model for each predictor with the change to proportions of variance components between the null and final models calculated as indexes of *Pseudo* R^2 (Singer & Willett, 2003).

To illustrate interaction effects between modelled variables the regression equation of each model was solved to generate predicted values. These values were calculated at four combinations of the 'high' (one standard deviation above the mean), and 'low' (one standard deviation below the mean) level of the relevant variables and then plotted to create the figures. To explore the secondary hypotheses regarding potential PTSD symptom severity change in the intervention group from baseline to post-ESM, subsequent multi-level analyses were conducted using this more macro-longitudinal style repeated assessment data which enabled comparisons of group outcome scores over time.

Results

Baseline Group Characteristics

As shown in Table 11, there was no significant difference between the control and intervention group baseline scores on the major indexes of PTSD and co-occurring disorder symptomology. Although this was not a PTSD treatment seeking sample, 40 participants had a PCL-5 score of 31 or above, indicating that over 62% of participants had scores representing clinically significant PTSD symptoms (Blevins et al., 2015).

Table 11

Group Differences in Mean Baseline Assessment Scores

	Control	Intervention				
Baseline Assessment	***M (SD)***	***M (SD)***	***t***	***df***	***p***	***d***
PCL-5 Total	39.81 (17.87)	37.73 (16.60)	0.48	62	.631	0.12
Re-experiencing	10.45 (4.70)	9.39 (3.49)	1.02	55.22	.314	0.26
Avoidance	4.61 (2.20)	5.27 (1.81)	-1.31	62	.194	-0.33
DASS-21 Total	26.71 (15.44)	23.61 (12.83)	0.88	62	.384	0.22
Depression	9.03 (6.81)	8.64 (6.81)	0.23	62	.817	0.06
Anxiety	7.55 (4.88)	5.70 (3.83)	1.70	62	.095	0.42
Stress	10.13 (5.49)	9.27 (5.04)	0.65	62	.518	0.16
NIIT	30.90 (13.31)	32.15 (11.38)	-0.40	62	.688	-0.10
RTQ	35.48 (7.86)	34.33 (7.88)	0.59	62	.561	0.15

Note. PCL= Posttraumatic Stress Disorder Checklist, DASS = Depression Anxiety and Stress Scale, NIIT = Negative Interpretation of Intrusive Thoughts, RTQ = Repetitive Thought Questionnaire. *t* and *df* are included as indexes of effect magnitude while *p* values ≤ .05 indicate statistical significance. *d* = Cohen's *d*, a measure of effect size. (*N* = 64. Control *N* = 31 and Intervention *N* = 33).

Intervention Engagement and Perceived Usefulness

The time spent on the intervention online material varied substantially across participants. Once significant outliers were removed[7], intervention engagement ranged from 7 to 40 minutes,

[7] Five outlier variables were removed from the total 34 recorded durations for the intervention, all of which were longer than deemed reasonable in the present sample. Two that exceeded 24-hours were removed as it was likely the

with an average duration of just over 16 minutes. At post-ESM assessment, intervention participants rated the elements of the intervention generally positively, considering the information provided about intrusive thoughts and suppression to be the most helpful (M = 6.27, SD = 2.25) and 'Then vs Now', specifically for rumination, slightly lower (M = 5.24, SD = 2.26). Perceived intervention helpfulness was also significantly associated with PCL-5 score change from baseline to Post-ESM $r(31) = .42$, $p = .016$, indicating greater ratings of helpfulness were associated with greater reduction of PTSD symptoms.

ESM Compliance and Data Quality

A total of 1635 ESM surveys were appropriately completed by the final sample of 64 participants, with 785 surveys from the 31 participants in the control group and 850 from the 33 intervention group participants. On average participants completed 91.3% of the surveys within 2 hours of receiving the link, with only two participants completing less than 20 surveys of the potential 28. Self-rated accuracy was high, with participants indicating that their responses were 'extremely' or 'very' accurate on 76% of the survey occasions. Although both groups had similar survey completion rates and generally high accuracy endorsements there was a significant difference between group's self-rated accuracy distributions (p <.001). Individuals in the control group were more likely to rate their responses as "extremely" accurate (56%) than individuals in the intervention group (28%) who were most likely to indicate that their responses were 'very' accurate (40%).

ESM Analyses

The first hypothesis, that on occasions where an individual reports greater negative appraisals of intrusions than their normal amount they would concurrently report greater intrusion related distress, was supported, with a significant positive association between WP variations in negative appraisals and intrusion related distress as shown in Table 12. However, the subsequent

intervention was left open after the participants completed their engagement, and three durations spanning between 103 and 96 minutes were removed as they were three or more interquartile range values from 75% of all values.

follow-on hypothesis that the strength of this association would vary between groups was not supported. Including group in the model generated no significant main effect, interaction with WP negative appraisals, or impact on the pattern of results.

Table 12

Linear Mixed Model Exploring the Associations of Negative Intrusion Appraisals with Intrusion Related Distress.

	Estimate	***SE***	**95% CI**		***p***
			LL	**UL**	
Fixed Effects					
Intercept	3.04	.277	2.49	3.60	<.001
BP Negative Appraisal	.631	.112	.407	.854	<.001
WP Negative Appraisal	.613	.132	.346	.880	<.001
BP × WP Negative Appraisal	-.196	.087	-.371	-.022	.028
Group	.152	.387	-.622	.927	.696

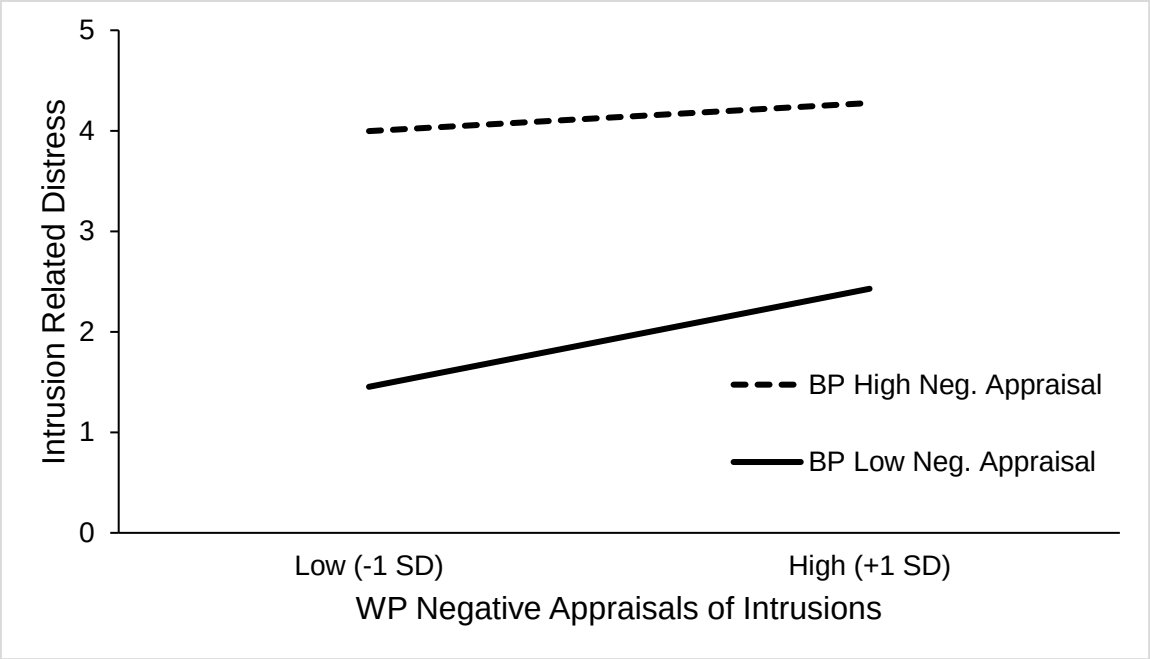
Note. BP = Between-person WP = Within-person; *CI* = confidence interval, *LL* = lower limit, *UL*= upper limit.

Although the predicted group interaction did not eventuate, a significant *negative* interaction between the WP and BP effects of negative appraisals was present. This interaction, illustrated in Figure 11, indicates that while participants who generally reported greater negative appraisals (BP High Neg. Appraisal) also reported higher distress than participants who reported fewer negative appraisals (BP Low Neg. Appraisal), WP variation in appraisals had a *greater* impact for individuals who reported generally *lower* levels of negative appraisals throughout the study (BP Low Neg. Appraisal). That is to say that individuals who have more negative appraisals of intrusions than the sample average consistently report higher levels of distress than others, with day-to-day changes in their appraisals having little impact on their amount of intrusion related distress. Comparatively, when individuals who generally considered appraisals in a less negative manner than the sample average reported a momentary change in their appraisals, they also reported larger changes in their distress than others. In terms of magnitude, the effect of negative appraisals of intrusions would be considered *medium*, accounting for approximately 9.11% of the WP variance

in intrusion related distress. This relationship was not significantly influenced by any of the included covariates.

Figure 11

The Association of Between (BP) and Within-Person (WP) Variation in Negative Appraisals of Intrusions with Intrusion Related Distress. Low and high BP and WP values represent 1 S.D. above and below the mean, respectively.



As Table 13 illustrates, the hypothesis that individuals in the control group would report greater negative appraisals than individuals in the intervention group was not supported, seen by the non-significant main effect of group. This suggests that there was no substantial difference in the level of negative appraisals of intrusions reported by the control group relative to the intervention group throughout the ESM period.

Table 13

Linear Mixed Model Exploring the Associations of Group with Negative Intrusion Appraisals.

	Estimate	*SE*	95% CI		*p*
			LL	UL	
Fixed Effects					
Intercept	3.27	.315	2.65	3.90	<.001
Group	-.341	.438	-1.22	.535	.493

Note. BP = Between-person WP = Within-person; *CI* = confidence interval, *LL* = lower limit, *UL*= upper limit.

In similar fashion to the first distress prediction, the hypothesis that individuals who reported greater engagement in maladaptive coping strategies at a given time point would also express greater intrusion related distress was supported through analyses of both avoidance and rumination. As Table 14 details, significant main effects of WP and BP variations in avoidance coping were contextualised by a significant negative cross-level interaction. Figure 12 depicts how this avoidance interaction relates to intrusion related distress, with the association between WP variation in avoidance coping and intrusion related distress appearing *stronger* for individuals who reported *less* engagement in avoidance coping than others (BP Low Avoidance). This model also revealed a significant main effect of time since trauma, indicating that individuals with more recent index trauma reported slightly less intrusion related distress. Avoidance strategy engagement accounted for an additional 7.86% of the WP variance in intrusion related distress, demonstrating a small but significant effect.

Table 14

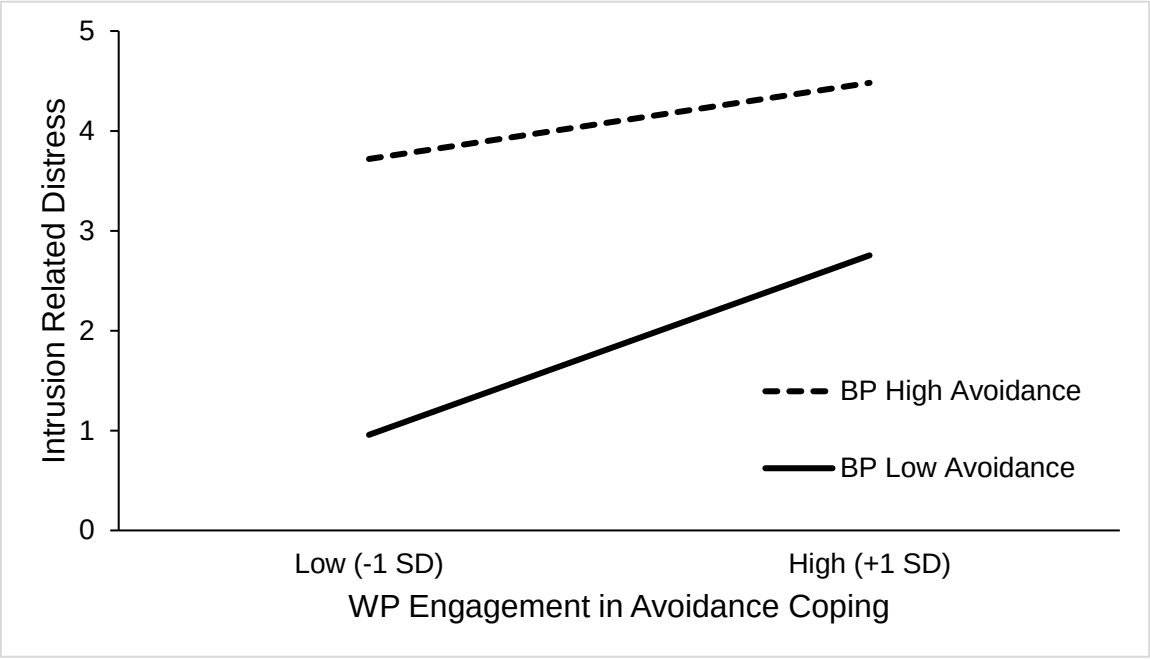
Linear Mixed Model Exploring the Associations of Avoidance Coping Strategy Engagement with Intrusion Related Distress.

	Estimate	*SE*	95% CI		*p*
			LL	UL	
Fixed Effects					
Intercept	2.978	.257	2.46	3.49	<.001
BP Avoidance	.668	.108	.452	.884	<.001
WP Avoidance	.457	.053	.351	.564	<.001
BP × WP Avoidance	-.110	.034	-.178	-.043	.002
Group	.186	.357	-.528	.901	.604
Time Since Index Trauma	.043	.018	.008	.078	.018

Note. BP = Between-person WP = Within-person; *CI* = confidence interval, *LL* = lower limit, *UL*= upper limit.

Figure 12

The Association of Between (BP) and Within-Person (WP) Variation in Avoidance Coping Strategy Engagement with Intrusion Related Distress. Low and high BP and WP values represent 1 S.D. above and below the mean, respectively.



In further support of the predicted relationship between maladaptive coping and intrusion related distress, the multilevel model exploring rumination revealed significant main effects of both

BP and WP as shown in Table 15. Unlike the models for negative appraisals and avoidance, no cross-level interaction was present for rumination indicating that momentary changes in rumination are consistently associated with changes in distress regardless of an individual's usual tendency towards ruminative thought. PCL-5 score at baseline was the only covariate to demonstrate a significant effect, indicating that individuals with higher initial symptom severity are likely to report slightly greater levels of intrusion related distress. This model explained a small, but still significant, additional 3.45% of the variance in intrusion related distress.

Table 15

Linear Mixed Model Exploring the Association of Rumination with Intrusion Related Distress.

	Estimate	***SE***	**95% CI**		***p***
			LL	**UL**	
Fixed Effects					
Intercept	3.00	.282	2.44	3.57	<.001
BP Rumination	.303	.088	.126	.479	.001
WP Rumination	.308	.049	.209	.406	<.001
Group	.195	.396	-.597	.986	.624
Baseline PCL-5 Score	.027	.013	.001	.053	.047

Note. BP = Between-person WP = Within-person; *CI* = confidence interval, *LL* = lower limit, *UL*= upper limit.

However, once again hypotheses related to the level of engagement in maladaptive coping across groups were not supported. As shown in Tables 16 and 17, no significant main effects of group were present for either avoidance coping engagement or rumination, indicating that the intervention and control groups did not differ significantly in the amount of maladaptive coping engagement.

Table 16

Linear Mixed Model Exploring the Association of Group with Avoidance Coping Strategy Engagement.

	Estimate	*SE*	95% CI		*p*
			LL	UL	
Fixed Effects					
Intercept	3.02	.306	2.41	3.63	<.001
Group	-.197	.425	-1.05	.654	.645

Note. BP = Between-person WP = Within-person; *CI* = confidence interval, *LL* = lower limit, *UL*= upper limit.

Table 17

Linear Mixed Model Exploring the Association of Group with Rumination.

	Estimate	*SE*	95% CI		*p*
			LL	UL	
Fixed Effects					
Intercept	3.20	.462	2.28	4.13	<.001
Group	-.821	.643	-2.11	.465	.207

Note. BP = Between-person WP = Within-person; *CI* = confidence interval, *LL* = lower limit, *UL*= upper limit.

Baseline to Post-ESM Change Analyses

Multilevel models were conducted to compare the baseline to post-ESM change in key variables between the intervention and control groups to test secondary hypotheses. Models exploring PCL-5 total score, PCL-5 indexes of intrusions, PCL-5 indexes of avoidance, and RTQ score generated significant effects of time but not group level interactions with time. Thus, largely failing to support these hypotheses and indicating that participants' scores on these measures reduced significantly from baseline to post-ESM but to similar extents for the intervention and control groups (see Table 18 for descriptive data and Appendix C for all output for these models). One exception was observed. As shown in Table 19, the model comparing group change in negative appraisals as indexed by NIIT score generated a significant effect for time as well as an interaction between time and group.

Table 18

Variable Assessment	*Control* *M (SD)*	*Intervention* *M (SD)*
PCL-5 Total Score		
Baseline	39.81 (17.87)	37.73 (16.60)
Post-ESM	31.00 (18.66)	27.27 (15.20)
PCL-5 Reexperiencing		
Baseline	10.45 (4.70)	9.39 (3.49)
Post-ESM	6.81 (4.66)	6.36 (3.38)
PCL-5 Avoidance		
Baseline	4.61 (2.20)	5.27 (1.81)
Post-ESM	3.16 (2.08)	3.39 (2.01)
NIIT Score		
Baseline	30.90 (13.31)	32.15 (11.38)
Post-ESM	30.38 (17.07)	24.09 (12.30)
RTQ Score		
Baseline	35.48 (7.86)	34.33 (7.88)
Post-ESM	31.77 (10.18)	29.45 (8.22)

Key Assessment Scores at Baseline and Post-ESM by Group

Note. PCL= Posttraumatic Stress Disorder Checklist, DASS = Depression Anxiety and Stress Scale, NIIT = Negative Interpretation of Intrusive Thoughts, RTQ = Repetitive Thought Questionnaire.

Table 19

Linear Mixed Model Exploring Group Change in Negative Appraisals (NIIT) Over Time

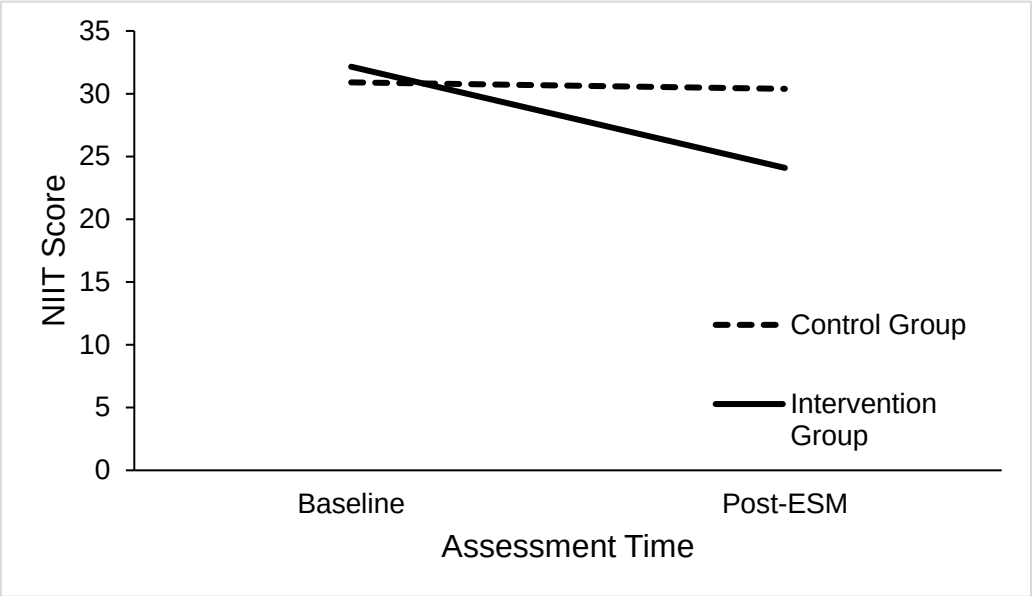
	F	***df***	***p***
Fixed Effects			
Intercept	335.29	62	<.001
Time	13.85	62	<.001
Group	0.62	62	.435
Group × Time	10.72	62	.002

Note. F and *df* are included as indexes of effect magnitude while *p* values ≤ .05 indicate statistical significance.

The group by time interaction depicted in Figure 13 shows that as would be expected, individuals in the intervention group reported a significantly greater reduction in negative appraisals than individuals in the control group. Comparisons of the post-ESM mean values indicated that this was a medium effect, $d = 0.5$.

Figure 13

Control and Intervention Group NIIT Score Over Assessment Times.



Exploratory Analyses

Given the present study was novel in its packaging of various techniques to address intrusion-related issues with this type of sample and in this design, exploratory analyses were conducted to better understand factors specific to the intervention condition that might have influenced the observed findings. First, separate multi-level models were conducted using only the data from the intervention group to explore potential intervention dose effects. The results of these models should however be interpreted in light of the lower power afforded in these analyses (intervention sample $N = 33$). As such the null model conducted for the intervention sample indicated that approximately 52.4% of the base variance in intrusion related distress was explained by WP factors while the remaining 47.6% could be attributed to BP level variables.

Next, intervention duration was included as a covariate in three separate models to examine whether the amount of time spent completing the intervention may have impacted the associations of negative appraisals of intrusions, avoidance coping strategy engagement, and rumination with intrusion related distress. None of these models showed significant main effects of intervention duration or changes to the pattern of results. This suggests that the amount of time an individual

spent completing the intervention had no impact on the relationships between distress and appraisals, avoidance, or rumination.

Subsequently, individual use of strategies presented in the intervention were explored. Therefore, the self-report measure that asked intervention group participants how much they had used the intervention strategies at each ESM time-point was divided into BP and WP components in the same manner as the primary variables of interest. When intervention use was included in a multilevel model with negative appraisals, BP effects of both appraisals and intervention use were non-significant, as was the WP interaction between appraisals and intervention use. Additionally, the model did not converge when a random slope for WP Negative Appraisal was included, hence the random slope and non-significant predictors were removed from the final model (summarised in Table 20). In the final model the significant main effect of WP appraisals and negative cross-level interaction observed in the entire sample remained, and a significant positive effect of WP intervention use appeared.

Table 20

Linear Mixed Model Exploring the Associations of Negative Appraisals of Intrusions with Intrusion Related Distress including Intervention Strategy Use.

	Estimate	***SE***	**95% CI**		***p***
			LL	**UL**	
Fixed Effects					
Intercept	3.47	.285	2.89	4.05	<.001
BP Negative Appraisal	.278	.178	-.085	.642	.128
WP Negative Appraisal	.338	.129	.085	.591	.009
BP × WP Negative Appraisal	-.312	.105	-.519	-.106	.003
WP Intervention Use	.205	.034	.138	.271	<.001

Note. BP = Between-person WP = Within-person; *CI* = confidence interval, *LL* = lower limit, *UL*= upper limit.

In similar fashion to the model results for the entire sample, these results suggest that individuals in the intervention group who reported greater negative appraisals than their normal amount were likely to also report greater distress at the same time, with individuals who generally

reported fewer negative appraisals than others experiencing this relationship more strongly. Simultaneously, a significant WP effect for intervention use showed that individuals who received the intervention were likely to report greater use of it than usual on occasions when they also reported more intrusion related distress. However, the non-significance of intervention use BP indicates that the amount an individual used the intervention strategies compared to others had no influence on their general distress. Furthermore, while momentary increases in negative appraisals and intervention use relative to a person's normal experience were both associated with increased distress, the non-significant WP interaction indicates that these variations in appraisals and intervention use were not related to each other. Unexpectedly, while statistically significant, WP intervention use explained a negligible < .01% of the residual variance in intrusion related distress.

Table 21 displays the output for the final multilevel model examining intrusion related distress with both avoidance coping and intervention use. Once again, the BP effect of intervention use and the WP interaction between avoidance and intervention use were not included in the final model due to non-significance. Mirroring the findings of analyses conducted on the full sample, individuals in the intervention group who generally reported more avoidance than others also reported more distress, and at times where individuals engaged in more avoidance coping than their normal amount, they also experienced greater distress. Once again momentary changes in avoidance were more strongly related to distress for individuals with less avoidance coping tendencies than others. Concurrently, individuals who received the intervention were likely to report greater use of it than usual on occasions when they also reported more intrusion related distress, however this did not significantly impact their avoidance coping at that time. Together, engagement in avoidance coping strategies and intervention use explained a small additional 2.0% of the WP variance in intrusion related distress.

Table 21

Linear Mixed Model Exploring the Associations of Avoidance Coping Strategy Engagement with Intrusion Related Distress including Intervention Strategy Use.

	Estimate	*SE*	95% CI		*p*
			LL	UL	
Fixed Effects					
Intercept	3.39	.249	2.89	3.90	<.001
BP Avoidance	.580	.174	.226	.935	.002
WP Avoidance	.237	.069	.096	.379	.002
BP × WP Avoidance	-.128	.050	-.229	-.027	.015
WP Intervention Use	.149	.033	.084	.215	<.001

Note. BP = Between-person WP = Within-person; *CI* = confidence interval, *LL* = lower limit, *UL*= upper limit.

Intervention strategy use was also added to a multilevel model examining the relationship between rumination and intrusion related distress. Table 22 shows that the pattern of results for the intervention group reflected the results seen in the full sample rumination model, with significant effects of rumination both BP and WP, as well as no significant cross-level interaction. Hence, on occasions where intervention group individuals reported more rumination than usual, they also reported more distress, with the strength of this relationship remaining consistent across people. Day to day individual changes in intervention use were again associated with intrusion related distress but not changes in rumination. As observed with negative appraisals, the residual variance in intrusion related distress explained by WP intervention use was negligible (< .01%).

Table 22

Linear Mixed Model Exploring the Associations of Rumination with Intrusion Related Distress including Intervention Strategy Use.

	Estimate	*SE*	95% CI		*p*
			LL	UL	
Fixed Effects					
Intercept	3.49	.279	2.92	4.06	<.001
BP Rumination	.274	.133	.004	.545	.047
WP Rumination	.180	.069	.037	.322	.016
WP Intervention Use	.159	.032	.095	.223	<.001

Note. BP = Between-person WP = Within-person; *CI* = confidence interval, *LL* = lower limit, *UL*= upper limit.

Discussion

The present study employed ESM following a brief analogue intervention to document in detail the relationships between PTSD intrusions and relevant associated variables. Specifically, the experimental micro-longitudinal design enabled the exploration of theorised causal mechanisms operating within the disorder as well as the potential clinical applicability of ESM. Mirroring the results of the previous study summarised in Chapter 2, momentary variations in individuals' negative appraisals of intrusions, avoidance coping strategy engagement, and ruminative thought were significantly related to intrusion related distress. Although the hypothesised intervention effects did not eventuate in the predicted manner, the intervention group did demonstrate significant reductions in negative appraisals of intrusions over and above the control group. Furthermore, the findings from using such intensive ESM to examine not only the relationships between these PTSD factors, but also the impact of an intervention, presents numerous avenues for future investigation and suggested guidance for the implementation of ESM protocols.

Many of the findings from the multilevel analyses in the present study replicated the expected pattern of results seen in Chapter 2 and prior research (e.g., Beierl et al., 2019; Dekel et al., 2013; Hoffart et al., 2019; Price et al., 2020), specifically those that link daily changes in PTSD

symptomology with intrusion related distress. Negative appraisals of intrusions, avoidance coping, and rumination all demonstrated the predicted positive direct effects, reinforcing the significance of day-to-day fluctuations in PTSD-associated factors for subjective distress and potential maintenance of the disorder (Canty et al., 2023). Although greater levels of these maladaptive intrusion responses both relative to a person's normal amount (WP) and relative to others (BP) were linked to greater distress, unexpected negative cross-level interactions were observed for negative appraisals and avoidance. Interestingly, this replicates the maladaptive coping negative cross-level interaction observed in Chapter 2, reinforcing the notion that momentary fluctuations in intrusion responses are more strongly related to distress in people who are less prone to negative appraisals of intrusions and avoidance than others.

A potential explanation for these unpredicted interactions is that individuals who reported greater negative appraisals and avoidance than others are likely to be more symptomatic (Beierl et al., 2019; Meiser-Stedman et al., 2019), hence the 'low BP' and 'high BP' relationship patterns in the present study may largely reflect symptom severity and be explained by established characteristics of the disorder. For example, individuals with PTSD are prone to 'overgeneralisation' (Ehlers & Clark, 2000; Kaczkurkin et al., 2017; Hammell et al., 2020), that is, catastrophising and perceiving danger in a manner that generates distress in response to 'normal', non-dangerous stimuli. The consistently high distress reports from individuals with greater than average tendencies towards negative appraisals and avoidance may reflect this overgeneralisation, where individuals do not discriminate between occasions of higher or lower symptoms compared to their normal experience but rather perceive it as all equally bad. Comparatively, individuals who reported fewer negative appraisals and avoidance than others likely also experience fewer intrusions, resulting in a greater sensitivity to variation as when they do occur, the intrusive experiences stand out as abnormal. It is also worth noting that the levels of intrusion related distress these individuals endorsed were quite low, even on more 'reactive' occasions where their negative appraisals and avoidance had increased (relatively). It is possible this represents a pattern somewhat

unique to trauma-exposed individuals with subclinical levels of symptoms, demonstrating the value of ESM which can illustrate how the pattern of intra-personal symptom relationships differs for individuals with more severe or entrenched post-trauma symptoms compared to sub-clinical populations.

The group level effects of the intervention were explored using both the micro-longitudinal ESM data and the more macro-longitudinal baseline to post-ESM data, which presented different perspectives. The primary ESM multilevel analyses did not show any of the anticipated significant group interactions, indicating that the strength and direction of the relationships between the three maladaptive intrusion factors and intrusion related distress were not substantially different between individuals in the intervention and control groups. Further exploration of the ESM data also showed no significant group differences in the level of negative appraisals, avoidance engagement, and rumination that participants reported. In comparison to those findings, the baseline to post-ESM models which explored group change revealed that the intervention group exhibited significantly greater reductions in negative appraisals of intrusions than the control group. This was not, however, coupled with anticipated group differences in avoidance coping, intrusion related distress, nor overall PTSD symptom severity, which significantly decreased over time for the entire sample. Considering both data sets in tandem suggests that negative appraisals did reduce from baseline as intended and seen in earlier work (Wild et al., 2020; Ehlers et al., 2023), but this did not precipitate to the expected improvements in distress and other PTSD-related variables, and any broader impact of the intervention was not readily observable in day-to-day symptom relationships.

Given that negative appraisals are proposed to be a driving factor in PTSD symptom maintenance (Beierl et al., 2019; Ehlers & Clark, 2000; Kleim, Grey, et al., 2013) and a target for intervention (Kooistra et al., 2023; Wild et al., 2020; Woud et al., 2021), significant improvements in appraisals could be expected to lead to changes in other symptoms of PTSD and related variables. There are several potential explanations for why the present study did not find these expected changes, such as the relatively low intensity of the intervention as well as the briefer

assessment window compared to actual treatment studies (e.g. Kooistra et al., 2023). While distressing memory related appraisals can be readily improved with brief cognitive interventions as achieved by the present study (see also Schartau et al., 2009; Woud et al., 2012), appraisal changes typically precede changes in other symptoms (Brown et al., 2019; Kleim, Grey, et al., 2013) hence the seven-day assessment period may not have been sufficient to capture subsequent changes in the other PTSD factors (Wiedemann et al., 2023). Additionally, the positive association with negative appraisals only explains a proportion of the variance in distress, thus improvements in one do not directly translate to the other as other unexplored factors may also determine change, such as intrusion characteristics (Kleim et al., 2013). It should be noted that while role of 'intervention dose' or engagement was closely examined in an effort to explore null findings, reduced power for these analyses might have masked this explanation.

Although the intervention was intended to improve PTSD symptoms, in particular intrusion related distress, both groups demonstrated significant reductions in PTSD severity (and other variables). With reference to the total PCL-5 score, reductions of between 8.5 and 12.5 points is indicative of a clinically significant improvement (Blanchard et al., 2023). In fact, post-ESM 44% of participants reported scores indicating probable PTSD, showing a 18% decrease from baseline. These findings are consistent with previous research has indicated that possible benefits of ESM type protocols on reducing PTSD symptoms (Dewey et al., 2015; Tarrier et al., 1999; Possemato et al., 2012). Potential explanations for such symptom improvement include the argument that the frequent assessments may act as a light form of exposure given participants actively recall intrusive symptoms (Dewey et al., 2015). Alternatively, researchers propose that the frequent monitoring prompts increased self-awareness that may encourage better emotional processing (Dewey et al., 2015; Kauer et al., 2012) and self-regulatory habits (Snippe et al., 2016). As discussed in Chapter 3, measurement reactivity is a prominent issue in ESM type research with largely unspecified impacts on the obtained data (e.g. Eisele et al. 2023). Further research exploring ESM as an independent

‘intervention’ and how assessment frequency impacts PTSD symptom reporting could provide interesting insight to the mechanisms behind symptom change during assessment.

Although the brief online intervention did not have broad intervention effects, there are still several important clinical implications from the study design with respect to the use of ESM. As highlighted above, the utility of ESM monitoring as an intervention in of itself deserves further study. For example, individuals on waitlists to see clinicians could potentially undertake such monitoring with a potential outcome being not only important clinical information available to help guide treatment planning with a clinician, but the possibility of small but significant symptom relief in this waitlist period. The findings of the present study also reinforce the relevance of within-person symptom fluctuations in PTSD for empirical investigation and clinical practice alongside a growing body of evidence (e.g., Canty et al., 2023; Greene et al., 2018; Hoeboer et al., 2022; Hoffart et al., 2019; Kooistra, et al., 2023; Price et al., 2020). The replication of many of the findings discussed in Chapter 2 strengthens confidence in the observed associations between key intrusive symptom reactions and other factors of PTSD. For clinicians, these findings suggest that even when individuals with severe PTSD successfully reduce their negative appraisals of intrusions they may report little change in their intrusion related distress, hence mental health professionals should consider multiple measures of progress and may find participant diaries improve accuracy in their understanding. Future research examining how the strength of the relationships between these key variables differs between people could help improve both the engagement in and efficacy of treatment, by better assessing individual needs and identifying more precisely key active components of efficacious interventions (Herzog & Kaiser, 2022; Kehle-Forbes et al., 2022). Such work has further downstream implications, for example, guiding decisions regarding allocation of mental health support resources such as informing stepped-care approaches (see Roberts & Nixon, 2023 for discussion), once optimal intervention components and approaches are identified. The study also showed that appraisal changes can be attained within relatively brief and accessible intervention strategies and that individuals did use the intervention strategies more than normal on

occasions where they were experiencing relatively elevated distress. Taken with the proposed self-awareness benefits of ESM (Dewey et al., 2015; Snippe et al., 2016), clinicians may in future be able to have clients use self-monitoring protocols to help them engage in the most effective ingredients of trauma-focused cognitive behavioural therapies day-to-day.

The present study formed a valuable initial investigation of potential intensive transdiagnostic mechanisms operating within trauma exposed individuals, however the exploratory design was not intended to treat PTSD or capture long term clinical benefits and thus some limitations are acknowledged. First, while the online intervention was based in well-established foundations for PTSD treatment (Wild et al., 2020), it was simplified for use in a short-term study and presented without clinician guidance, hence there was no prior evidence for the efficacy of this specific intervention package. Replicating the overall ESM design in combination with an established clinician guided intervention, such as many of the recommended trauma focused cognitive therapies (e.g. Cognitive Processing Therapy, Cognitive Therapy for PTSD, Prolonged Exposure Therapy) would build on the present findings and yield new information regarding the relationships operating between key PTSD transdiagnostic variables. Furthermore, the present sample included less severe symptom ranges in participants than seen in those in PTSD treatment studies and the intervention was of low intensity, both of which could have contributed to a lack of significant observable change; in conjunction, the modest sample size may have resulted in smaller effects not being detected due to lowered statistical power (Arend & Schäfer, 2019). Finally, these results reflect the relationships between variables and outcomes following a single week ESM protocol with no observation of longer-term effects. Nonetheless, the present study provides one of the first experimental explorations of using ESM to intensively study mechanisms potentially driving PTSD maintenance in the context of an easily deliverable online clinical intervention package for trauma exposed individuals, providing several exciting avenues for further investigation.

Conclusions

In summary, the findings of this study reinforce the significance of intensive within-person relationships between negative appraisals of intrusions, avoidance coping, rumination, and intrusion related distress while presenting an initial demonstration for the intervention-based applications of ESM. Increased negative appraisals and maladaptive coping were again seen to be closely linked to increased distress, with momentary changes having a greater influence for individuals with lower negative appraisal and avoidance tendencies than others. The experimental manipulation resulted in significant reductions in negative appraisals in the online intervention group relative to the control condition. Further research is needed to delineate at which point changes in these relationships result in actual posttraumatic symptom change. The broader context of these and earlier thesis findings are discussed in the next chapter.

CHAPTER FIVE – GENERAL DISCUSSION

Overview

The present PhD thesis tested key relationships between variables proposed to be intrinsic to the development and maintenance of PTSD using intensive Experience Sampling Methodologies (ESM). This micro-longitudinal approach specifically facilitated in depth explorations of the relationships operating between negative appraisals of intrusions, intrusion related distress, and maladaptive coping at both the within-person and between-person level. These factors encompass those thought to represent trauma-specific variables as well as those considered more transdiagnostic. Hence, the present thesis presents a unique combined exploration of cognitive theories of PTSD that not only examined intensive within-person relationships, providing novel detail of how fast-acting relationships may appear over brief assessment intervals, but also the involvement of intrusion related distress as a factor independent from the frequency of intrusions. The detailed examination of these relationships over numerous consecutive days expanded upon previous macro-longitudinal research and advances our understanding of how the complex mechanisms driving extended trauma responses may operate day-to-day.

Study 1a (Chapter 2) first explored cognitive mechanisms involving intrusions and related distress in a micro-longitudinal methodology, investigating whether the relationships observed in macro-longitudinal research were also present within-individuals throughout the day. The results of Study 1a were then examined further using a more advanced analytic approach in Study 1b (Chapter 3) which illustrated the contemporaneous and temporal within-person relationships occurring at specific time-points. Together these studies demonstrated how current cognitive theories of PTSD and macro-longitudinal understandings of the disorder map onto daily individual processes. Study 2 (Chapter 4) then investigated the application of ESM to analogue PTSD intervention techniques, comparing the ESM reports of trauma-exposed individuals who had, and had not, received a brief online intervention.

Summary of Findings

Guided by Ehlers and Clarks' cognitive model of PTSD (2000), Study 1a presented an initial exploration of the intensive within-person level relationships between negative appraisals of intrusions, intrusion frequency, related distress, and maladaptive coping strategy engagement. As predicted, at the within-person level intrusion frequency, intrusion related distress, and estimated intrusion related distress were all significantly positively associated with both negative appraisals of intrusions and maladaptive coping strategy engagement. These contemporaneous relationships demonstrated that significant change in these factors occurred within-individuals over the intensive assessment windows of interest and largely aligned with the intra-individual relationships examined in prior research (Beierl et al., 2019; Dekel et al., 2013; Hoffart et al., 2019; Price et al., 2020; Stallard & Smith, 2007). Notably, the within-person relationships of appraisals and maladaptive coping explained a substantially greater amount of the variance in intrusion related distress, than the frequency of intrusions themselves. Intrusion frequency was also the only variable that was not associated with negative appraisals or maladaptive coping at the between-person level, contributing to the growing body of evidence that the occurrence of intrusions per se is not the key determinant of PTSD development (Kleim et al., 2013; Marks et al., 2018; Meiser-Stedman et al., 2019; Stallard & Smith, 2007). Additionally, unexpected negative cross-level interactions of maladaptive coping strategy engagement in association with intrusion frequency, intrusion related distress, and estimated distress indicated that individuals with less tendency to engage in maladaptive coping than others were *more* reactive to fluctuations in their intrusion responses.

Study 1b directly expanded on the results and findings of Study 1a, using RI-CLPM to examine the contemporaneous and temporal within-person relationships operating at individual time-points. As informed by the previous results, this study focused on intrusion related distress and dissected maladaptive coping into two forms - avoidant coping and rumination. Fewer cross-lagged paths than anticipated were significant in the final models, with some of the contemporaneous associations from Study 1a no longer appearing significant once temporal relationships were

accounted for and each time-point was considered individually. Although Study 1a indicated that the observed within-person relationships largely mirrored Ehlers and Clark's (2000) cognitive model, Study 1b showed that intra-individual fluctuations in these key trauma reaction factors may appear differently when examined in independent assessment windows rather than across the full 10 days. Specifically, negative appraisals of intrusions were rarely associated with distress on any singular time-point, but over all 40 time-points a significant contemporaneous relationship was observed between appraisals and distress. Interestingly, within-person variability appeared most substantial during Day 1 of the ESM protocol, becoming more stable through the middle of the assessment period (Day 5), before negative associations appeared on Day 10, potentially reflecting reduced inter-individual reactivity. As this study was intended to simply observe post-trauma reactions without intentional intervention, this change over time was unexpected, however these findings may reflect assessment reactivity effects and provide additional, albeit preliminary, evidence that participant reports of trauma related factors improve throughout ESM protocols (e.g. Dewey et al., 2015). Nonetheless, intrusion related distress remained consistently associated with both avoidance coping and rumination at the within-person level. Furthermore, the patterns of relationships with negative intrusion appraisals and intrusion related distress differed for avoidance coping compared to rumination. These results indicated that negative appraisals were more consistently linked to rumination than avoidance, supporting theories that suggest maladaptive rumination and avoidance following trauma exposure operate via different mechanisms (Wisco et al., 2023), as expanded upon later.

Study 2 presented a more exploratory application of ESM to assess negative intrusion appraisals, related distress, avoidance coping, and rumination following a brief online intervention. The intervention itself was informed by cognitive models of PTSD such as Ehlers and Clark's (2000) as well as intervention studies that have utilised similar techniques in PTSD treatment (Lewis et al., 2019; Wild et al., 2016), hence it intended to reduce negative appraisals of intrusions through education and provided tips and experiential exercises for alternative coping mechanisms to

reduce maladaptive approaches. Unexpectedly, the control and intervention group participants did not differ significantly in any of the factors measured throughout ESM, however the within-person contemporaneous relationships did replicate many of the distress associations and negative cross-level interactions observed in Study 1a. The only significant interaction evident was that the intervention group reported significantly greater reductions in negative appraisals from baseline to post-ESM than the control group. Interestingly, both groups reported reduced PTSD symptoms and ruminative tendencies from baseline to post-ESM which reflected the Study 1b results and current research on assessment related change in post-trauma factors (Dewey et al., 2015; Possemato et al., 2012). The intervention was well tolerated, and participants reported greater use of intervention strategies compared to their normal amount on occasions where they also reported relatively increased distress.

Implications of Findings and Avenues of Future Research

The present thesis aimed to provide an in depth understanding of posttraumatic intrusions and day-to-day relationships within trauma reactions by building upon current macro-longitudinally based theories of PTSD development and maintenance to examine how the specific mechanisms may operate for individuals during the day. As detailed in Chapter 1, current conceptualisations of trauma reaction persistence are largely based in macro-longitudinal research that generalises data over extended timeframes to compare groups of people, providing little insight on the course of fast acting intra-individual factors like emotions (Greene et al., 2018). For example, Ehlers and Clark's (2000) cognitive model of PTSD proposed that only some trauma exposed individuals go on to develop the disorder because those individuals appraise their experience or following symptom sequelae as a current threat, causing continued distress which then prompts engagement in maladaptive coping. Although this theory has garnered significant empirical support (e.g., Beierl et al., 2019; Gómez de La Cuesta et al., 2019; Marks et al., 2018; Miethe et al., 2023) it presents no discernible timeframe over which this process occurs nor how it could be expected to change over time. This has significant implications for clinical practice as the research predominantly informing

our current treatment approaches conceptualises PTSD at the group level over undefined time periods, but these same intervention procedures are presented to individuals who are asked to apply change in their daily routines. Therefore, empirical investigations of day-to-day intrapersonal trauma reactions and associations can provide a valuable evidence base to guide specific approaches in clinical practice.

Micro-longitudinal assessment methods such as ESM are increasingly used to explore individual variability and frequently changing trauma response factors (e.g. Greene et al., 2018; Gelkopf et al., 2019; Price et al., 2020). Thus, Studies 1a and 1b assessed key elements of Ehlers and Clark's (2000) Cognitive theory using ESM to explore how the proposed relationships apply to individual intrusion responses throughout the day. The results of these studies generally supported this (and other established cognitive or emotional processing models of PTSD, e.g. Foa et al., 1989), showing significant associations between the anticipated key variables both between and within individuals. However, the isolated perspective of measurement occasions in Study 1b revealed that these relationships do not look the same in the moment as they do over weeks or months. Specifically, when considered across a 10-day period, individual fluctuations in negative appraisals of intrusions were positively associated with intrusion related distress, however in arguably more sophisticated analysis (RI-CLPMs) appraisals were rarely directly linked to distress at individual time points. This suggests that while negative appraisals and intrusion related distress are related as theorised and do change together inter-individually, in this data most of the variance in appraisals was determined at the between-person level, a finding that was also observed in Study 2. Hence, each person's day-to-day appraisals of intrusions are predominantly determined by their tendency towards negative appraisals, which do change over days or weeks, but are largely consistent across a single day. Comparatively, both avoidance coping engagement and rumination were often linked with intrusion related distress at each time point, indicating that these intrusion reactions readily change together over a matter of hours. Hence, in clinical practice settings, clinicians may find weekly assessments of appraisals are suitable indexes of change throughout

intervention and provide valuable insight to a client's tendencies, but more frequent measures of coping behaviours are necessary to explore individual mechanisms accurately and could there prove a useful tool for functional behavioural analyses. This finding also speaks more broadly to the value of examining and tracking fast changing factors through micro-longitudinal methods, as longer assessment windows generalise relationships in a manner that may not reflect real world experiences or clients' attempts to adopt intervention-based habits day-to-day.

Guided by current discussions in PTSD research regarding the predictive value of intrusion related distress over and above intrusion frequency (Bryant et al., 2011; Kleim et al., 2013; Marks et al., 2018) Study 1a also provided a direct comparison of intrusion frequency and related distress. As discussed in Chapter 2, the within-person covariance effect sizes and absence of between-person associations for intrusion frequency indicated that intrusion related distress was more strongly associated with both negative appraisals and maladaptive coping than frequency. These findings demonstrate that intrusion frequency and related distress operate through distinct micro-longitudinal mechanisms and reinforce the significance of intrusion related distress as a factor independent from the occurrence of intrusions. Given that most current studies of PTSD focus on measuring intrusion frequency (Marks et al., 2018), or use self-report items that combine intrusion occurrence and related distress as a single value (e.g. Greene et al., 2018), these findings have significant implications for future research, primarily indicating that symptom and sequelae related distress should be captured in separate items from the frequency of occurrence of these factors to accurately examine their relationships with post-trauma cognitions. These results also provide micro-longitudinal support for Ehlers and Clark's (2000) cognitive model of PTSD as well as other conceptualisations of the disorder that propose distress-based reactions are the key determinant in maintaining post-trauma reactions, such as intrusions, beyond the adaptive point that they would naturally reduce (e.g. Brooks et al., 2019; Yehuda & LeDoux, 2007). Although some recent intervention studies of PTSD have intentionally assessed distress (e.g. Hoeboer et al., 2022; Zoellner et al., 2022), lending weight to its predictive role, further intensive measurement of distress

could clarify the mechanisms by which it influences symptom persistence and identify explicit measurable targets for intervention.

Further reflecting gaps in current conceptualisations of PTSD, our understanding of the mechanisms around maladaptive coping strategies is also limited by predominantly macro-longitudinal research that considers many factors together rather than in individual detail (Miethe et al., 2023; Moulds et al., 2020). For example, conceptualisations of and approaches to treating rumination vary, from being considered to be an independent maladaptive strategy that directly maintains PTSD (e.g. Ehlers & Wild, 2020) on the one hand, to being viewed as a form of avoidance operating through the same mechanisms as other avoidance behaviours on the other hand (e.g. Schumm et al., 2022). As Chapter 3 details, the significant paths for avoidance coping with intrusion related distress and appraisals were quite different to the paths for rumination with those same variables. These findings support conceptualisations of rumination as a factor that influences post-trauma reactions in a distinct manner, rather than through the same mechanisms as avoidance (e.g. Ehlers & Wild, 2020). Given that previous research has found that rumination is more strongly associated with post-trauma intrusions than it is with avoidance (Szabo et al., 2017), rumination may be a factor more central to the mechanisms of intrusion frequency proposed in Study 1a, while avoidance is more strongly associated with distress. Beyond PTSD, mixed conceptualisations of rumination appear across multiple disorders including depression, anxiety, and eating disorders (Aldao et al., 2010; Cavicchioli et al., 2023; Moulds et al., 2020; Smith et al., 2018). Current treatment protocols such as Rumination-focused CBT (RFCBT; Watkins, 2015) approach rumination as a form of avoidance, however if the findings in the current study are replicated in other disorders, the underlying rationale underpinning non-PTD treatment protocols might benefit from an updated discussion of the role of rumination, with further research on its specific mechanisms to better target it in interventions. Overall, my findings highlight the importance of considering maladaptive responses such as avoidance and rumination independently in psychological studies and clinical practice. These findings not only improve our understanding of

intensive maladaptive coping responses to traumatic intrusions, but also provide insight to the nature of rumination more broadly.

The present thesis also provided further information complementing prior methodological work with respect to how trauma exposed individuals may respond to ESM. As discussed in Chapters 3 and 4, assessment reactivity is a particularly prominent but largely unspecified consideration in self-report micro-longitudinal research (Eisele et al., 2023), hence the findings of Studies 1b and 2 provide valuable insight to how PTSD related factors may change throughout assessment. In studies attempting to accurately measure constructs as they occur in everyday life, measurement reactivity presents a challenging potential source of bias through altered reporting behaviour (Ram et al., 2017) but in explorations of novel treatment methods, reactive change in intensive designs could provide a means for long-lasting change in constructs of interest (Eisele et al., 2023; Korotitsch & Nelson-Gray, 1999). At present, few psychological ESM studies assess or report measurement reactivity (Wrzus & Neubauer, 2023) but improvements in cognitive-behavioural factors throughout ESM protocols may indicate micro-longitudinal assessments prompt beneficial measurement reactivity through lasting construct-based change (Hoemann et al., 2021; Kauer et al., 2012; Korotitsch & Nelson-Gray, 1999; Snippe et al., 2016; Widdershoven et al., 2019). In studies of depression, ESM type assessments have been found to provide independent benefits when used as a self-monitoring tool (Kauer et al., 2012; Snippe et al., 2016;) and enhance symptom reduction alongside more extensive interventions (Kramer et al., 2014). Unfortunately, it is difficult to generalise or predict how assessment methodology may impact any given findings as a vast number of variables, including individual participant characteristics, assessment duration and scheduling, and assessed constructs, have been found to influence the nature of this reactivity (Eisele et al., 2023; Korotitsch & Nelson-Gray, 1999). Hence, in order to understand how measurement reactivity may specifically impact PTSD related factors in micro-longitudinal research, intensive assessment research such as the present thesis is necessary. For example, negative cross-level interactions observed in Study 1a and Study 2 indicate that individuals with

lower tendencies to engage in maladaptive coping than others were more impacted by variation their coping behaviours and distress than individuals with greater maladaptive tendencies. Therefore, researchers assessing highly symptomatic clinical samples may expect weaker within-person associations for these factors than observed in a non-clinical sample and could thus explore whether a reduction in symptoms corresponds with increased intra-individual variability.

Although ESM has not yet been extensively applied to clinical PTSD research, initial evidence indicates that reactivity to micro-longitudinal assessments is relatively low and comparable to retrospective assessments (Chun et al., 2016; Gaher et al., 2014; Rattel et al., 2019). This suggests that ESM based findings are valid representations of everyday trauma reactions and related factors, hence symptom improvements observed throughout ESM protocols (e.g. Ehlers et al., 2003; Possemato et al., 2012) are likely indicative of change in the underlying constructs rather than change in response completion behaviour. The findings of Studies 1b and 2 add to the growing evidence base behind ESM facilitated improvement in PTSD related factors, showing how within-person relationships changed over assessed days and demonstrating significant reductions in self-reported symptoms from baseline to post-ESM respectively. These findings should encourage researchers to explore ESM as a stand-alone intervention, with potential applications for the initial stages of stepped care models and waitlisted clients, as well as a tool to enhance current treatment programs as seen in depression studies (e.g. Kramer et al., 2014).

Current theories of how ESM protocols reduce trauma reactions propose that frequent assessments may act as a low level of exposure, prompting individuals to engage with thoughts and feelings they may otherwise avoid, or encourage self-monitoring which consequently improves emotional understanding and processing (Dewey et al., 2015). The patterns of within-person relationship paths observed in Study 1b fit with both of these conceptualisations, as distress in response to intrusions appeared most variable at Day 1 before becoming more stable by Day 5 potentially illustrating an exposure-based reduction in reactions to intrusions, while the emergence of negative relationships at Day 10 may reflect changes to emotional processing. Future research

directly assessing the emotional processing of intrusions and other trauma reactions throughout ESM protocols may be able to identify which elements of intensive repeated assessments are most beneficial, optimising ESM for inclusion in intervention procedures. For example, researchers could administer a more extended ESM protocol with questions relating to individuals' subjective awareness of their emotions, to assess whether change in self-awareness occurs throughout ESM and is associated with corresponding change in posttraumatic symptoms. Qualitative work could also be conducted, making individuals aware of these observed changes and documenting their explanations for such change, perhaps even including qualitative items within an ESM protocol. At the same time from a theoretical perspective, randomised controlled trials examining ESM as a trauma intervention could compare within-person processes for control and experimental groups to enhance our direct understanding of measurement reactivity in PTSD as well as fast acting mechanisms underlying broader cognitive theories.

The findings summarised in this thesis directly demonstrate the analytic potential and clinical benefits of ESM in trauma-affected groups and those with PTSD, and as such there are numerous avenues for ESM based research to build on these findings within the trauma field. For one, current conceptions of coping strategies in anxiety disorders propose that, depending on the cognition behind and purpose of each engagement, some instances of strategies that are generally considered to be maladaptive, may be helpful (Goetz et al., 2016; Hofmann & Hay, 2018; Littleton et al., 2007). Although some research has explored the relationships between specific safety behaviours and PTSD symptomology (e.g. Blakey et al., 2020), future studies employing ESM to capture day-to-day engagement in these strategies, as well as the intent behind them, would provide accurate insight to the momentary mechanisms operating in individual's coping strategies. An ESM driven detailed exploration of coping strategies like avoidance and safety behaviours could not only assist researchers in defining the specifics of 'helpful' and 'unhelpful' approaches, but also might be a useful tool for clinicians in individual clients' functional behaviour analyses. Another area of research that could inform the extension of the present findings is resilience and flexibility in

response to trauma exposure. As summarised by Bonanno et al. (2023), regulatory flexibility may explain why some individuals are resilient to traumatic experiences, and that the skills involved in this flexibility could be improved by relatively simple training and feedback processes. Here ESM protocols could be applied independently to standard interventions to improve self-awareness of flexibility mindset factors, or alternatively, combined with intervention training programs to facilitate feedback provision through relatively inexpensive means.

The contributions of the present thesis to our understanding of micro-longitudinal assessments can be applied broadly to other areas of psychological research. As discussed in Chapter 1, intrusions are a key feature of PTSD but do appear across several other mental health conditions like panic disorders, anxiety, depression, and obsessive-compulsive disorder, as do many of the key relationships explored throughout the present thesis (Bryant et al., 2011; Inozu et al., 2021; Newby & Moulds, 2010). Hence, from the present study findings, it would be worth asking whether we might expect that distress is more relevant to coping behaviours than intrusions in other disorders, for example, for individuals with obsessive-compulsive disorder, and whether they too would report relatively stable negative appraisals throughout each day. This information could inform researchers as to how frequently constructs of interest should be assessed, and might encourage explicit exploration of the role of factors like distress and rumination in those presentations. Furthermore, these findings lend support to the therapeutic value of frequent self-report assessments. ESM protocols have the potential to provide low cost, accessible, low intensity psychological intervention for numerous concerns. For example, rapidly advancing methods for automation ESM diary scoring (e.g. Bellhäuser et al., 2023; Bringmann et al., 2021) mean clinicians could provide ESM style diaries to individuals on waitlists, with two-fold outcomes of providing helpful baseline information on the new incoming clients as well as potentially reducing individuals' symptoms in a period in which they normally might not see much change. Some ESM integrated interventions are already emerging for psychological disorders (e.g., Therap-I for depression Riese et al., 2023) and for non-clinical behavioural change such as reducing

procrastination (Wessel et al., 2021), but further ESM based initiatives could have far reaching benefits in self-help and clinical intervention.

Limitations and Strengths

The present thesis endeavoured to explore several new frontiers in posttraumatic stress research, employing intensive assessments and advanced statistical methods to assess key cognitive factors at both the within-person and between-person level in a trauma exposed sample. Although a novel program of research for several reasons, it was not without limitations.

Firstly, the participant samples recruited in Study 1a and Study 2 included non-treatment seeking, non-clinical, individuals who had been exposed to a Criterion A trauma (APA, 2013). As participants were not formally diagnosed with PTSD the observed levels of symptom severity were lower than generally included in randomized controlled trials (e.g. Hoeboer et al., 2022; Monson et al., 2018). This could limit the applicability of the present findings to clinical populations and presents the possibility that floor effects impacted the relationships observed, hence a generally more symptomatic sample may show different results. That said, there is evidence that non-clinical and non-treatment seeking trauma samples demonstrate many characteristics and relationships between trauma variables to a similar extent as observed in more symptomatic samples (see Boals et al., 2020). Furthermore, participants were carefully screened for exposure to a Criterion A trauma that *could* have precipitated a PTSD diagnosis (APA, 2013), lending confidence that the sample had truly experienced a significant traumatic event. The greater range of symptom severity also posed advantages for the broader assessment of post-trauma reactions, enabling the present research to explore differences in the within-person dynamics of individuals with generally lower compared to higher symptom endorsements.

Another caveat was that all assessments within the present thesis were self-report based. While the ecological and intensive nature of ESM studies necessitate self-report methods, they do not have the same objective validity as clinician administered interviews (Chun, 2016; Kramer et al., 2023). Additionally, as frequently done in ESM research (e.g. Price et al., 2020; Short et al.,

2018), the present study employed adapted and abbreviated versions of standard self-reports in the ESM survey. Despite being common in the emerging ESM practice, these adapted measures are unstandardized which has been argued by some to limit the applicability of results (Chun, 2016). While unstandardized, the abbreviated ESM measures in the present thesis enabled the exploration of numerous variables without excessive participant burden and were supplemented with standardized instruments with good psychometric validity such as the PCL-5 (Blevins et al., 2015; Kramer et al., 2023). Although there are some limitations to these self-report ESM protocols which future research could improve upon with the inclusion of clinician administered assessments, this methodology was appropriate for the subjective concepts explored and allowed the present research to capture day-to-day within-person trauma reactions in more detail than pervious macro-longitudinal research.

In a similar vein, the research and intervention protocols for the studies included in this thesis were new or exploratory in nature, i.e., using relatively short observation periods within the ESM and the employment of a low intensity analogue intervention that was not previously formally tested. Hence, the observations of the present thesis were constrained by the methodologies employed within the PhD timeline. For instance, as longer-term follow-up assessments were not included in Study 2 the stability of the observed relationships were not captured beyond the ESM protocol. Thus, the findings of this research could be greatly expanded by applying an ESM protocol throughout a more extensive randomized controlled trial of an established intervention for PTSD (e.g., CPT, PE, EMDR) and examination of longer-term outcomes. However, few studies have applied four-hourly ESM assessment intervals in trauma studies, and none (to my knowledge) have explicitly examined intrusion related distress. Thus, this PhD research program represents first steps in investigations of within-person distress related processes that provided valuable insights to novel concepts and justifiable directions for further investigations.

As is often the case, refinements and broader applications of statistical methods occurred in parallel during the period this PhD was conducted (e.g., RI-CLPM). Thus, while multi-level

modelling was appropriate for the research questions examined in Study 1a, Study 1b afforded the opportunity to investigate further (and extend) the intensive intra-personal relationships of Study 1a using RI-CLPM. As the data collection was not planned to suit RI-CLPM, some concessions were made to apply this analysis to the data and future research with larger samples but in a design with fewer time-points (to maximise the full potential of RI-CLPM) could be more sensitive to a greater number of significant relationships (paths) of interest. Despite this challenge, Study 1b successfully applied an advanced and relatively novel analytical approach to provide unique insights of intrusion related distress, avoidance coping, and rumination by mapping the within-person relationships at individual time points.

The present thesis was naturally limited to some degree by the time and resource constraints of a PhD and could not index all the potentially rich information ESM can provide to our understanding of trauma reactions and PTSD. It does however begin to traverse the gap between psychological research of PTSD and advancing methods of data collection and analysis. As such this research provided new insight to the day-to-day relationships occurring in trauma exposed individuals, provided detailed exploration of factors such as distress that were previously largely unstudied, and demonstrated the applicability of ESM for numerous fields of research as well as clinical practice.

Concluding Remarks

Current theoretical and clinical conceptualisations of PTSD are largely based on macro-longitudinal research that provide minimal guidance on the day-to-day processes that drive the development and maintenance of the disorder, limiting application of these concepts to real world therapeutic intervention. The overarching aim of the present thesis was to address this gap by using intensive micro-longitudinal assessments, guided by Ehlers and Clark's (2000) cognitive model of PTSD, to provide a more in depth understanding of individual day-to-day posttraumatic cognitions and reactions. Three studies were conducted, with each presenting a unique perspective of the intra-personal mechanisms of negative appraisals of intrusions, intrusion related distress, and

maladaptive coping assessed through ESM. This program of research found that significant within-person associations between these variables are evident in intensive time frames and illustrated how the individual mechanisms of these factors appear differently over hours, single days, and across multiple days. Alongside the analytical benefits of the ESM protocols, indications of positive assessment reactivity in this research highlight the potential of repeated self-assessment as a tool for clinicians and, like other clinical disorders, has implications for future interventions. As discussed throughout, the findings of this thesis have substantial implications for the procedures used to research PTSD and other presentations (clinical or otherwise) characterised by rapidly fluctuating psychological factors, as well as how this understanding can be applied to clinical settings. It is hoped that this thesis will not only contribute to the evidence base for understanding, preventing, and treating PTSD, but will also highlight valuable avenues of investigation for micro-longitudinal research and encourage more widespread study of the implementation of ESM in applied settings.

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APPENDICES

Appendix A –Materials and Questionnaires

Appendix A1: Baseline Survey for Studies 1a, 1b, and 2

Please enter your Participant ID provided to you by the Researcher.

_____

Please enter your age.

_____

Gender:

- ○ Male
- ○ Female
- ○ Other (Please specify). _____

Racial or Ethnic Origin:

- ○ Caucasian
- ○ Aboriginal or Torres Strait Islander
- ○ European (please specify) _____
- ○ Asian (please specify) _____
- ○ Middle Eastern (please specify) _____
- ○ Other (please specify) _____

How many years of education have you completed (full-time equivalent)? e.g. high school completed = 12; university undergraduate completed = 15-16.

_____

Marital status: (Please select the appropriate option).

- ○ Single
- ○ In a relationship but not living together.
- ○ In a relationship and living together.
- ○ Married.
- ○ Separated or divorced.
- ○ Widow.

Have you previously received, or are you currently receiving, any mental health related therapy?

- ○ Yes
- ○ No

Briefly describe what type of therapy you received/are receiving.
That is, what type of therapy, if it had a name (e.g., CBT, general counselling), what it was for (e.g., trauma/PTSD, anxiety, or depression), the type of professional seen (psychologist, counsellor, social worker), and when you started the therapy.
Also include approximately when you received therapy.

_____

This questionnaire asks about problems you may have had after a negative experience involving actual or threatened death, serious injury, or sexual violence. It could be something that **happened to you** directly, something you **witnessed**, or something you **learned** happened to a close family member or close friend. Some examples are a serious accident; fire; disaster such as a hurricane, tornado, or earthquake; physical or sexual attack or abuse; war; homicide; or suicide. First, please answer a few questions about the negative experience that you discussed with the researcher. This could be one of the examples above or some other very stressful experience. Also, it could be a single event (for example, a car crash) or multiple similar events (for example, multiple stressful events in a war-zone or repeated sexual abuse).

Briefly identify the negative experience that occurred (if you feel comfortable doing so):

_____

_____

As close as you can remember, what was the date of the event that occurred?

_____

Did it involve actual or threatened death, serious injury, or sexual violence?

- ○ Yes
- ○ No

How did you experience it?

- ○ It happened to me directly
- ○ I witnessed it
- ○ I learned about it happening to a close family member or close friend
- ○ I was repeatedly exposed to details about it as part of my job (for example, paramedic, police, military, or other first responder)
- ○ Other, please describe _____

If the event involved the death of a close family member or close friend, was it due to some kind of accident or violence, or was it due to natural causes?

- ○ Accident or violence
- ○ Natural causes
- ○ Not applicable (the event did not involve the death of a close family member or close friend)

Second, keeping the negative experience discussed with the researcher in mind, read each of the problems and then indicate to the right how much you have been bothered by that problem **in the past month.**

	Not at all	**A little bit**	**Moderately**	**Quite a bit**	**Extremely**
Repeated, disturbing, and unwanted memories of the stressful experience?	○	○	○	○	○
Repeated, disturbing dreams of the stressful experience?	○	○	○	○	○
Suddenly feeling or acting as if the stressful experience were actually happening again *(as if you were actually back there reliving it)?*	○	○	○	○	○
Feeling very upset when something reminded you of the stressful experience?	○	○	○	○	○
Having strong physical reactions when something reminded you of the stressful experience *(for example, heart pounding, trouble breathing, sweating)?*	○	○	○	○	○

Avoiding memories, thoughts, or feelings related to the stressful experience?	○	○	○	○	○
Avoiding external reminders of the stressful experience *(for example, people, places, conversations, activities, objects, or situations)?*	○	○	○	○	○
Trouble remembering important parts of the stressful experience?	○	○	○	○	○
Having strong negative beliefs about yourself, other people, or the world *(for example, having thoughts such as: I am bad, there is something seriously wrong with me, no one can be trusted, the world is completely dangerous)?*	○	○	○	○	○
Blaming yourself or someone else for the stressful experience or what happened after it?	○	○	○	○	○
Having strong negative feelings such as fear, horror, anger, guilt, or shame?	○	○	○	○	○
Loss of interest in activities that you used to enjoy?	○	○	○	○	○
Feeling distant or cut off from other people?	○	○	○	○	○
Trouble experiencing positive feelings *(for example, being unable to feel happiness or have loving feelings for people close to you)?*	○	○	○	○	○
Irritable behavior, angry outbursts, or acting aggressively?	○	○	○	○	○
Taking too many risks or doing things that could cause you harm?	○	○	○	○	○
Being "superalert" or watchful or on guard?	○	○	○	○	○

Feeling jumpy or easily startled?	○	○	○	○	○
Having difficulty concentrating?	○	○	○	○	○
Trouble falling asleep or staying asleep?	○	○	○	○	○

How true is this of you?

	Not at all	A little bit	Moderately	Quite a bit	Extremely
When I am upset, it takes me a long time to calm down	○	○	○	○	○
I feel numb or emotionally shut down	○	○	○	○	○
I feel like a failure	○	○	○	○	○
I feel worthless	○	○	○	○	○
I find it hard to stay emotionally close to people	○	○	○	○	○

Intrusions are unwanted thoughts about or memories of the negative or traumatic event that come to mind without you thinking of the event. In relation to intrusive memories from the negative experience discussed with the researcher, *what is your most feared negative prediction about these intrusions* (e.g., a fear you will get so upset from the intrusion that you can't calm down, the intrusion might interfere with what you are working on etc.). **We are not asking about fearing the experience will happen again, but what might be worried about in relation to these intrusions.**
(Please type your answer below)

_____

What is the likelihood that your most feared negative prediction about your intrusion will come true? Please answer even if you haven't had an intrusion today or recently.
(0% = *Not all likely*, 100% = *Extremely likely)*

- ○ 100%
- ○ 90%
- ○ 80%
- ○ 70%
- ○ 60%
- ○ 50%
- ○ 40%
- ○ 30%
- ○ 20%
- ○ 10%
- ○ 0%

Is the event that you discussed with the researcher the only traumatic event that has happened in your lifetime?

- ○ Yes
- ○ No

You are now going to be asked similar sorts of questions but be sure to consider your entire life (growing up as well as adulthood). Listed below are a number of difficult or stressful things that sometimes happen to people. For each event select one or more of the responses to the right to indicate that : (a) it happened to you personally; (b) you witnessed it happen to someone else; (c) you learned about it happening to a close family member or close friend; (d) you were exposed to it as part of your job (for example, paramedic, police, military, or other first responder); (e) you're not sure if it fits or (f) it doesn't apply to you.

Natural disaster (e.g., flood, hurricane, tornado, earthquake).

- ○ Happened to me
- ○ Witnessed it
- ○ Learned about it
- ○ Part of my job
- ○ Not sure
- ○ Doesn't apply

Fire or explosion.

- ○ Happened to me
- ○ Witnessed it
- ○ Learned about it
- ○ Part of my job
- ○ Not sure
- ○ Doesn't apply

Transportation accident (e.g., car accident, boat accident, train wreck, plane crash).

- ○ Happened to me
- ○ Witnessed it
- ○ Learned about it
- ○ Part of my job
- ○ Not sure
- ○ Doesn't apply

Serious accident at work, home, or during recreational activity.

- ○ Happened to me
- ○ Witnessed it
- ○ Learned about it
- ○ Part of my job
- ○ Not sure
- ○ Doesn't apply

Exposure to toxic substance (e.g., dangerous chemicals, radiation).

- ○ Happened to me
- ○ Witnessed it
- ○ Learned about it
- ○ Part of my job
- ○ Not sure
- ○ Doesn't apply

Physical assault (e.g., being attacked, hit, slapped, kicked, beaten up).

- ○ Happened to me
- ○ Witnessed it
- ○ Learned about it
- ○ Part of my job
- ○ Not sure
- ○ Doesn't apply

Assault with a weapon (e.g., being shot, stabbed, threatened with a knife, gun, bomb).

- ○ Happened to me
- ○ Witnessed it
- ○ Learned about it
- ○ Part of my job
- ○ Not sure
- ○ Doesn't apply

Sexual assault (e.g., rape, attempted rape, made to perform any type of sexual act through force or threat of harm).

- ○ Happened to me
- ○ Witnessed it
- ○ Learned about it
- ○ Part of my job
- ○ Not sure
- ○ Doesn't apply

Other unwanted or uncomfortable sexual experience.

- ○ Happened to me
- ○ Witnessed it
- ○ Learned about it
- ○ Part of my job
- ○ Not sure
- ○ Doesn't apply

Combat or exposure to a war zone (in the military or as a civilian).

- ○ Happened to me
- ○ Witnessed it
- ○ Learned about it
- ○ Part of my job
- ○ Not sure
- ○ Doesn't apply

Captivity (e.g., being kidnapped, abducted, held hostage, prisoner of war).

- ○ Happened to me
- ○ Witnessed it
- ○ Learned about it
- ○ Part of my job
- ○ Not sure
- ○ Doesn't apply

Life threatening illness or injury.

- ○ Happened to me
- ○ Witnessed it
- ○ Learned about it
- ○ Part of my job
- ○ Not sure
- ○ Doesn't apply

Severe human suffering.

- ○ Happened to me
- ○ Witnessed it
- ○ Learned about it
- ○ Part of my job
- ○ Not sure
- ○ Doesn't apply

Sudden violent death (e.g., homicide, suicide).

- ○ Happened to me
- ○ Witnessed it
- ○ Learned about it
- ○ Part of my job
- ○ Not sure
- ○ Doesn't apply

Sudden accidental death.

- ○ Happened to me
- ○ Witnessed it
- ○ Learned about it
- ○ Part of my job
- ○ Not sure
- ○ Doesn't apply

Serious injury, harm, or death you caused to someone else.

- ○ Happened to me
- ○ Witnessed it
- ○ Learned about it
- ○ Part of my job
- ○ Not sure
- ○ Doesn't apply

Any other very stressful event or experience.

- ○ Happened to me
- ○ Witnessed it
- ○ Learned about it
- ○ Part of my job
- ○ Not sure
- ○ Doesn't apply

Please read each statement and select the answer which indicates how much the statement applied to you **over the past week.** There are no right or wrong answers. Do not spend too much time on any statement.

I found it hard to wind down.

- ○ Did not apply to me at all.
- ○ Applied to me to some degree, or some of the time.
- ○ Applied to me to a considerable degree, or a good part of the time.
- ○ Applied to me very much, or most of the time.

I was aware of dryness of my mouth.

- ○ Did not apply to me at all.
- ○ Applied to me to some degree, or some of the time.
- ○ Applied to me to a considerable degree, or a good part of the time.
- ○ Applied to me very much, or most of the time.

I couldn't seem to experience any positive feelings at all.

- ○ Did not apply to me at all.
- ○ Applied to me to some degree, or some of the time.
- ○ Applied to me to a considerable degree, or a good part of the time.
- ○ Applied to me very much, or most of the time.

I experienced breathing difficulty (e.g., excessively rapid breathing, breathlessness in the absence of physical exertion).

- ○ Did not apply to me at all.
- ○ Applied to me to some degree, or some of the time.
- ○ Applied to me to a considerable degree, or a good part of the time.
- ○ Applied to me very much, or most of the time.

I found it difficult to work up the initiative to do things.

- ○ Did not apply to me at all.
- ○ Applied to me to some degree, or some of the time.
- ○ Applied to me to a considerable degree, or a good part of the time.
- ○ Applied to me very much, or most of the time.

I tended to over-react to situations.

- ○ Did not apply to me at all.
- ○ Applied to me to some degree, or some of the time.
- ○ Applied to me to a considerable degree, or a good part of the time.
- ○ Applied to me very much, or most of the time.

I experienced trembling (e.g., in the hands).

- ○ Did not apply to me at all.
- ○ Applied to me to some degree, or some of the time.
- ○ Applied to me to a considerable degree, or a good part of the time.
- ○ Applied to me very much, or most of the time.

I felt that I was using a lot of nervous energy.

- ○ Did not apply to me at all.
- ○ Applied to me to some degree, or some of the time.
- ○ Applied to me to a considerable degree, or a good part of the time.
- ○ Applied to me very much, or most of the time.

I was worried about situations in which I might panic and make a fool of myself.

- ○ Did not apply to me at all.
- ○ Applied to me to some degree, or some of the time.
- ○ Applied to me to a considerable degree, or a good part of the time.
- ○ Applied to me very much, or most of the time.

I felt that I had nothing to look forward to.

- ○ Did not apply to me at all.
- ○ Applied to me to some degree, or some of the time.
- ○ Applied to me to a considerable degree, or a good part of the time.
- ○ Applied to me very much, or most of the time.

I found myself getting agitated.

- ○ Did not apply to me at all.
- ○ Applied to me to some degree, or some of the time.
- ○ Applied to me to a considerable degree, or a good part of the time.
- ○ Applied to me very much, or most of the time.

I found it difficult to relax.

- ○ Did not apply to me at all.
- ○ Applied to me to some degree, or some of the time.
- ○ Applied to me to a considerable degree, or a good part of the time.
- ○ Applied to me very much, or most of the time.

I felt down-hearted and blue.

- ○ Did not apply to me at all.
- ○ Applied to me to some degree, or some of the time.
- ○ Applied to me to a considerable degree, or a good part of the time.
- ○ Applied to me very much, or most of the time.

I was intolerant of anything that kept me from getting on with what I was doing.

- ○ Did not apply to me at all.
- ○ Applied to me to some degree, or some of the time.
- ○ Applied to me to a considerable degree, or a good part of the time.
- ○ Applied to me very much, or most of the time.

I felt I was close to panic.

- ○ Did not apply to me at all.
- ○ Applied to me to some degree, or some of the time.
- ○ Applied to me to a considerable degree, or a good part of the time.
- ○ Applied to me very much, or most of the time.

I was unable to become enthusiastic about anything.

- ○ Did not apply to me at all.
- ○ Applied to me to some degree, or some of the time.
- ○ Applied to me to a considerable degree, or a good part of the time.
- ○ Applied to me very much, or most of the time.

I felt I wasn't worth much as a person.

- ○ Did not apply to me at all.
- ○ Applied to me to some degree, or some of the time.
- ○ Applied to me to a considerable degree, or a good part of the time.
- ○ Applied to me very much, or most of the time.

I felt that I was rather touchy.

- ○ Did not apply to me at all.
- ○ Applied to me to some degree, or some of the time.
- ○ Applied to me to a considerable degree, or a good part of the time.
- ○ Applied to me very much, or most of the time.

I was aware of the action of my heart in the absence of physical exertion (e.g., sense of heart rate increase, heart missing a beat).

- ○ Did not apply to me at all.
- ○ Applied to me to some degree, or some of the time.
- ○ Applied to me to a considerable degree, or a good part of the time.
- ○ Applied to me very much, or most of the time.

I felt scared without any good reason.

- ○ Did not apply to me at all.
- ○ Applied to me to some degree, or some of the time.
- ○ Applied to me to a considerable degree, or a good part of the time.
- ○ Applied to me very much, or most of the time.

I felt that life was meaningless.

- ○ Did not apply to me at all.
- ○ Applied to me to some degree, or some of the time.
- ○ Applied to me to a considerable degree, or a good part of the time.
- ○ Applied to me very much, or most of the time.

We are interested in the kind of thoughts which you may have had after the negative experience you have discussed with the researcher. Below are a number of statements that may or may not be representative of your thinking. Please read each statement carefully and tell us how much you AGREE or DISAGREE with each statement. People react to traumatic events in many different ways. There are no right or wrong answers to these statements.

	Totally Disagree	Disagree very much	Disagree slightly	Neutral	Agree Slightly	Agree Very Much	Totally Agree
The event happened because of the way I acted	○	○	○	○	○	○	○
I can't trust that I will do the right thing	○	○	○	○	○	○	○
I am a weak person	○	○	○	○	○	○	○
I will not be able to control my anger and will do something terrible	○	○	○	○	○	○	○
I can't deal with the even slightest upset	○	○	○	○	○	○	○
I used to be a happy person but now I am always miserable	○	○	○	○	○	○	○
People can't be trusted	○	○	○	○	○	○	○
I have to be on guard all the time	○	○	○	○	○	○	○

I feel dead inside	○	○	○	○	○	○	○
You can never know who will harm you	○	○	○	○	○	○	○
I have to be especially careful because you never know what can happen next	○	○	○	○	○	○	○
I am inadequate	○	○	○	○	○	○	○
I will not be able to control my emotions, and something terrible will happen	○	○	○	○	○	○	○
If I think about the event, I will not be able to handle it	○	○	○	○	○	○	○
The event happened to me because of the sort of person I am	○	○	○	○	○	○	○
My reactions since the event mean that I am going crazy	○	○	○	○	○	○	○
I will never be able to feel normal emotions anymore	○	○	○	○	○	○	○
The world is a dangerous place	○	○	○	○	○	○	○
Somebody else would have stopped the event from happening	○	○	○	○	○	○	○
I have permanently changed for the worse	○	○	○	○	○	○	○
I feel like an object, not like a person	○	○	○	○	○	○	○
Somebody else would not have gotten into this situation	○	○	○	○	○	○	○
I can't rely on other people	○	○	○	○	○	○	○

I feel isolated and set apart from others	○	○	○	○	○	○	○
I have no future	○	○	○	○	○	○	○
I can't stop bad things from happening to me	○	○	○	○	○	○	○
People are not what they seem	○	○	○	○	○	○	○
My life has been destroyed by the trauma or negative event	○	○	○	○	○	○	○
There is something wrong with me as a person	○	○	○	○	○	○	○
My reactions since the event show that I am a lousy coper	○	○	○	○	○	○	○
There is something about me that made the event happen	○	○	○	○	○	○	○
I will not be able to tolerate my thoughts about the event, and I will fall apart	○	○	○	○	○	○	○
I feel like I don't know myself anymore	○	○	○	○	○	○	○
You never know when something terrible will happen	○	○	○	○	○	○	○
I can't rely on myself	○	○	○	○	○	○	○
Nothing good can happen to me anymore	○	○	○	○	○	○	○

In this questionnaire, you will be asked to describe how you typically think about negative experiences or problems. Please read the following statements and rate the extent to which they apply to you when you think about negative experiences or problems.

The same thoughts keep going through my mind again and again.

- ○ Never
- ○ Rarely
- ○ Sometimes
- ○ Often
- ○ Almost always

Thoughts intrude into my mind.

- ○ Never
- ○ Rarely
- ○ Sometimes
- ○ Often
- ○ Almost always

I can't stop dwelling on them.

- ○ Never
- ○ Rarely
- ○ Sometimes
- ○ Often
- ○ Almost always

I think about many problems without solving any of them.

- ○ Never
- ○ Rarely
- ○ Sometimes
- ○ Often
- ○ Almost always

I can't do anything else while thinking about my problems.

- ○ Never
- ○ Rarely
- ○ Sometimes
- ○ Often
- ○ Almost always

My thoughts repeat themselves.

- ○ Never
- ○ Rarely
- ○ Sometimes
- ○ Often
- ○ Almost always

Thoughts come to my mind without me wanting them to.

- ○ Never
- ○ Rarely
- ○ Sometimes
- ○ Often
- ○ Almost always

I get stuck on certain issues and can't move on.

- ○ Never
- ○ Rarely
- ○ Sometimes
- ○ Often
- ○ Almost always

I keep asking myself questions without finding an answer.

- ○ Never
- ○ Rarely
- ○ Sometimes
- ○ Often
- ○ Almost always

My thoughts prevent me from focusing on other things.

- ○ Never
- ○ Rarely
- ○ Sometimes
- ○ Often
- ○ Almost always

I keep thinking about the same issue all the time.

- ○ Never
- ○ Rarely
- ○ Sometimes
- ○ Often
- ○ Almost always

Thoughts just pop into my mind.

- ○ Never
- ○ Rarely
- ○ Sometimes
- ○ Often
- ○ Almost always

I feel driven to continue dwelling on the same issue.

- ○ Never
- ○ Rarely
- ○ Sometimes
- ○ Often
- ○ Almost always

My thoughts are not much help.

- ○ Never
- ○ Rarely
- ○ Sometimes
- ○ Often
- ○ Almost always

My thoughts take up all my attention.

- ○ Never
- ○ Rarely
- ○ Sometimes
- ○ Often
- ○ Almost always

Think about the negative experience that you have discussed with the researcher. Please read each statement carefully and tell us how much you **AGREE or DISAGREE** with each statement regarding what any intrusive memory, thoughts or images from that event means to you.

My intrusions since the negative experience mean that something is wrong with me

- ○ Totally Disagree
- ○ Disagree Very Much
- ○ Disagree Slightly
- ○ Neutral
- ○ Agree Slightly
- ○ Agree Very Much
- ○ Totally Agree

If I think about the intrusions/memories, I will not be able to handle it

- ○ Totally Disagree
- ○ Disagree Very Much
- ○ Disagree Slightly
- ○ Neutral
- ○ Agree Slightly
- ○ Agree Very Much
- ○ Totally Agree

My intrusions since the negative experience mean that I am going crazy

- ○ Totally Disagree
- ○ Disagree Very Much
- ○ Disagree Slightly
- ○ Neutral
- ○ Agree Slightly
- ○ Agree Very Much
- ○ Totally Agree

My intrusions/memories since the negative experience make me feel inadequate

- ○ Totally Disagree
- ○ Disagree Very Much
- ○ Disagree Slightly
- ○ Neutral
- ○ Agree Slightly
- ○ Agree Very Much
- ○ Totally Agree

If I think about the intrusions/memories, I will not be able to control my emotions, and something terrible will happen

- ○ Totally Disagree
- ○ Disagree Very Much
- ○ Disagree Slightly
- ○ Neutral
- ○ Agree Slightly
- ○ Agree Very Much
- ○ Totally Agree

My intrusions/memories since the negative experience show that I have a psychological problem

- ○ Totally Disagree
- ○ Disagree Very Much
- ○ Disagree Slightly
- ○ Neutral
- ○ Agree Slightly
- ○ Agree Very Much
- ○ Totally Agree

My intrusions/memories since the negative experience show I am a lousy coper

- ○ Totally Disagree
- ○ Disagree Very Much
- ○ Disagree Slightly
- ○ Neutral
- ○ Agree Slightly
- ○ Agree Very Much
- ○ Totally Agree

If I think about the intrusions/memories, I will go out of my mind

- ○ Totally Disagree
- ○ Disagree Very Much
- ○ Disagree Slightly
- ○ Neutral
- ○ Agree Slightly
- ○ Agree Very Much
- ○ Totally Agree

I will not be able to tolerate my intrusions/memories about the negative experience, and I will fall apart

- ○ Totally Disagree
- ○ Disagree Very Much
- ○ Disagree Slightly
- ○ Neutral
- ○ Agree Slightly
- ○ Agree Very Much
- ○ Totally Agree

Below you will find a list of statements. Please rate how true each statement is for you by selecting the most appropriate response.

My painful experiences and memories make it difficult for me to live a life that I would value.

- ○ Never true
- ○ Very seldom true
- ○ Seldom true
- ○ Sometimes true
- ○ Frequently true
- ○ Almost always true
- ○ Always true

I'm afraid of my feelings.

- ○ Never true
- ○ Very seldom true
- ○ Seldom true
- ○ Sometimes true
- ○ Frequently true
- ○ Almost always true
- ○ Always true

I worry about not being able to control my worries and feelings.

- ○ Never true
- ○ Very seldom true
- ○ Seldom true
- ○ Sometimes true
- ○ Frequently true
- ○ Almost always true
- ○ Always true

My painful memories prevent me from having a fulfilling life.

- ○ Never true
- ○ Very seldom true
- ○ Seldom true
- ○ Sometimes true
- ○ Frequently true
- ○ Almost always true
- ○ Always true

Emotions cause problems in my life.

- ○ Never true
- ○ Very seldom true
- ○ Seldom true
- ○ Sometimes true
- ○ Frequently true
- ○ Almost always true
- ○ Always true

It seems like most people are handling their lives better than I am.

- ○ Never true
- ○ Very seldom true
- ○ Seldom true
- ○ Sometimes true
- ○ Frequently true
- ○ Almost always true
- ○ Always true

Worries get in the way of my success.

- ○ Never true
- ○ Very seldom true
- ○ Seldom true
- ○ Sometimes true
- ○ Frequently true
- ○ Almost always true
- ○ Always true

This survey is about thoughts. There are no right or wrong answers, so please respond honestly to each of the items below. Be sure to answer every item by selecting the most appropriate response.

There are things I prefer not to think about.

- Strongly disagree
- Disagree
- Neutral or don't know
- Agree
- Strongly agree

Sometimes I wonder why I have the thoughts I do.

- Strongly disagree
- Disagree
- Neutral or don't know
- Agree
- Strongly agree

I have thoughts that I cannot stop.

- Strongly disagree
- Disagree
- Neutral or don't know
- Agree
- Strongly agree

There are images that come to mind that I cannot erase.

- Strongly disagree
- Disagree
- Neutral or don't know
- Agree
- Strongly agree

My thoughts frequently return to one idea.

- ○ Strongly disagree
- ○ Disagree
- ○ Neutral or don't know
- ○ Agree
- ○ Strongly agree

I wish I could stop thinking of certain things.

- ○ Strongly disagree
- ○ Disagree
- ○ Neutral or don't know
- ○ Agree
- ○ Strongly agree

Sometimes my mind races so fast I wish I could stop it.

- ○ Strongly disagree
- ○ Disagree
- ○ Neutral or don't know
- ○ Agree
- ○ Strongly agree

I always try to put problems out of my mind.

- ○ Strongly disagree
- ○ Disagree
- ○ Neutral or don't know
- ○ Agree
- ○ Strongly agree

There are thoughts that keep jumping into my head.

- ○ Strongly disagree
- ○ Disagree
- ○ Neutral or don't know
- ○ Agree
- ○ Strongly agree

There are things that I try not to think about.

- ○ Strongly disagree
- ○ Disagree
- ○ Neutral or don't know
- ○ Agree
- ○ Strongly agree

Sometimes I really wish I could stop thinking.

- ○ Strongly disagree
- ○ Disagree
- ○ Neutral or don't know
- ○ Agree
- ○ Strongly agree

I often do things to distract myself from my thoughts.

- ○ Strongly disagree
- ○ Disagree
- ○ Neutral or don't know
- ○ Agree
- ○ Strongly agree

I have thoughts that I try to avoid.

- ○ Strongly disagree
- ○ Disagree
- ○ Neutral or don't know
- ○ Agree
- ○ Strongly agree

There are many thoughts that I have that I don't tell anyone.

- ○ Strongly disagree
- ○ Disagree
- ○ Neutral or don't know
- ○ Agree
- ○ Strongly agree

Sometimes I stay busy just to keep thoughts from intruding on my mind.

- ○ Strongly disagree
- ○ Disagree
- ○ Neutral or don't know
- ○ Agree
- ○ Strongly agree

How true are each of these statements, with respect to the negative experience you discussed with the researcher, when you are distressed or upset?

	Not at all true		Somewhat true		Very True
I have thoughts or images about all my shortcomings, failings, faults, mistakes.	○	○	○	○	○
I have thoughts or images about the experience that come into my head even when I do not wish to think about them again	○	○	○	○	○
I have thoughts or images that "I won't be able to do my job/work because I feel so badly."	○	○	○	○	○
I have thoughts or images of the experience that are difficult to forget.	○	○	○	○	○
Once I start thinking about the experience, I can't stop.	○	○	○	○	○
I notice that I think about the experience.	○	○	○	○	○
I have thoughts or images of the experience that I try to resist thinking about.	○	○	○	○	○
I think about the experience all the time.	○	○	○	○	○
I know I shouldn't think about the experience, but can't help it.	○	○	○	○	○
I have thoughts or images about the experience and wish it would go better.	○	○	○	○	○

We thank you for your time spent taking this survey.

Your response has been recorded.

Appendix A2: Study 1a and 1b ESM Survey

This is the daily diary for the thought monitoring study.

Please insert your ID

_____

Just now, before you began the survey, were you thinking about your negative experience?

- ○ Yes, and I was aware of these thoughts/images before this question
- ○ Yes, but I did not realize until I saw this question
- ○ Yes, but only because I was sent the link to this survey
- ○ No, I was thinking about other things

Please read each statement carefully and indicate how much the state applies to you **at this present time**

	Does not apply to me at all	Applies to me to some degree	Applies to me to a considerable degree	Applies to me very much
I feel down-hearted and blue	○	○	○	○
I feel that I have nothing to look forward to	○	○	○	○
I am unable to become enthusiastic about anything	○	○	○	○

How true are each of these statements, with respect to your negative experience, when you are distressed or upset?

	Not at all true		Somewhat true		Very true
I know I shouldn't think about the experience, but can't help it.	○	○	○	○	○
Once I started thinking about the experience, I couldn't stop.	○	○	○	○	○
I have thoughts or images of the experience that are difficult to forget.	○	○	○	○	○

Rate how happy you feel at the moment
(0-Not at all happy to 10-Extremely happy)

- ○ 0- Not at all happy
- ○ 1
- ○ 2
- ○ 3
- ○ 4
- ○ 5
- ○ 6
- ○ 7
- ○ 8
- ○ 9
- ○ 10- Extremely happy

Rate how sad you feel at the moment
(0-Not at all sad to 10-Extremely sad)

- ○ 0- Not at all sad
- ○ 1
- ○ 2
- ○ 3
- ○ 4
- ○ 5
- ○ 6
- ○ 7
- ○ 8
- ○ 9
- ○ 10- Extremely sad

Rate how anxious you feel at the moment
(0-Not at all anxious to 10-Extremely anxious)

- ○ 0- Not at all anxious
- ○ 1
- ○ 2

- ○ 3
- ○ 4
- ○ 5
- ○ 6
- ○ 7
- ○ 8
- ○ 9
- ○ 10- Extremely anxious

As best as you can remember, how many times have you had an intrusion of your negative experience **today?** *(Remember, an intrusion is an unwanted memory/thought/image, **NOT** a deliberate thinking about the event).*

- ○ 0
- ○ 1
- ○ 2
- ○ 3
- ○ 4
- ○ 5
- ○ 6
- ○ 7
- ○ 8
- ○ 9
- ○ 10
- ○ 10+

As best as you can remember, how many times have you had an intrusion of your recent negative experience **since the last survey?** *(Remember, an intrusion is an unwanted memory/thought/image, **NOT** a deliberate thinking about the event).*

- ○ 0
- ○ 1
- ○ 2
- ○ 3
- ○ 4

- ○ 5
- ○ 6
- ○ 7
- ○ 8
- ○ 9
- ○ 10
- ○ 10+

If you <u>had</u> experienced an intrusion since the last survey, how distressing do you think it would have been*?*
(0-Not at all distressing to 10- Extremely distressing)

- ○ 0- Not at all distressing
- ○ 1
- ○ 2
- ○ 3
- ○ 4
- ○ 5
- ○ 6
- ○ 7
- ○ 8
- ○ 9
- ○ 10- Extremely distressing

How distressing was the worst intrusion*?*
(0-Not at all distressing to 10- Extremely distressing)

- ○ 0- Not at all distressing
- ○ 1
- ○ 2
- ○ 3
- ○ 4
- ○ 5
- ○ 6
- ○ 7

- ○ 8
- ○ 9
- ○ 10- Extremely distressing

What was the AVERAGE level of distress associated with all other intrusions?
(0- Not at all distressing to 10- Extremely distressing)

- ○ 0- Not at all distressing
- ○ 1
- ○ 2
- ○ 3
- ○ 4
- ○ 5
- ○ 6
- ○ 7
- ○ 8
- ○ 9
- ○ 10- Extremely distressing
- ○ NA- No other intrusions

What triggered the worst intrusion? *(Tick all that apply)*

- ☐ Perceptual (visual, smell, taste etc), similar situation, stimulus or person
- ☐ Physiological (e.g. heart racing was a reminder)
- ☐ Actual trauma scene
- ☐ Newspaper or TV reports
- ☐ Trauma- related conversations
- ☐ Trauma-related thoughts
- ☐ Study-related cues (other than text reminder, see below)
- ☐ Diary scheduled reminder
- ☐ Other _____
- ☐ No triggers perceived

Where were you when you experienced your worst intrusion?

- ○ Home
- ○ Someone else's home
- ○ Work
- ○ In a public Space (e.g. on the street/ in a shop)
- ○ In an educational setting (e.g. School, university, TAFE class)
- ○ Other _____

Were you with anyone when you experienced your worst intrusion?

- ☐ I was alone
- ☐ Partner/significant other
- ☐ Family member(s)
- ☐ Friend(s)
- ☐ Co-worker(s) or Classmate(s)
- ☐ Acquaintance(s)
- ☐ Stranger(s)

Were these people with you in person or online?

- ○ In person
- ○ Online
- ○ Both in person and online

What form did the intrusion(s) take?

- ○ Thoughts only
- ○ Images only
- ○ Both thoughts and images

For each of these responses rate how much you used them in response to your most recent significant intrusion

(0 = Not at all, 10 = Extreme)

	0	1	2	3	4	5	6	7	8	9	10
Suppression (tried not to think about it)	○	○	○	○	○	○	○	○	○	○	○
Thought substitution (specifically thought of something else)	○	○	○	○	○	○	○	○	○	○	○
Distraction (did something or tried to think of other things to distract myself)	○	○	○	○	○	○	○	○	○	○	○
Rumination (thought over and over about it)	○	○	○	○	○	○	○	○	○	○	○
Other	○	○	○	○	○	○	○	○	○	○	○

What is the likelihood that your most feared negative prediction about your intrusion(s) will come true? We are not asking about fearing the experience will happen again, but what might be worried about in relation to these intrusions (e.g., a fear you will get so upset from the intrusion that you can't calm down). Please answer even if you haven't had an intrusion so far today.

(0% = Not at all likely, 100% = Extremely likely)

- ○ 100%
- ○ 90%
- ○ 80%
- ○ 70%
- ○ 60%
- ○ 50%
- ○ 40%
- ○ 30%
- ○ 20%
- ○ 10%
- ○ 0%

Please read the next six statements carefully and tell us how much you **AGREE or DISAGREE** with each statement regarding what your worst intrusive memory means to you **RIGHT NOW.**
(Please answer even if you haven't had an intrusion so far today)

I have a psychological problem

- ○ Totally disagree
- ○ Disagree very much
- ○ Disagree slightly
- ○ Neutral
- ○ Agree slightly
- ○ Agree very much
- ○ Totally agree

My intrusion/memory shows that I am a lousy coper

- ○ Totally disagree
- ○ Disagree very much
- ○ Disagree slightly
- ○ Neutral
- ○ Agree slightly
- ○ Agree very much
- ○ Totally agree

I will not be able to tolerate my intrusion/memory about the experience**, and I will fall apart**

- ○ Totally disagree
- ○ Disagree very much
- ○ Disagree slightly
- ○ Neutral
- ○ Agree slightly
- ○ Agree very much
- ○ Totally agree

These painful experiences and memories make it difficult for me to live a life that I value

- ○ Never true
- ○ Very seldom true

- ○ Seldom true
- ○ Sometimes true
- ○ Frequently true
- ○ Almost always true
- ○ Always true

I'm afraid of my feelings about this intrusion

- ○ Never true
- ○ Very seldom true
- ○ Seldom true
- ○ Sometimes true
- ○ Frequently true
- ○ Almost always true
- ○ Always true

The emotions from the intrusion are causing problems for me

- ○ Never true
- ○ Very seldom true
- ○ Seldom true
- ○ Sometimes true
- ○ Frequently true
- ○ Almost always true
- ○ Always true

Please read the next four statements carefully and indicate the degree they occurred to you over the last 24 hours

Did you have an argument or disagreement with anyone?

- ○ Not at all
- ○ A little
- ○ Somewhat
- ○ Very

Did anything else happen that you could have argued or disagreed about, but you decided to let it pass?

- ○ Not at all
- ○ A little
- ○ Somewhat
- ○ Very

Did anything happen to a close friend or relative that turned out to be stressful for you?

- ○ Not at all
- ○ A little
- ○ Somewhat
- ○ Very

Did anything stressful happen regarding your personal health?

- ○ Not at all
- ○ A little
- ○ Somewhat
- ○ Very

Did anything else happen that most people would consider stressful?

- ○ Not at all
- ○ A little
- ○ Somewhat
- ○ Very

Please rate how accurately you have rated your intrusions today *(e.g. taking care with your responses, answering questions soon after receiving the text etc.)*

- ○ Extremely accurately
- ○ Very accurately
- ○ Moderately accurately
- ○ Slightly accurately
- ○ Not accurately at all

End of Day

Thank you for completing this questionnaire. You will receive an SMS with your next questionnaire tomorrow morning at 9 am.

End of Testing

Thank you for completing this phase of the study. You will soon receive an SMS with the final questionnaire. Please remember to attend your scheduled debriefing session.

Thank you for completing this questionnaire. You will receive an SMS with your next questionnaire in 4 hours.

Appendix A3: Study 2 Online Intervention

An Online Diary Study for Understanding Unwanted Memories

Online intervention resource

Welcome to the understanding unwanted memory learning resource!

This online material is designed to teach you about some common thoughts and behaviours after potentially negative or traumatic experiences and some ways to manage them. It should take approximately 30 minutes to complete and is intended to be done in one sitting. Please take the time to read the information and complete the exercises.

If you find you are having difficulty completing this module, begin to feel distressed, or have any questions, please contact the research team via email (Alexandra.canty@flinders.edu.au). You can also contact lifeline 24/7 via 13 11 14 and www.lifeline.org.au for support.

A message will inform you when you reach the end of the lesson and will also let the research team know to organise your online diary links.

Intrusive Thoughts After Traumatic Experiences

What is an intrusive or unwanted memory?

Everyone has unwanted memories from time to time. But most often they occur after you've seen or experienced something stressful or traumatic. The memories are called *intrusive* because they intrude into your mind without you trying to think of them. They can be emotional and distressing and disrupt whatever you are doing at the time. They are also difficult to forget or ignore. This is a common experience for people who have had a potentially traumatic experience and does not necessarily mean there is a problem.

Intrusive memories can have different forms when they spontaneously pop into your mind, such as:

- Seeing images or hearing sounds of the experience
- Experiencing thoughts related to the experience
- Having bodily reactions like you did at the time
- Experiencing feelings or emotions associated with the experience
- Nightmares or unpleasant dreams related to the experience

Why do memories become intrusive?

Stressful incidents can become intrusive when your brain has not completely processed the memory and if there is some overlap with sensory cues in your life. For example, perhaps you saw a road traffic accident and the woman driving looked like your sister. When you next see your sister, she may trigger the memory of the woman and accident. Or perhaps you hear a loud bang and it reminds your brain of the sound of the accident and brings it to mind. The link between the stressful event in the past and similarities in the present, however subtle, may mean that the memory is more likely to unexpectedly come to mind.

Triggers usually have some similarity to the memory they bring to mind, have a go at matching the triggers (on the left) below to the memories they might bring up (on the right)

Items
A loud bang
The smell of hospital cleaning products
Seeing broken glass
Seeing a picture of your grandparents
Medical equipment beeping
Crossing a busy road

Witnessing a car crash
A loud bang
Seeing broken glass
Crossing a busy road

Visiting a grandparent in hospital
The smell of hospital cleaning products
Seeing a picture of your grandparents
Medical equipment beeping

Well done! These are just some examples of triggers that might lead to an unwanted memory of a stressful event.

How we manage intrusive thoughts: Avoidance

Intrusive thoughts and memories about these experiences can be unpleasant and bring on strong emotions. It is common for people to want to avoid these thoughts and feelings.

One way people may try to avoid thoughts of their experience is through suppression, where they actively try to push thoughts from their mind.

Suppressing Your Memories: Helpful Or Unhelpful?

Is suppression a good way to get rid of your unwanted memories? Let's find out. Have a go with the exercise below.

Take a moment to watch this video (1 min) and then answer the questions below.

https://youtu.be/1vBHlKO-FXI

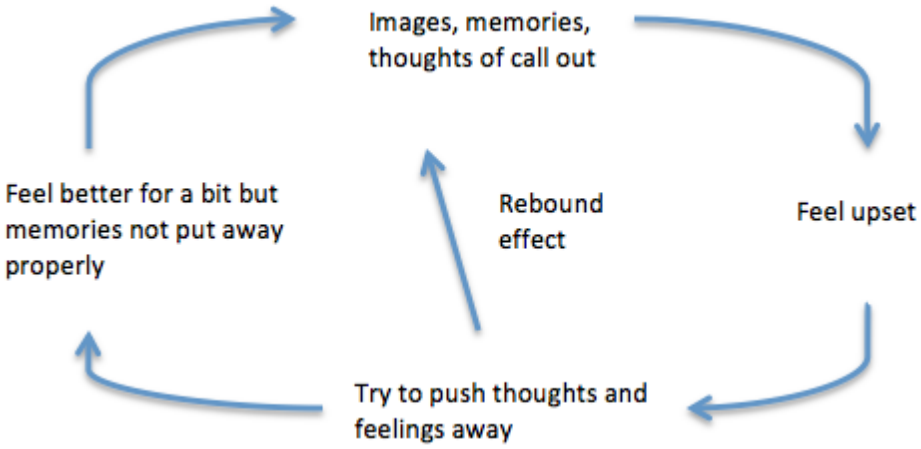
Now take a second, be honest, and write down exactly what popped into your head when you tried very hard not to think about 'that thing':

What does this tell you about what happens when you try hard to push something out of your head?

- It is difficult
- It comes back stronger
- It is not effective

Good work!

There are several common strategies people may use to avoid having some thoughts and feelings. Thought suppression like you just tried is one example, but thought substitution and distraction are similar strategies where people try to think of other things to avoid thoughts of their experience. In the exercise just now you probably found that the image of that thing popped back into your head when you tried to push it away. Psychologists call this **the rebound effect.** Research shows the more people try to avoid thinking about something, the more it pops up over time.



People may also engage in <u>behaviours</u> to avoid thoughts and feelings about negative experiences, such as not going to certain places or events to avoid reminders of the event and using substances to make themselves feel calmer.
Research has shown us that efforts to avoid thinking about or feeling emotions related to potentially traumatic events are not helpful long term. Sometimes they may reduce stress in the moment, but continued avoidance reinforces negative aspects of the experience, makes people more sensitive to intrusive thoughts, and makes them last longer.
So, what can you do instead?

Dealing with Unwanted Memories Linked to Triggers:

<u>Then vs Now</u>

Then vs Now is a strategy that helps us to focus on the differences between the triggers in the present and past events. Focusing on the differences helps to break the link between the present and the past, helping unpleasant memories to become less frequent and less distressing.
The following video has been used to explain Then vs Now to emergency responders, where a turn out refers to a job they have attended in the past. Take a moment to watch the video to understand the steps:

https://youtu.be/JZ2fYIrjDec

<u>Then vs Now for unwanted memories - 3 Steps</u>

1. The first is to **SPOT THE TRIGGER**. What is it that has brought back memories of the stressful event? The trigger may be a similar location, or a certain smell or sound.
2. NOTICE how the trigger is similar to your stressful experience. Perhaps you experienced a fire then and you can smell something burning in the distance now, or you see a car now that is similar to the one you saw crash then. Notice the link between the trigger in the present and your past experience.

3. Then, importantly, notice how the trigger in the present is **DIFFERENT** to the experience you had. For example, perhaps the car is the same colour but it is newer and is driving perfectly well. Focus on what is different about the trigger and try to identify all of the differences in where you are, what time it is, what you can see and hear, even in yourself as a person. If the trigger is a sound or smell, focus on how the environment you are in **TODAY** is different to the past experience. Perhaps it is a different time of day, perhaps the smell is different - more the smell of a BBQ rather than the smell of trees burning.
Remind yourself that if someone did suffer in the past event, they are no longer suffering now. You have the freedom to spot what is happening ***now*** and how this is different to the past event ***then***.

Your turn!

Practice Then Vs Now with Sarah:

On her way to work Sarah sees a car accident and helps the two men involved. When she gets home that evening, she watches a show with her family where a car accident occurs and experiences intrusive images of the real accident she saw.

What was the trigger for Sarah's intrusive memory?

- ☐ She finished work
- ☐ The car crash on TV
- ☐ Seeing her family
- ☐ The smell of popcorn

The most likely trigger is that Sarah saw the car crash on the TV show, as it has similarities to her experience. The accident she witnessed did not involve her family or a similar family, it was not directly related to her work, and there was no popcorn at the accident.

Look at the pictures above and list three things Sarah could notice that are different between the car accident THEN and her situation NOW to help her put her memory into context:

_____

Great work!

There are lots of differences Sarah could notice: that she is in a different place – at home not on the street, that she is with different people – her family rather than the two men, that it is a different time of day – the evening rather than the morning, that she can smell different things – pop corn rather than petrol, and much more.

In these situations it can help to notice a range of differences in what we can see, smell, hear, feel, taste as well as differences in the circumstances (e.g. time of day, weather) and even ourselves (e.g. you are safe now, are older etc.)

How we manage intrusive thoughts: Rumination

While some people may avoid thoughts about their traumatic experience, some people may repeatedly think about aspects of the experience in an effort to 'make sense' of it or think about how it could have gone differently.

Memories of incidents can come to mind when we question what we did at the time. We may go over and over the decisions we made, why it happened, how things would be if the event had not happened. Or, we may go over our actions at the time. Did we do the right thing? Did we handle it well?

When we spend a lot of time repeatedly going over questions like this it is called **rumination**; it is an **unhelpful** way to think and can keep the memory in our mind for longer than we would like.

What is helpful and unhelpful thinking?

Helpful thinking in response to problems takes into account specific details like what, when, where and how a situation happened.

Helpful thinking focuses on practical questions like: How can I move forward? How can I break this down into smaller steps? What is the first step I can take?

Helpful thinking includes flexible or balanced thoughts rather than extreme ones.

For example, when we are thinking about day-to-day troubles, like not doing well in a test or missing a train, thinking becomes **helpful** when thoughts are **flexible** rather than extreme. Examples of flexible thoughts would be, "I*'ve done everything I can to prepare for the test. It may work out, but if it doesn't, I know I have done the best I can*" and "*Sometimes the train is late, but mostly it's on time*". Flexible thinking is linked to happier moods.

Unhelpful thinking can be extreme all-or-nothing thoughts or focuses on trying to find the meaning and explanation for events. It includes questions like: Why did this happen? Why me? What does this mean about me? What if it had not happened?

Thoughts like "*I will never pass the test*" or "*Why is the train is always late when I need it?*" are examples of unhelpful extreme thoughts, also called all-or-nothing, or black-and-white thinking. Thinking in extremes has been linked to depression and anxiety.

When we continuously think over and over about one thing, such as a traumatic experience or our reaction to it, we are likely ruminating, which is an unhelpful style of thinking.

Research has demonstrated that rumination focusing on *'Why did this happen? Why me? What does this mean about me?'* predicted more severe mental health concerns following trauma exposure.

How do I know if I am ruminating?

Ruminating often starts with ‘why?’ or ‘What if..”. These questions usually have no answers and do not help us solve problems.

Three questions to help you spot rumination:

1. Is this question answerable?
2. Do my thoughts lead to a plan or action?
3. Have I been worrying on this for more than 30 minutes?

If you are repeatedly asking yourself unanswerable questions like *‘why did this happen to me?’* for more than 30 minutes, chances are you are ruminating. Ruminating is an unproductive pattern of thinking that leads to no plan, action, or solution.

Even though it may sound like the opposite to avoidance, rumination prevents us from forming accurate perspectives of the traumatic experience and our reaction. Like trying to avoid these thoughts and feelings, ruminating on them excessively has also been linked to longer and more severe negative reactions after trauma.

Your turn!

Identify which of the following scenarios describes rumination.

- Jeremiah spends one hour planning an upcoming trip and booking flights
- Sophia has been lying awake at night thinking about why she is so unlucky
- Rachel writes a list of her jobs for the next day
- Mark spent his whole workout thinking about what he should have done differently today

(Incorrect responses will not allow participants to progress until correct items are selected, feedback provided: While all of the people in our examples are thinking, the most important part is what they are thinking about and how. Two people here are making practical plans and the other two are ruminating on questions they won't be able to properly answer.)

(Correct Response: Correct! Jeremiah and Rachel are taking practical approaches and thinking about how they are going to do things. Sophia and Mark are ruminating on questions they can’t really answer and not coming up with any solutions to their problems)

Dealing With Intrusive Memories I’m Deliberately Going Over

After a difficult event, it is common for people to think about how they could have prevented it or what they could have done differently. In hindsight (looking back with what we know now), there may be things that you wished you had done or said. But it’s important to remember that we can’t see into the future, even if you think something ‘should’ have been different there is no way to guarantee that would have helped. Blaming ourselves for things we could not have known at the time is not fair. At any given moment, we can only act on what we know and believe right then.

Unpleasant events can be:

Overwhelming → We can’t think clearly, are very afraid, or in shock. So, we can’t do much to improve the situation.

Sudden and unpredictable → So we don’t have much time to think about a plan of action.

So, what can you do if you notice you are ruminating?

You can re-frame the way you think to take unhelpful thoughts and make them helpful!

- Ask yourself if you are being fair, would you say these things to a close friend if they had your experience?
- Make an effort to ask ‘how’ questions such as ‘how can I move forwards from this?’ and ‘what is the next best step?’ rather than ‘why’ questions
- Try to be flexible in the way you think, take out words like ‘always’ and ‘never’ and focus on the parts you can control

You can also use Then vs Now to help to break the link between the present and the past for experiences that you're repeatedly thinking about or ruminating on. For these memories, Then vs Now has 3 different steps.

Then vs Now for Unwanted Memories I'm Deliberately Thinking About: The 3 Steps

1. The first is a **REMINDER.** Remind yourself that these memories that happened in the PAST and cannot hurt you or change. Also, **remind yourself of what you knew at the time.**

2. Then **FOCUS** on what is happening **NOW**, starting with the things you can SEE and HEAR. For example; Where are you? What can you see now? What can you hear? – Then try thinking **HOW**; How can you move on from these thoughts? How can you help your situation now?

3. The final step is the **MOVE and DO**. Move around the room. Focus on the fact that you have the freedom to move anywhere, and do anything now. Follow the answers to your how questions and **DO** what will help you.

It is important to realise that our memories and thoughts do not indicate current danger or suffering. They are MEMORIES. They occurred in a different context to the one you are in now. Where you are and what is happening in your life NOW today is different to what happened in the incident in the past THEN. The main point of THEN vs NOW for both types of memories is to focus on what is **different** and what is going on **NOW**.

Key Points

- Intrusive memories are common and can be upsetting, but they are memories from the past that can't hurt you
- Avoiding thoughts or reminders of traumatic experiences is not a helpful strategy, avoidance often makes intrusive memories and negative feelings stay around longer
- You can use THEN Vs NOW to help break the link between you triggers in the present that bring your memories from the past to mind. Focus on how NOW is different to THEN
- Ruminating is unhelpful overthinking and involves lots of 'why' and 'what if' questions with no good answer
- You can re-frame your thinking from unhelpful to helpful by asking 'how' questions and reminding yourself to be flexible and fair to yourself

You have now completed the Understanding Unwanted Memory study intervention.

Great job!

The research team will organise your automatic diary links to begin on the next possible morning which, may be tomorrow or the next day, and will email you the details. Remember these links are sent each day at 9am, 1pm, 5pm, and 9pm – it is best if you can complete them as close to those times as possible!

We thank you for your time and efforts in participation so far. If you have any questions or concerns feel free to reach out to the research team (Alexandra.canty@flinders.edu.au).

Appendix A4: Study 2 ESM Survey

This is the online diary for the trauma intervention study.

Please insert your ID

_____

Did you receive the online intervention?

- ○ Yes
- ○ No

Please read each statement carefully and indicate how much the state applies to you **at this present time**

	Does not apply to me at all	Applies to me to some degree	Applies to me to a considerable degree	Applies to me very much
I feel down-hearted and blue	○	○	○	○
I feel that I have nothing to look forward to	○	○	○	○
I am unable to become enthusiastic about anything	○	○	○	○

How true are each of these statements, with respect to your negative experience, when you are distressed or upset?

	Not at all true		Somewhat true		Very true
I know I shouldn't think about the experience, but can't help it.	○	○	○	○	○
Once I started thinking about the experience, I couldn't stop.	○	○	○	○	○
I have thoughts or images of the experience that are difficult to forget.	○	○	○	○	○

Rate how happy you feel at the moment
(0-Not at all happy to 10-Extremely happy)

- ○ 0- Not at all happy
- ○ 1
- ○ 2
- ○ 3
- ○ 4
- ○ 5
- ○ 6
- ○ 7
- ○ 8
- ○ 9
- ○ 10- Extremely happy

Rate how sad you feel at the moment
(0-Not at all sad to 10-Extremely sad)

- ○ 0- Not at all sad
- ○ 1
- ○ 2
- ○ 3
- ○ 4
- ○ 5
- ○ 6
- ○ 7
- ○ 8
- ○ 9
- ○ 10- Extremely sad

Rate how anxious you feel at the moment
(0-Not at all anxious to 10-Extremely anxious)

- ○ 0- Not at all anxious
- ○ 1
- ○ 2

- ○ 3
- ○ 4
- ○ 5
- ○ 6
- ○ 7
- ○ 8
- ○ 9
- ○ 10- Extremely anxious

As best as you can remember, how many times have you had an intrusion of your negative experience **today?** *(Remember, an intrusion is an unwanted memory/thought/image, **NOT** a deliberate thinking about the event).*

- ○ 0
- ○ 1
- ○ 2
- ○ 3
- ○ 4
- ○ 5
- ○ 6
- ○ 7
- ○ 8
- ○ 9
- ○ 10
- ○ 10+

As best as you can remember, how many times have you had an intrusion of your recent negative experience **since the last survey?** *(Remember, an intrusion is an unwanted memory/thought/image, **NOT** a deliberate thinking about the event).*

- ○ 0
- ○ 1
- ○ 2
- ○ 3
- ○ 4

- 5
- 6
- 7
- 8
- 9
- 10
- 10+

If you had experienced an intrusion since the last survey, how distressing do you think it would have been*?*
(0-Not at all distressing to 10- Extremely distressing)

- 0- Not at all distressing
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10- Extremely distressing

How distressing was the worst intrusion*?*
(0-Not at all distressing to 10- Extremely distressing)

- 0- Not at all distressing
- 1
- 2
- 3
- 4
- 5
- 6
- 7

- ○ 8
- ○ 9
- ○ 10- Extremely distressing

What was the AVERAGE level of distress associated with all other intrusions?
(0- Not at all distressing to 10- Extremely distressing)

- ○ 0- Not at all distressing
- ○ 1
- ○ 2
- ○ 3
- ○ 4
- ○ 5
- ○ 6
- ○ 7
- ○ 8
- ○ 9
- ○ 10- Extremely distressing
- ○ NA- No other intrusions

What triggered the worst intrusion? *(Tick all that apply)*

- ☐ Perceptual (visual, smell, taste etc), similar situation, stimulus or person
- ☐ Physiological (e.g. heart racing was a reminder)
- ☐ Actual trauma scene
- ☐ Newspaper or TV reports
- ☐ Trauma- related conversations
- ☐ Trauma-related thoughts
- ☐ Study-related cues (other than text reminder, see below)
- ☐ Diary scheduled reminder
- ☐ Other _____
- ☐ No triggers perceived

Where were you when you experienced your worst intrusion?

- ○ Home
- ○ Someone else's home
- ○ Work
- ○ In a public Space (e.g. on the street/ in a shop)
- ○ In an educational setting (e.g. School, university, TAFE class)
- ○ Other _____

What form did the intrusion(s) take?

- ○ Thoughts only
- ○ Images only
- ○ Both thoughts and images

Administered to Intervention Group Participants Only

How much have you used the information and strategies from the online intervention since the last survey? *(Where 0 = Not at all and 10 = Very much)*

	0	1	2	3	4	5	6	7	8	9	10
I thought about the information											
I used the strategies											

Since the last survey, how much did you find the information and strategies from the intervention: *(Where 0 = Not at all and 10 = Very Much)*

	0	1	2	3	4	5	6	7	8	9	10
Helpful											
Practical											
Made you feel less distressed											

Administered to All

For each of these responses rate how much you used them in response to your most recent significant intrusion

(0 = Not at all, 10 = Extreme)

	0	1	2	3	4	5	6	7	8	9	10
Suppression (tried not to think about it)	○	○	○	○	○	○	○	○	○	○	○
Thought substitution (specifically thought of something else)	○	○	○	○	○	○	○	○	○	○	○
Distraction (did something or tried to think of other things to distract myself)	○	○	○	○	○	○	○	○	○	○	○
Rumination (thought over and over about it)	○	○	○	○	○	○	○	○	○	○	○
I avoided certain places or activities	○	○	○	○	○	○	○	○	○	○	○
I did or used something to make me feel calmer (e.g. alcohol, nicotine)	○	○	○	○	○	○	○	○	○	○	○

Please read the next six statements carefully and tell us how much you **AGREE or DISAGREE** with each statement regarding what your worst intrusive memory means to you **RIGHT NOW.**
(Please answer even if you haven't had an intrusion so far today)

I have a psychological problem

- ○ Totally disagree
- ○ Disagree very much
- ○ Disagree slightly
- ○ Neutral
- ○ Agree slightly
- ○ Agree very much
- ○ Totally agree

My intrusion/memory shows that I am a lousy coper

- ○ Totally disagree
- ○ Disagree very much
- ○ Disagree slightly
- ○ Neutral
- ○ Agree slightly
- ○ Agree very much
- ○ Totally agree

I will not be able to tolerate my intrusion/memory about the experience, and I will fall apart

- ○ Totally disagree
- ○ Disagree very much
- ○ Disagree slightly
- ○ Neutral
- ○ Agree slightly
- ○ Agree very much
- ○ Totally agree

These painful experiences and memories make it difficult for me to live a life that I value

- Never true
- Very seldom true
- Seldom true
- Sometimes true
- Frequently true
- Almost always true
- Always true

I'm afraid of my feelings about this intrusion

- Never true
- Very seldom true
- Seldom true
- Sometimes true
- Frequently true
- Almost always true
- Always true

The emotions from the intrusion are causing problems for me

- Never true
- Very seldom true
- Seldom true
- Sometimes true
- Frequently true
- Almost always true
- Always true

Please read the next four statements carefully and indicate the degree they occurred to you over the last 24 hours

Did you have an argument or disagreement with anyone?

- Not at all
- A little
- Somewhat

- ○ Very

Did anything else happen that you could have argued or disagreed about, but you decided to let it pass?

- ○ Not at all
- ○ A little
- ○ Somewhat
- ○ Very

Did anything happen to a close friend or relative that turned out to be stressful for you?

- ○ Not at all
- ○ A little
- ○ Somewhat
- ○ Very

Did anything stressful happen regarding your personal health?

- ○ Not at all
- ○ A little
- ○ Somewhat
- ○ Very

Did anything else happen that most people would consider stressful?

- ○ Not at all
- ○ A little
- ○ Somewhat
- ○ Very

Please rate how accurately you have rated your intrusions today *(e.g. taking care with your responses, answering questions soon after receiving the text etc.)*

- ○ Extremely accurately
- ○ Very accurately
- ○ Moderately accurately
- ○ Slightly accurately
- ○ Not accurately at all

Administered to Intervention Group Participants Only

Have you viewed or read any of the resources provided to you in the intervention today?

- ○ Yes
- ○ No

End of Day

Thank you for completing this questionnaire. You will receive an SMS with your next questionnaire tomorrow morning at 9 am.

End of Testing

Thank you for completing this phase of the study. You will soon receive an SMS with the final questionnaire. The research team will be in touch regarding the final survey and the completion of your participation.

Thank you for completing this questionnaire. You will receive an SMS with your next questionnaire in 4 hours.

Appendix A5: Study 2 Post-ESM Survey

These are the final sets of questions for the daily thought monitoring study.

Please insert your ID

_____

Did you receive the online intervention before completing the unwanted memory diaries?

- ○ Yes
- ○ No, I have not seen the online intervention

Administered to Intervention Group Only

Rank the elements of the online intervention in order from what you found most (*position 1*) to least (*position 4*) helpful:

_____ Then Vs Now for unwanted memories
_____ Then vs Now for ruminating thoughts
_____ Information about intrusive thoughts and the impact of thought suppression
_____ How to increase helpful/flexible thinking styles

How helpful did you find each element in the online intervention? *(Where 0 = Not at all and 10 = Very Much)*

	0 1 2 3 4 5 6 7 8 9 10
Then Vs Now for unwanted memories	
Then vs Now for ruminating thoughts	
Information about intrusive thoughts and the impact of thought suppression	
How to increase helpful/flexible thinking styles	

Keeping the negative experience you have referred to in this study in mind, read each of the problems and then indicate to the right how much you have been bothered by that problem **in the past 7 days.**

	Not at all	**A little bit**	**Moderately**	**Quite a bit**	**Extremely**
Repeated, disturbing, and unwanted memories of the stressful experience?	○	○	○	○	○
Repeated, disturbing dreams of the stressful experience?	○	○	○	○	○

Suddenly feeling or acting as if the stressful experience were actually happening again *(as if you were actually back there reliving it)?*	○	○	○	○	○
Feeling very upset when something reminded you of the stressful experience?	○	○	○	○	○
Having strong physical reactions when something reminded you of the stressful experience *(for example, heart pounding, trouble breathing, sweating)?*	○	○	○	○	○
Avoiding memories, thoughts, or feelings related to the stressful experience?	○	○	○	○	○
Avoiding external reminders of the stressful experience *(for example, people, places, conversations, activities, objects, or situations)?*	○	○	○	○	○
Trouble remembering important parts of the stressful experience?	○	○	○	○	○
Having strong negative beliefs about yourself, other people, or the world *(for example, having thoughts such as: I am bad, there is something seriously wrong with me, no one can be trusted, the world is completely dangerous)?*	○	○	○	○	○
Blaming yourself or someone else for the stressful experience or what happened after it?	○	○	○	○	○
Having strong negative feelings such as fear, horror, anger, guilt, or shame?	○	○	○	○	○
Loss of interest in activities that you used to enjoy?	○	○	○	○	○
Feeling distant or cut off from other people?	○	○	○	○	○

Trouble experiencing positive feelings *(for example, being unable to feel happiness or have loving feelings for people close to you)?*	○	○	○	○	○
Irritable behaviour, angry outbursts, or acting aggressively?	○	○	○	○	○
Taking too many risks or doing things that could cause you harm?	○	○	○	○	○
Being "superalert" or watchful or on guard?	○	○	○	○	○
Feeling jumpy or easily startled?	○	○	○	○	○
Having difficulty concentrating?	○	○	○	○	○
Trouble falling asleep or staying asleep?	○	○	○	○	○

How true is this of you **over the past 7 days?**

	Not at all	A little bit	Moderately	Quite a bit	Extremely
When I am upset, it takes me a long time to calm down	○	○	○	○	○
I feel numb or emotionally shut down	○	○	○	○	○
I feel like a failure	○	○	○	○	○
I feel worthless	○	○	○	○	○
I find it hard to stay emotionally close to people	○	○	○	○	○

Please read each statement and select the answer which indicates how much the statement applied to you **over the past 7 days.** There are no right or wrong answers. Do not spend too much time on any statement.

I found it hard to wind down.

- ○ Did not apply to me at all.
- ○ Applied to me to some degree, or some of the time.
- ○ Applied to me to a considerable degree, or a good part of the time.
- ○ Applied to me very much, or most of the time.

I was aware of dryness of my mouth.

- ○ Did not apply to me at all.
- ○ Applied to me to some degree, or some of the time.
- ○ Applied to me to a considerable degree, or a good part of the time.
- ○ Applied to me very much, or most of the time.

I couldn't seem to experience any positive feelings at all.

- ○ Did not apply to me at all.
- ○ Applied to me to some degree, or some of the time.
- ○ Applied to me to a considerable degree, or a good part of the time.
- ○ Applied to me very much, or most of the time.

I experienced breathing difficulty (e.g., excessively rapid breathing, breathlessness in the absence of physical exertion).

- ○ Did not apply to me at all.
- ○ Applied to me to some degree, or some of the time.
- ○ Applied to me to a considerable degree, or a good part of the time.
- ○ Applied to me very much, or most of the time.

I found it difficult to work up the initiative to do things.

- ○ Did not apply to me at all.
- ○ Applied to me to some degree, or some of the time.
- ○ Applied to me to a considerable degree, or a good part of the time.
- ○ Applied to me very much, or most of the time.

I tended to over-react to situations.

- ○ Did not apply to me at all.
- ○ Applied to me to some degree, or some of the time.
- ○ Applied to me to a considerable degree, or a good part of the time.
- ○ Applied to me very much, or most of the time.

I experienced trembling (e.g., in the hands).

- ○ Did not apply to me at all.
- ○ Applied to me to some degree, or some of the time.
- ○ Applied to me to a considerable degree, or a good part of the time.
- ○ Applied to me very much, or most of the time.

I felt that I was using a lot of nervous energy.

- ○ Did not apply to me at all.
- ○ Applied to me to some degree, or some of the time.
- ○ Applied to me to a considerable degree, or a good part of the time.
- ○ Applied to me very much, or most of the time.

I was worried about situations in which I might panic and make a fool of myself.

- ○ Did not apply to me at all.
- ○ Applied to me to some degree, or some of the time.
- ○ Applied to me to a considerable degree, or a good part of the time.
- ○ Applied to me very much, or most of the time.

I felt that I had nothing to look forward to.

- ○ Did not apply to me at all.
- ○ Applied to me to some degree, or some of the time.
- ○ Applied to me to a considerable degree, or a good part of the time.
- ○ Applied to me very much, or most of the time.

I found myself getting agitated.

- ○ Did not apply to me at all.
- ○ Applied to me to some degree, or some of the time.
- ○ Applied to me to a considerable degree, or a good part of the time.
- ○ Applied to me very much, or most of the time.

I found it difficult to relax.

- ○ Did not apply to me at all.
- ○ Applied to me to some degree, or some of the time.
- ○ Applied to me to a considerable degree, or a good part of the time.
- ○ Applied to me very much, or most of the time.

I felt down-hearted and blue.

- ○ Did not apply to me at all.
- ○ Applied to me to some degree, or some of the time.
- ○ Applied to me to a considerable degree, or a good part of the time.
- ○ Applied to me very much, or most of the time.

I was intolerant of anything that kept me from getting on with what I was doing.

- ○ Did not apply to me at all.
- ○ Applied to me to some degree, or some of the time.
- ○ Applied to me to a considerable degree, or a good part of the time.
- ○ Applied to me very much, or most of the time.

I felt I was close to panic.

- ○ Did not apply to me at all.
- ○ Applied to me to some degree, or some of the time.
- ○ Applied to me to a considerable degree, or a good part of the time.
- ○ Applied to me very much, or most of the time.

I was unable to become enthusiastic about anything.

- ○ Did not apply to me at all.
- ○ Applied to me to some degree, or some of the time.
- ○ Applied to me to a considerable degree, or a good part of the time.
- ○ Applied to me very much, or most of the time.

I felt I wasn't worth much as a person.

- ○ Did not apply to me at all.
- ○ Applied to me to some degree, or some of the time.
- ○ Applied to me to a considerable degree, or a good part of the time.
- ○ Applied to me very much, or most of the time.

I felt that I was rather touchy.

- ○ Did not apply to me at all.
- ○ Applied to me to some degree, or some of the time.
- ○ Applied to me to a considerable degree, or a good part of the time.
- ○ Applied to me very much, or most of the time.

I was aware of the action of my heart in the absence of physical exertion (e.g., sense of heart rate increase, heart missing a beat).

- ○ Did not apply to me at all.
- ○ Applied to me to some degree, or some of the time.
- ○ Applied to me to a considerable degree, or a good part of the time.
- ○ Applied to me very much, or most of the time.

I felt scared without any good reason.

- ○ Did not apply to me at all.
- ○ Applied to me to some degree, or some of the time.
- ○ Applied to me to a considerable degree, or a good part of the time.
- ○ Applied to me very much, or most of the time.

I felt that life was meaningless.

- ○ Did not apply to me at all.
- ○ Applied to me to some degree, or some of the time.
- ○ Applied to me to a considerable degree, or a good part of the time.
- ○ Applied to me very much, or most of the time.

We are interested in the kind of thoughts which you may have had after the negative experience you have referred to in this study. Below are a number of statements that may or may not be representative of your thinking. Please read each statement carefully and tell us how much you AGREE or DISAGREE with each statement. People react to traumatic events in many different ways. There are no right or wrong answers to these statements.

	Totally Disagree	Disagree very much	Disagree slightly	Neutral	Agree Slightly	Agree Very Much	Totally Agree
The event happened because of the way I acted	○	○	○	○	○	○	○
People can't be trusted	○	○	○	○	○	○	○
Somebody else would not have gotten into this situation	○	○	○	○	○	○	○
I can't rely on other people	○	○	○	○	○	○	○
I have no future	○	○	○	○	○	○	○
People are not what they seem	○	○	○	○	○	○	○
There is something about me that made the event happen	○	○	○	○	○	○	○
I feel like I don't know myself	○	○	○	○	○	○	○

anymore Nothing good can happen to me anymore	○ ○ ○ ○ ○ ○ ○

Intrusions are unwanted thoughts about or memories of the negative or traumatic event that come to mind without you thinking of the event. Do you have any concerns about your **intrusive thoughts** (e.g., a fear you will get so upset from the intrusion that you can't calm down, the intrusion might interfere with what you are working on etc.). We are not asking about fearing the experience will happen again, but what you might be worried about in relation to these intrusions. *(Please type your answer below)*

_____

What is the likelihood that your concern about your intrusion will come true? Please answer even if you haven't had an intrusion today or recently. *(0% = Not all likely, 100% = Extremely likely)*

	0 10 20 30 40 50 60 70 80 90 100
I think my concern is ...% likely to happen	

Think about the negative experience you have referred to in this study. Please read each statement carefully and tell us how much you **AGREE or DISAGREE** with each statement regarding what any intrusive memory, thoughts or images from that event means to you.

My intrusions since the experience mean that something is wrong with me

- ○ Totally Disagree
- ○ Disagree Very Much
- ○ Disagree Slightly
- ○ Neutral
- ○ Agree Slightly
- ○ Agree Very Much
- ○ Totally Agree

If I think about the intrusions/memories, I will not be able to handle it

- ○ Totally Disagree
- ○ Disagree Very Much
- ○ Disagree Slightly
- ○ Neutral
- ○ Agree Slightly
- ○ Agree Very Much
- ○ Totally Agree

My intrusions since the negative experience mean that I am going crazy

- ○ Totally Disagree
- ○ Disagree Very Much
- ○ Disagree Slightly
- ○ Neutral
- ○ Agree Slightly
- ○ Agree Very Much
- ○ Totally Agree

My intrusions/memories since the negative experience make me feel inadequate

- ○ Totally Disagree
- ○ Disagree Very Much
- ○ Disagree Slightly
- ○ Neutral
- ○ Agree Slightly
- ○ Agree Very Much
- ○ Totally Agree

If I think about the intrusions/memories, I will not be able to control my emotions, and something terrible will happen

- ○ Totally Disagree
- ○ Disagree Very Much
- ○ Disagree Slightly
- ○ Neutral
- ○ Agree Slightly
- ○ Agree Very Much
- ○ Totally Agree

My intrusions/memories since the negative experience show that I have a psychological problem

- ○ Totally Disagree
- ○ Disagree Very Much
- ○ Disagree Slightly
- ○ Neutral
- ○ Agree Slightly
- ○ Agree Very Much
- ○ Totally Agree

My intrusions/memories since the negative experience show I am a lousy coper

- ○ Totally Disagree
- ○ Disagree Very Much
- ○ Disagree Slightly
- ○ Neutral
- ○ Agree Slightly
- ○ Agree Very Much
- ○ Totally Agree

If I think about the intrusions/memories, I will go out of my mind

- ○ Totally Disagree
- ○ Disagree Very Much
- ○ Disagree Slightly
- ○ Neutral

- ○ Agree Slightly
- ○ Agree Very Much
- ○ Totally Agree

I will not be able to tolerate my intrusions/memories about the negative experience, and I will fall apart

- ○ Totally Disagree
- ○ Disagree Very Much
- ○ Disagree Slightly
- ○ Neutral
- ○ Agree Slightly
- ○ Agree Very Much
- ○ Totally Agree

How true are each of these statements, with respect to the negative experience you have referred to in this study, when you are distressed or upset?

	Not at all true		Somewhat true		Very True
I have thoughts or images about all my shortcomings, failings, faults, mistakes.	○	○	○	○	○
I have thoughts or images about the experience that come into my head even when I do not wish to think about them again	○	○	○	○	○
I have thoughts or images that “I won’t be able to do my job/work because I feel so badly.”	○	○	○	○	○
I have thoughts or images of the experience that are difficult to forget.	○	○	○	○	○
Once I start thinking about the experience, I can’t stop.	○	○	○	○	○
I notice that I think about the experience.	○	○	○	○	○
I have thoughts or images of the experience that I try to resist thinking about.	○	○	○	○	○
I think about the experience all the time.	○	○	○	○	○

I know I shouldn't think about the experience, but can't help it.	○	○	○	○	○
I have thoughts or images about the experience and wish it would go better.	○	○	○	○	○

Has an additional negative/traumatic experience occurred in the last 7-days?

- ○ Yes
- ○ No

Briefly identify the recent experience and when it occurred (if you feel comfortable doing so):

_____

Thank you for taking the time to engage in this study and complete the final survey!
These responses will be compared to your first survey to show us how your thoughts and feelings may have changed throughout the study.

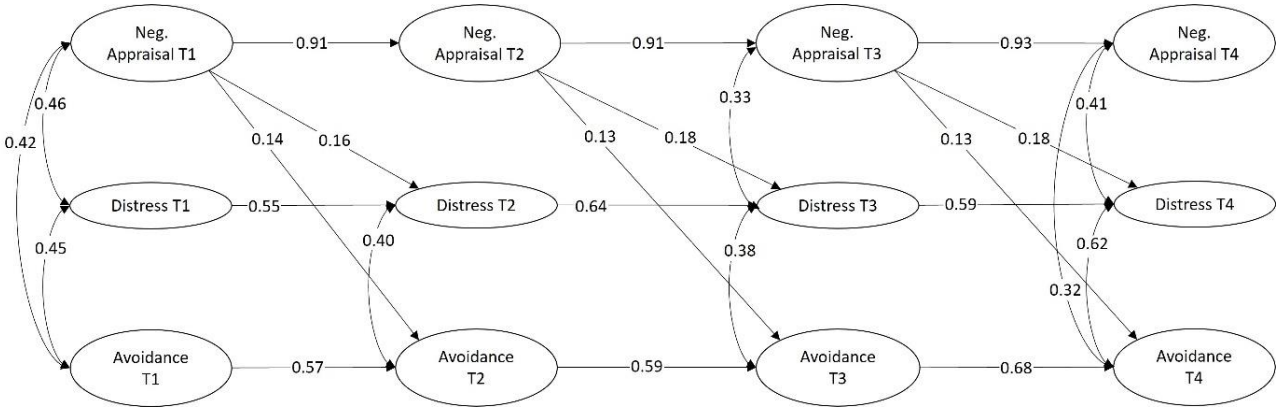
The research team will be in touch to discuss your completed participation and reimbursement. If you have questions about your survey responses, feel free to ask!

We understand that some of the questions in this survey may bring up unpleasant feelings. If you are experiencing distress please reach out to the research team (alexandra.canty@flinders.edu.au) or seek support from Lifeline – ph. 13 11 14 www.lifeline.org.au or Beyond Blue - ph.1300 22 4636, www.beyondblue.org.au

Appendix B – Chapter Three Supplementary Models

Figure S. 1

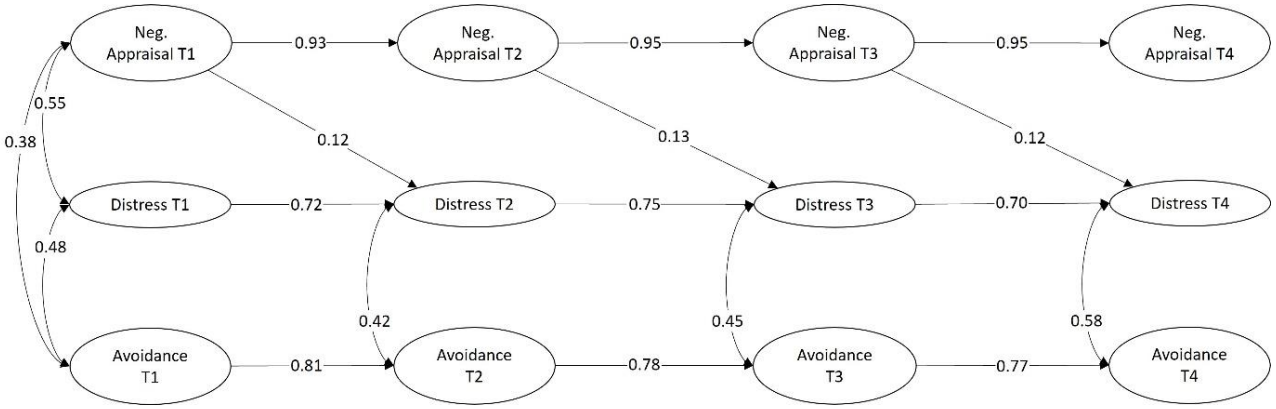
Standardized Coefficients for the Initial CLPM Testing the Micro-longitudinal Effects of Negative Appraisals of Intrusions on Related Distress and Avoidance Coping Strategy Engagement using Day 1 Data.



Note. Figure does not include paths where p > .05.

Figure S. 2

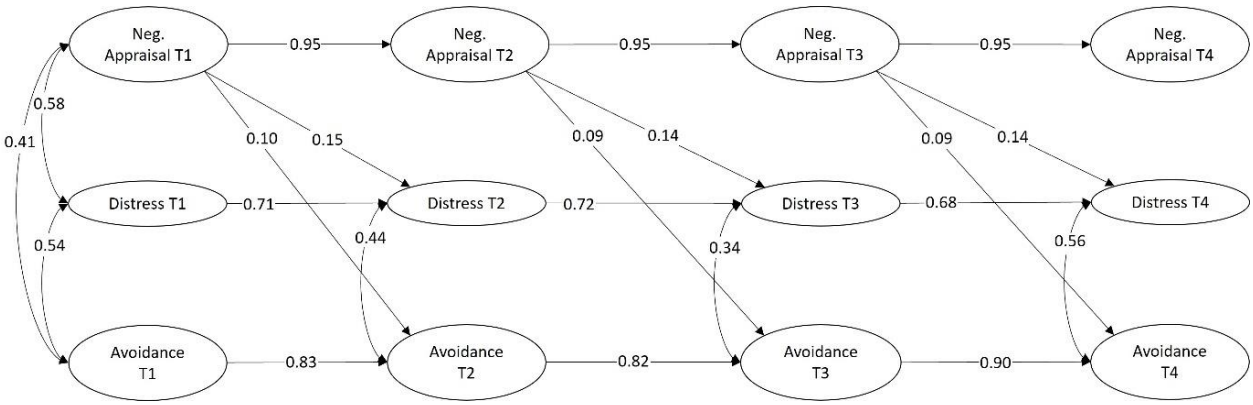
Standardized Coefficients for the Initial CLPM Testing the Micro-longitudinal Effects of Negative Appraisals of Intrusions on Related Distress and Avoidance Coping Strategy Engagement using Day 5 Data.



Note. Figure does not include paths where p > .05.

Figure S. 3

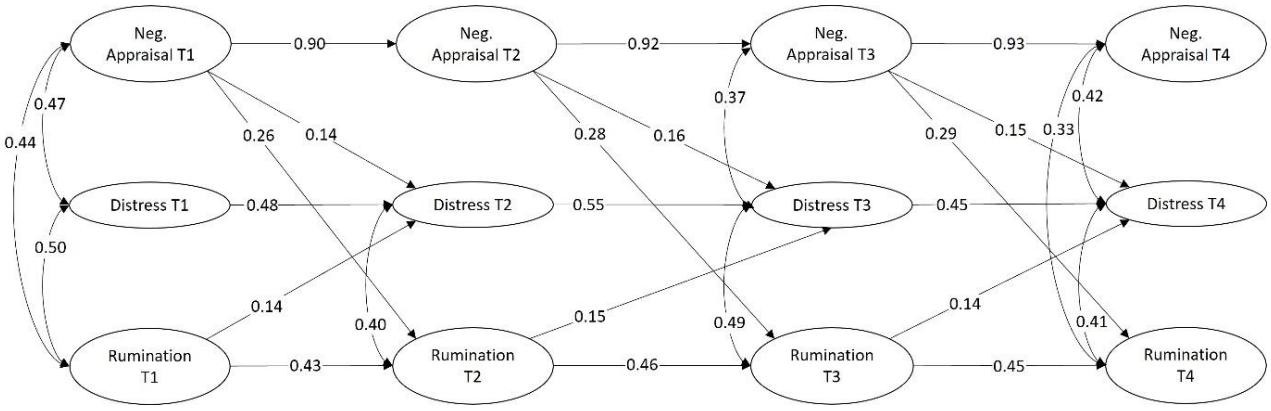
Standardized Coefficients for the Initial CLPM Testing the Micro-longitudinal Effects of Negative Appraisals of Intrusions on Related Distress and Avoidance Coping Strategy Engagement using Day 10 Data.



Note. Figure does not include paths where p > .05.

Figure S. 4

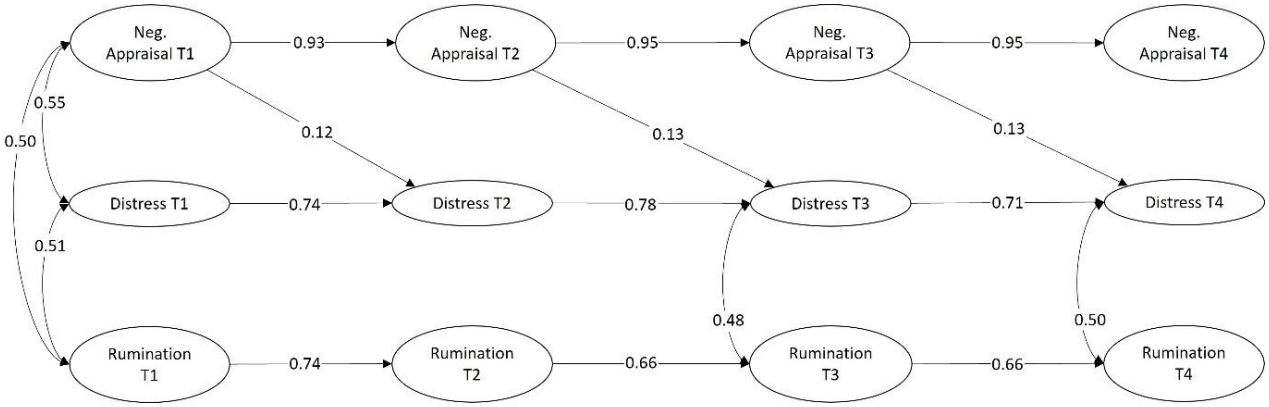
Standardized Coefficients for the Initial CLPM Testing the Micro-longitudinal Effects of Negative Appraisals of Intrusions on Related Distress and Rumination using Day 1 Data.



Note. Figure does not include paths where p > .05.

Figure S. 5

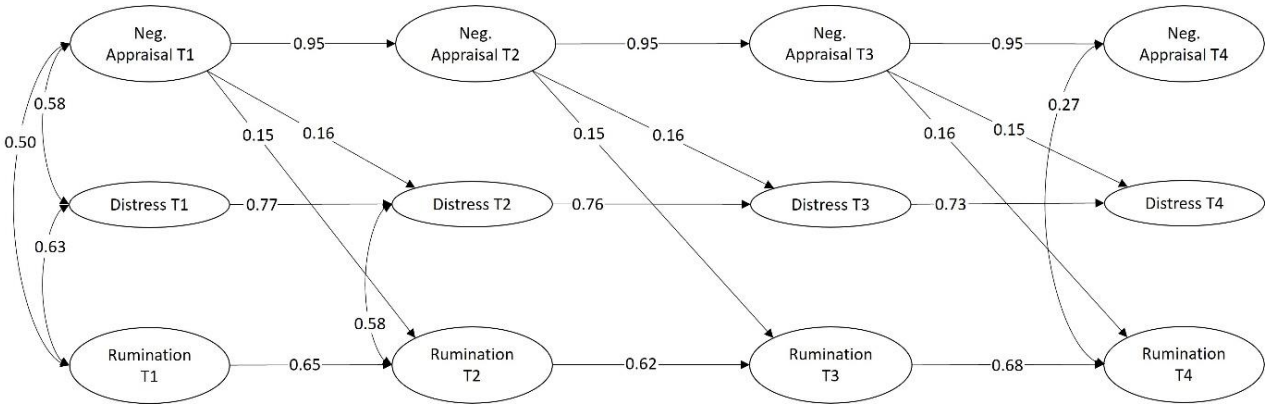
Standardized Coefficients for the Initial CLPM Testing the Micro-longitudinal Effects of Negative Appraisals of Intrusions on Related Distress and Rumination using Day 5 Data.



Note. Figure does not include paths where p > .05.

Figure S. 6

Standardized Coefficients for the Initial CLPM Testing the Micro-longitudinal Effects of Negative Appraisals of Intrusions on Related Distress and Rumination using Day 10 Data.



Note. Figure does not include paths where p > .05.

Appendix C– Chapter Four Supplementary Models

Table S. 1

Linear Mixed Model Exploring Group Change in PCL-5 Score Over Time

	F	***df***	***p***
Fixed Effects			
Intercept	286.26	62	<.001
Time	42.53	62	<.001
Group	0.52	62	.472
Group × Time	0.31	62	.579

Note. F and *df* are included as indexes of effect magnitude while *p* values ≤ .05 indicate statistical significance.

Table S. 2

Linear Mixed Model Exploring Group Change in Intrusive Re-experiencing Over Time

	F	*df*	*p*
Fixed Effects			
Intercept	319.04	62	<.001
Time	58.26	62	<.001
Group	0.66	62	.420
Group × Time	0.49	62	.485

Note. F and *df* are included as indexes of effect magnitude while *p* values ≤ .05 indicate statistical significance.

Table S. 3

Linear Mixed Model Exploring Group Change in Avoidance Coping Over Time

	F	*df*	*p*
Fixed Effects			
Intercept	353.98	62	<.001
Time	41.76	62	<.001
Group	1.04	62	.311
Group × Time	0.69	62	.410

Note. F and *df* are included as indexes of effect magnitude while *p* values ≤ .05 indicate statistical significance.

Table S. 4

Linear Mixed Model Exploring Group Change in Repetitive Thinking Questionnaire Score Over Time

	F	*df*	*p*
Fixed Effects			
Intercept	1131.63	62	<.001
Time	23.00	62	<.001
Group	0.79	62	.376
Group × Time	0.43	62	.516

Note. F and *df* are included as indexes of effect magnitude while *p* values ≤ .05 indicate statistical significance.