Improving Wellbeing in Student Paramedics: Targeting Risk Factors and Predictors of PTSD

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Abstract

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Student paramedics are at an increased risk of developing mental health problems compared to the general population due to the nature of their work. They are especially at high risk of developing posttraumatic stress disorder (PTSD), a severe stress reaction that can occur after exposure to traumatic events. To date, interventions aimed at reducing poor mental health or preventing the risk of PTSD in this population have not been very effective. Evidence-based interventions are urgently needed.

This thesis aims to address poor mental health in student paramedics. First, by evaluating a tool to improve wellbeing and reduce psychological distress (Study 1). Second, by targeting factors relevant to the development of PTSD with a specific focus on assessing and understanding rumination, a risk factor for PTSD, characterised by abstract thinking, and modifying responses to intrusive memories, a predictor of PTSD (Chapters 2, 3 and 4). No previous studies have looked at these factors in a population of student paramedics.

Study 1 showed that daily planning ahead can improve wellbeing in student paramedics significantly better than reading about mental health. Planning ahead also reduced psychological distress and increased the experience of mindfulness in student paramedics as did reading about how to cope with stress. Study 2 developed and validated a new measure of concrete and abstract thinking (CAT). The CAT fills a gap in the literature by providing a user-friendly, valid, reliable and population-specific measure of concrete and abstract thinking. A 'Best Version CAT' is recommended for further use. Abstract thinking measured by the CAT was associated with established measures of rumination, worry and PTSD. Study 3 builds on this by assessing abstract thinking (using the CAT) as a predictor of PTSD symptom severity, at 6-week and 6-month follow-up in a large sample of student paramedics. Findings revealed that abstract thinking predicts PTSD symptom severity over and above established measures of rumination at 6-weeks but not at 6-months. Finally, Study 4 aimed to reduce intrusive memories and maladaptive responses to intrusions after an analogue trauma film. The study failed to show superiority of a stimulus discrimination technique over a counting intrusions technique, both of which seemed to help student paramedics disengage from trauma memories.

The results of this thesis contribute to our understanding of factors that may influence the wellbeing and mental health of student paramedics. A better understanding of these factors may, in the future, help to inform targeted PTSD prevention for student paramedics and emergency workers more broadly.

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1 Chapter 1: Literature Review

1.1 Overview

Student paramedics are at an increased risk of developing mental health problems compared to the general population due to the nature of their work. They face demanding university environments as well as exposure to trauma on placements. They are most commonly at risk of developing posttraumatic stress disorder (PTSD), a severe stress reaction that can occur after the exposure to traumatic events. To date, interventions aimed at preventing or reducing the risk of PTSD in this population have not been very effective. Evidence-based interventions are urgently needed.

The current thesis considers two ways to address poor mental health in student paramedics: by increasing general wellbeing, and by targeting malleable risk factors and predictors of PTSD. The thesis aims to add to the understanding of rumination as a risk factor for PTSD in student paramedics by investigating the underlying concept of abstract thinking. In addition, the thesis aims to test strategies to modify intrusive memories, a predictor of PTSD, in an analogue trauma setting. A better understanding of these factors may help to inform targeted PTSD prevention for student paramedics.

The following chapter will review the literature relevant to the studies conducted in this thesis. It will first give an overview of PTSD and its consequences and describe a cognitive model of PTSD (Ehlers & Clark, 2000). Next, emergency workers in general, and student paramedics in particular will be highlighted as a population at risk for PTSD. Existing PTSD prevention programmes will be critically considered to inform methods for improving wellbeing and targeting risk factors and predictors of PTSD in this population. The subsequent section will give an overview of these risk factors and predictors with a focus on rumination and intrusive memories. The penultimate section

will give an overview of what is known about abstract thinking linked to rumination, and of intrusive memories as a symptom and predictor of PTSD. Finally, the link between rumination and intrusive memories will be reviewed.

The overall aim of the thesis is to advance the understanding of factors and interventions that may contribute to the primary prevention of PTSD in student paramedics.

1.2 Posttraumatic Stress Disorder

1.2.1 Defining Posttraumatic Stress Disorder

Posttraumatic stress disorder (PTSD) is a severe stress reaction that can occur after a traumatic event. PTSD can be diagnosed after exposure to 'actual or threatened death (violent or accidental), serious injury, or sexual violence.' Examples of traumatic events include rape or sexual assault, road traffic accidents and natural disasters. Individuals may experience this traumatic event directly, witness it happening, learn about it happening to another person or experience repeated exposure to details of a traumatic event, for example through their work (American Psychiatric Association, 2013). This exposure is a new addition to the diagnosis and may be especially relevant for emergency workers, for example paramedics helping injured people in the aftermath of accidents. According to the Diagnostic and Statistical Manual of Mental Disorders, fifth edition (DSM-5; American Psychiatric Association, 2013), symptoms are categorised into four clusters: re-experiencing symptoms associated with the trauma, avoidance of stimuli associated with the trauma, negative alterations in mood or cognition and alterations in arousal and reactivity (e.g. hypervigilance). To meet a diagnosis for PTSD, individuals must have experienced a traumatic event as described above and a set number of symptoms in each of the four clusters. The symptoms must

cause clinically significant distress or impairment and must have persisted for more than one month.

The most recent adult psychiatric morbidity survey of England from 2014 (McManus, Bebbington, Jenkins, Brugha, et al., 2016) estimated that about a third (31.4%) of adults experienced at least one traumatic event in their lifetime (McManus, Bebbington, Jenkins, Brugha, et al., 2016). Across countries, the percentage of individuals exposed to trauma is even higher. The WHO World Mental Health (WMH) surveys across 24 countries found that around 70% of respondents were exposed to a traumatic event during their lifetime (Benjet et al., 2016; R. Kessler et al., 2017). Although many individuals are exposed to trauma, most recover naturally afterwards (Bonanno, 2004; Morina et al., 2014) and acute stress reactions (ASR), which are normal after trauma, are not a good predictor of persistent PTSD (e.g. Kleim et al., 2007). Some survivors of trauma even experience positive changes in their lives such as posttraumatic growth (Linley & Joseph, 2004).

However, a significant number of individuals go on to develop PTSD after exposure to a traumatic event. In England, 4.4% screened positive for self-reported PTSD in the past month. Women between the ages of 16-24 screened particularly high (12.6%) (McManus, Bebbington, Jenkins, Brugha, et al., 2016). A recent birth-cohort study (Lewis et al., 2019) followed children born in England and Wales until the age of 18. Based on DSM-5 criteria, 7.8% had experienced PTSD in their lifetime and 4.4% in the past 12 months. Of the 31.1% who had been exposed to a traumatic event, 25.0% showed a lifetime prevalence of PTSD and 14.0% experienced PTSD in the past 12 months.

1.2.2 Ehlers and Clark's (2000) Model of PTSD

Multiple models of PTSD have been proposed (e.g. Brewin et al., 1996). The current thesis addresses PTSD through Ehlers and Clark's (2000) cognitive model of persistent PTSD (see Figure 1) since this model guides evidence-based treatment for PTSD. It suggests that PTSD is maintained by a sense of current threat. This current threat stems from the nature of the trauma memory, negative appraisals of the trauma or its sequelae and dysfunctional behaviours/coping strategies. According to Ehlers and Clark, the trauma memory that gives rise to PTSD symptoms is disjointed and poorly elaborated. In other words, it is poorly integrated into the context of time, place and other events (e.g. "I'm still in danger"). These memory characteristics trigger and maintain unwanted, intrusive memories (see section 1.7.2) and fuel the sense of current threat. Negative appraisals contribute to the sense of current threat. These are negative interpretations of the meaning of the trauma and its sequelae, such as interpretations about the self (e.g. "the trauma showed that I am weak"), other people (e.g. "people cannot be trusted"), or the world ("the world is a dangerous place"). In order to control symptoms or the sense of threat, individuals may (intentionally or unintentionally) turn to maladaptive coping strategies (dysfunctional behaviours and cognitive strategies). These maladaptive responses prevent a change to the negative appraisals and nature of the trauma memory, lead to a sense of current threat and maintain PTSD symptoms (Ehlers & Clark, 2000). Examples of these coping strategies are safety behaviours (such as, taking excessive precautions) and maladaptive responses to intrusive memories, such as rumination and thought suppression.

Extensive empirical evidence supports Ehlers and Clark's model (Beierl et al., 2019; Ehring, Ehlers, et al., 2008; Kleim et al., 2012; Lancaster et al., 2011). Ehlers and Clark further formulated treatment targets and techniques based on their model. Ehlers

and colleagues proposed a cognitive therapy for PTSD (Ehlers et al., 2005a; CT-PTSD; Ehlers & Clark, 2008) which has shown to be effective and efficient in randomised controlled trials (RCTs) of PTSD treatment (Brewin et al., 2008; Duffy et al., 2007; Ehlers et al., 2003, 2010, 2014; Gillespie et al., 2002; Kleim et al., 2013; P. Smith et al., 2007). Figure 1 shows the cognitive model of PTSD (Ehlers & Clark, 2000).

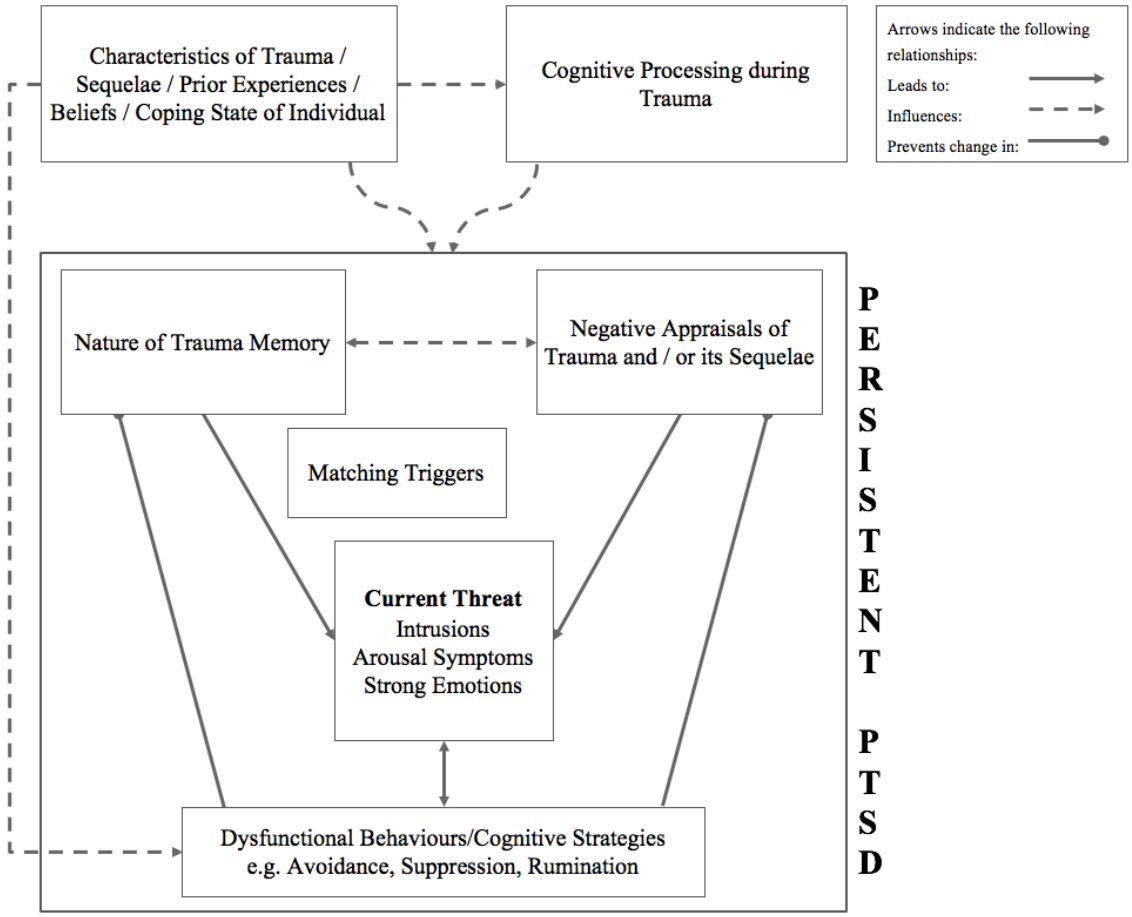


Figure 1. Cognitive model of PTSD (Ehlers & Clark, 2000)

1.2.3 Consequences of Trauma and PTSD

Besides PTSD, traumatic events have been associated with other psychological disorders such as major depression, anxiety disorders and substance abuse (Debell et al., 2014; Lewis et al., 2019; Rytwinski et al., 2013) and PTSD has been associated with suicidality in adults as well as adolescents (Bernal et al., 2007; Lewis et al., 2019; Panagioti et al., 2015).

There is accumulating evidence that PTSD is also associated with several physical health problems (Pacella et al., 2013; Pietrzak et al., 2012). A recent meta-analysis found strong evidence that PTSD increases the risk of cardiovascular disease, metabolic and musculoskeletal disorders (Ryder et al., 2018). In addition, PTSD has been linked to a greater frequency and severity of pain (Pacella et al., 2013), to the risk of developing dementia (Yaffe et al., 2009) and even to early death (Xue et al., 2012).

1.2.3.1 Subsyndromal PTSD.

Individuals who have been exposed to a traumatic event can suffer from impaired functioning even if they do not meet the full diagnostic criteria for PTSD (Carlier & Gersons, 1995; Cukor et al., 2010; Grubaugh et al., 2005; Marshall et al., 2001; McLaughlin et al., 2013; Norman et al., 2007). Definitions of partial, subthreshold or subsyndromal PTSD vary in the literature with some definitions requiring a minimum of one symptom in each symptom cluster (Stein et al., 1997), or a lower number of symptoms than full PTSD (McLaughlin et al., 2013; Resnick et al., 1993), or meeting criteria for re-experiencing symptoms in addition to either avoidance or hyperarousal symptoms (Blanchard et al., 1996). Compared to non-traumatised individuals, individuals with partial or subthreshold PTSD show significantly higher distress (Schützwohl & Maercker, 1999), withdrawal from loved ones, increased work absences and increased healthcare utilization (Breslau et al., 2004), work and relationship problems (Pietrzak et al., 2009), higher alcohol use (Adams et al., 2006; Yarvis & Schiess, 2008), comorbidity with other disorders such as major depression (Cukor et al., 2010; Grubaugh et al., 2005; McLaughlin et al., 2013; Yarvis & Schiess, 2008) and suicidality (Marshall et al., 2001; McLaughlin et al., 2013). In populations at high risk of trauma exposure, such as emergency workers, it is important to note that

many individuals may be suffering from functional impairment associated with trauma, even though they may not meet full diagnostic criteria for PTSD.

1.3 Student Paramedics at High Risk for PTSD

1.3.1 Poor Mental Health in Emergency Workers

Emergency workers dedicate their lives to ensuring the health and safety of others but can suffer significant distress and poor mental health as a result of their job (Beaton et al., 1998; McFarlane & Bryant, 2007). The UK mental health charity Mind (2014) surveyed almost 4,000 UK-based emergency workers in 2014. This included people who served in the ambulance, police, fire and search and rescue services. Their survey revealed that 55% of emergency personnel reported mental health problems and that 90% reported high levels of stress and poor mental health at some point in their career. These rates are much higher than surveys of the general workforce in the UK where rates of reported mental health problems are at 26% (Chartered Institute of Personnel and Development (CIPD), 2011). Emergency workers also show a high prevalence of other mental health problems. Two studies (Alexander & Klein, 2001; Clohessy & Ehlers, 1999) have found between 22-32% of their paramedic samples to meet screening criteria for psychiatric symptoms as measured by the General Health Questionnaire (GHQ; Goldberg & Williams, 1988) and a metanalysis of 18 studies estimated a prevalence of 27% for general psychological distress among ambulance personnel (Petrie et al., 2018). Rates of common mental health disorders, such as depression and anxiety, also seem above general population estimates in ambulance workers (Alexander & Klein, 2001; Bennett et al., 2005). [Note: some literature uses the umbrella term ‘ambulance personnel/workers’ which in the UK describes paramedics as well as emergency medical technicians (EMTs), emergency care assistants, patient

transport service drivers and handlers (PTS) and call handlers/emergency medical dispatchers.]

1.3.2 Paramedics at Risk for PTSD

Specific occupational groups are frequently exposed to traumatic events and are therefore at risk of developing PTSD. An occupational group at high risk for PTSD that is often overlooked are paramedics (Bennett et al., 2004), police officers (e.g. Carlier et al., 1997) and firefighters (e.g. Heinrichs et al., 2005; E. C. Meyer et al., 2012; Wagner et al., 2010). Across studies, paramedics seem to show a greater prevalence of PTSD than other emergency worker populations. A systematic review of emergency rescue workers worldwide found a pooled PTSD prevalence of 10%, with ambulance personnel showing the highest risk (14.6%) (Berger et al., 2012). In another study, paramedics/EMTs reported higher distress compared to police and fire personnel when trauma exposure was controlled for (Marmar et al., 1996). Ambulance workers may be at higher risk because of the frequency of their exposure since they respond to more emergency calls than the police and fire service combined (A. E. C. James & Wright, 1991). Other factors that may help explain this elevated risk in ambulance workers are high organisational stress, pressure at work, shift work and lack of control or unpredictability of their work (Bennett et al., 2005; Sterud et al., 2011; Young & Cooper, 1995).

In the UK, studies show a prevalence of PTSD in paramedics between 10% and 22%. Wild and colleagues (2016) followed 453 newly recruited English paramedics over a two-year period. They found that 8.3% of their sample developed PTSD and 10.6% developed major depression within the first two years of their work. Bennett (Bennett et al., 2004) described the mental health of UK emergency ambulance workers

in a sample of 380 paramedics and 194 emergency medical technicians and found a 22% prevalence of PTSD based on self-reported scores on the Posttraumatic Diagnostic Scale (PDS). Another study reported similar prevalence rates of 21% in English paramedics and ambulance technicians (Clohessy & Ehlers, 1999). Most recently, a metanalysis of 18 studies of ambulance workers found a PTSD prevalence of 11% (Petrie et al., 2018). Although these numbers vary across studies, they are all higher than statistics for the general population in England where 4.4% reported PTSD within the past 12 months and 7.8% during their lifetime (Lewis et al., 2019; McManus, Bebbington, Jenkins, & Brugha, 2016).

1.3.2.1 Trauma exposure in paramedics.

Exposure to traumatic events differs greatly in paramedics compared to other civilian population because exposure is voluntary, regular and expected as part of their work. Some of the most distressing traumatic events ambulance service workers are exposed to include cases of cot death, death or rescue of a child, major fires, burns victims and murder scenes (Clohessy & Ehlers, 1999; Katsavouni & Bebetsos, 2016). One study reported that emotionally distressing events associated with PTSD symptoms were characterised by chaos and resource limitations (Regambal et al., 2015). Although paramedics' own lives are rarely in danger they witness or learn about traumatic events, often on a daily basis. The DSM-5 diagnosis of PTSD specifically includes PTSD after 'extreme indirect exposure to either events, or details of events, through one's professional activities' (American Psychiatric Association, 2013). Repeatedly witnessing or being exposed to traumatic events increases the risk of PTSD (Bennett et al., 2005). Similarly, evidence suggests that time spent in service predicted lower wellbeing and greater PTSD symptom severity in ambulance personnel (Bennett et al., 2005; Eiche et al., 2019). While paramedics are usually exposed to indirect threats,

direct threats can also occur in the form of physical violence, intimidation and sexual harassment (Boyle et al., 2007). Direct threats have an even higher chance of eliciting full or partial PTSD than indirect threats (Michael et al., 2016).

1.3.2.2 Psychological, physical and occupational impact of PTSD in paramedics.

As discussed earlier in this chapter (section 1.2.3), PTSD increases the likelihood of a range of mental ill health outcomes. In populations of paramedics, episodes of PTSD have been associated with significantly lower wellbeing (Eiche et al., 2019), clinically significant distress and poorer quality of life (Wild et al., 2016).

Similarly, as discussed in this chapter (section 1.2.3), PTSD is associated with poorer physical health, however, only few studies have assessed this in paramedics. One study found that paramedics who experienced an episode of PTSD also reported poorer sleep and greater weight gain than their non-PTSD counterparts (Wild et al., 2016).

There is accumulating evidence that trauma and PTSD significantly impact occupational health. This is especially important in populations which experience traumatic events through their work. Paramedics who reported episodes of PTSD or major depression during the first two years of their service also reported more days off work and greater burn-out (Wild et al., 2016). Other studies have supported this association between PTSD and burn-out in ambulance personnel (Katsavouni & Bebetsos, 2016). PTSD may also impact work performance. Emergency workers with PTSD reported experiencing higher acute stress in intensive situations, compared to emergency workers without PTSD, which was associated with performance deficits on cognitive tasks and verbal memory impairment (Regehr & LeBlanc, 2017). However, this relationship was not found in the much smaller sample (N=22) of paramedics only.

1.3.3 Higher Risk of Mental Ill Health in Student Paramedics

Students training to be paramedics (student paramedics) may be at particular high risk of developing mental health problems since they experience the daily stressors linked to the role of a paramedic as well as the demands of university. University students are considered a population at high risk for mental ill health, suffering higher rates of mental health problems than the general population (Ibrahim et al., 2013; Macaskill, 2013; Stallman, 2008; Stewart-Brown et al., 2000; Thorley, 2017). Research suggests that students' mental health declines upon arrival to university and does not return to pre-university levels (Cooke et al., 2006). Over the past 10 years, rates of mental health problems amongst British young adults (aged 20-24) have been steadily increasing (Thorley, 2017).

Due to a change in the UK system, paramedics can now qualify through a 3-year university undergraduate degrees (Bachelor of Paramedic Science; BSc) which they can enter immediately after school (after A-Levels) at the age of 18 or 19. Student paramedics attend a combination of university classes and work placements where they join fully qualified paramedics on shifts and contribute to the work depending on their year of training. The alternative full-time routes to becoming a paramedic are a 2-year diploma or a foundation degree course at university. Entry to these alternatives requires more work experience so programmes often include older students. Across the UK, an increasing number of young people are entering university with acceptance rates steadily rising since 2012 (UCAS Analysis and Research, 2016). Similarly, more and more paramedics train through a university degree. This means that, compared to previous generations, student paramedics are often younger and have little to no experience in seeing death or dealing with extreme or fatal injuries before they enter their placements.

In the current thesis, studies are primarily conducted with samples of student paramedics completing a 3-year university undergraduate degree. This allows for a more homogeneous sample with comparable backgrounds, work experience, and age. Targeting this population may provide a unique opportunity to learn about this high risk group and to evaluate early interventions that could prevent the development of mental health problems such as PTSD.

1.4 Preventing PTSD in Emergency Workers

Evidence-based PTSD treatment has greatly improved over the past decades with treatments such as cognitive behavioural therapy (CBT) showing efficient and effective results. However, research on PTSD prevention is lagging behind. Prevention of mental illness is high on the mental health agenda internationally (World Health Organization, 2013) yet progress has been slow. Knowing that specific occupational groups, such as emergency workers, will be exposed to trauma through their work, provides a unique opportunity to prevent the development of psychological issues linked to trauma exposure. Currently, there is a surprising lack of successful, evidence-based programmes for this population.

1.4.1 PTSD Prevention Programmes for Emergency Workers

When considering PTSD prevention interventions, one should be mindful of the distinction between different time points of prevention. Compared to other disorders, PTSD is linked to a specific onset event. Primary prevention can take place any time before a traumatic event and focuses on preparing for and dealing with traumatic events. Secondary prevention occurs shortly after the traumatic event and aims to prevent the emergence or maintenance of PTSD symptoms. Full PTSD can only be diagnosed when

symptoms have been present for at least one month.

1.4.1.1 Primary prevention of PTSD in emergency workers.

One study (Skeffington et al., 2016) attempted the primary prevention of PTSD in firefighters through a resilience training consisting of Mental Agility and Psychological Strength training (MAPS). The MAPS programme includes cognitive and psychoeducational components that may facilitate adaptive appraisals and encourage help-seeking, as well as mindfulness and relaxation. The randomised controlled trial (RCT) with a 12-month follow-up period found no evidence that the intervention prevented PTSD. The authors claimed that their study was the first RCT investigating the primary prevention of PTSD in this population. Similarly, a recent RCT of the British mental health charity Mind's CBT group-based resilience intervention for emergency workers was unsuccessful in improving participants' levels of resilience and mental health (Wild et al., 2017). Another resilience programme designed for student paramedics to mitigate the impacts of their work (Anderson et al., 2017) was evaluated in an RCT. It consisted of a 6-8 hour online 'resiliency training' which included education about resilience, emotional and physical risks of paramedicine work, recognising symptoms of stress and PTSD and techniques to manage feelings and behaviours. The authors found that the intervention successfully increased resilience scores as measure by The Resilience Scale (Wagnild & Young, 1993). However, there was no follow-up and so it is impossible to determine whether or not participants maintained their gains or whether the benefits linked to the training prevented episodes of PTSD. To date and to the author's knowledge, none of the programmes have been successful at preventing or reducing the risk for PTSD in emergency workers.

As can be seen in the examples noted above, many prevention programmes have

been labelled ‘resilience interventions’ or have actively aimed to increase and measure resilience. Some researchers argue that evidence-based resilience interventions are a promising strategy to prevent stress-related disorders such as PTSD (Kalisch et al., 2017). However, despite a growing number of studies on resilience, there are still no clear predictors or markers of resilience. Definitions of resilience still vary, although resilience commonly refers to stable or only moderately deteriorated mental health despite exposure to psychological or physical adversity (Kalisch et al., 2017). Some propose that general wellbeing is a characteristic that can increase resilience, and that resilience in turn is a component of wellbeing (Balme et al., 2015; Campion & Nurse, 2007), or simply that there is a positive correlation between increased wellbeing and increased resilience (Sanders et al., 2015; Tomyn & Weinberg, 2018). Wellbeing specifically in student paramedics will be addressed in more detail in Chapter 2.

1.4.1.2 Secondary prevention of PTSD in emergency workers.

Multiple interventions have aimed to prevent PTSD in emergency workers after they have been exposed to a traumatic event. Critical incident stress debriefing (CISD) is widely used by UK emergency services as PTSD prevention. CISD is often mandatory and includes a single-session intervention, taking place within the first week after a traumatic event. The approach includes recalling the trauma and talking about it in detail, in an individual or group setting (Rose et al., 2002). However, across multiple studies, debriefing has been shown, at best, to have no efficacy in reducing symptoms of PTSD, or worse, to have detrimental effects. (Bledsoe, 2003; McNally et al., 2003; Rose et al., 2002; A. Smith & Roberts, 2003; van Emmerik et al., 2002), although some have argued against these findings (e.g. Hawker et al., 2011). CISD may interfere with the natural processing of traumatic events and inhibit natural recovery. Despite the number of research publications demonstrating none to limited benefits of CISD, the

debate about its efficacy continues and the programme is still widely implemented across the UK.

Another secondary intervention is Trauma Risk Management (TRiM) used by military, fire and police populations. It is a 3-5 day peer-support programme which intends to reduce stigma and encourage individuals to seek help after a traumatic event. An evaluation of TRiM in a military population followed participants after 12 to 18 months and found that TRiM failed to protect participants from developing mental health problems and PTSD compared to no intervention (Greenberg et al., 2010). On the other hand, a recent study of British police officers found participants of TRiM to report lower PTSD symptoms, fewer barriers to help-seeking and lower public stigma compared to non-TRiM participants (L. Watson & Andrews, 2018). However, this was a cross-sectional study of police forces that had already been using the programme for seven to twelve years compared to forces that had no standardised process for managing trauma. The study can therefore not definitely attribute the between-group differences to the TRiM programme since other factors may have been at play. For example, police forces that have had TRiM in place for many years may be more open to discussing mental health and may have additional mental health or PTSD support available. This could contribute to fewer barriers to help-seeking and reduced stigma in the force, independent of, or in addition to, the effects of TRiM.

1.4.2 Recommended Approach to Target PTSD in Emergency Workers

In light of these failed or insufficiently supported interventions, effective interventions are urgently needed. Multiple programmes such as MAPS or CISD have attempted to increase resilience or prevent PTSD with well-intended but non-evidence

based interventions. One possible reason why previous programmes have not been very successful is because they have failed to target risk factors and predictors of PTSD and have failed to use evidence-based techniques, such as CBT, for dealing with the emergence of symptoms. Preliminary research shows that studies with populations other than emergency workers have had some success in in lowering later PTSD severity through secondary CBT prevention (Foa et al., 1995). In this study, survivors of sexual and non-sexual assault received four sessions of psychoeducation and CBT coping skills. At 3-month follow-up they showed lower PTSD symptoms and at 5 ½ months lower re-experiencing symptoms, compared to a no-intervention control group. It is possible that emergency workers may also benefit from a science-informed approach to preventing PTSD.

The current thesis considers a science-informed approach to addressing poor mental health in student paramedics: by increasing general wellbeing, and by targeting malleable risk factors and predictors of PTSD. The current thesis thereby aims to contribute to our understanding of factors and interventions that may contribute to the primary prevention of PTSD in student paramedics.

1.5 Risk Factors and Predictors of PTSD

As discussed in the previous section, it may be possible to prevent PTSD by targeting modifiable factors that lead to PTSD. It is therefore important to understand which risk factors and predictors lead to the development of PTSD. Many studies have not differentiated between risk factors and predictors and use the words interchangeably. However, for clarity, this thesis will apply a previously established differentiation: According to Kraemer and colleagues (Boellinghaus, 2009; Kraemer et

al., 1997), risk factors are variables that temporally precede an individual's exposure to a traumatic event and make them more vulnerable to PTSD. Variables that are assessed after exposure to a traumatic event are referred to as predictors (Kraemer et al., 1997). These are factors or responses that occur during the traumatic event (peri-traumatic responses) or after the traumatic event and predict PTSD. Using this definition, some factors can be considered risk factors as well as predictors. For example, rumination pre-trauma has been found to be a risk factor for PTSD (Wild et al., 2016) while post-traumatic state rumination is an established predictor of PTSD (e.g. Ehlers et al., 1998). The differentiation between risk factor and predictor becomes significant when considering the time points of preventative interventions. Primary prevention addresses risk factors since no traumatic event has taken place yet, while secondary prevention focuses on predictors of PTSD and responses to the traumatic event.

Another important distinction is the difference between fixed and malleable factors. Fixed risk factors and predictors are often facts, such as gender, genetics, past events, or characteristics of the traumatic event which cannot be changed. Malleable or modifiable factors are cognitive, emotional or behavioural variables that could be changed with training and could therefore be addressed preventatively.

1.5.1 Fixed Risk Factors and Predictors

1.5.1.1 Fixed risk factors.

The following section will give an overview of fixed risk factors in general, independent of occupational group. In their meta-analysis, Brewin and colleagues (Brewin et al., 2000) identified multiple fixed risk factors for PTSD in civilian samples. Socio-economic status had the strongest association (r=.15), followed by female gender, family psychiatric history and adverse childhood experience (r=.13) and trauma or

psychiatric history (*r*=.11). Reviews, single studies, and another meta-analysis by Ozer and colleagues found similar fixed risk factors such as: female gender (Ehlers et al., 1998; Landolt et al., 2013; McLaughlin et al., 2013; Olff & Langeland, 2007), prior trauma history (Ozer et al., 2003; Pietrzak et al., 2014; Razik et al., 2013), exposure to multiple traumatic events (Landolt et al., 2013), previous emotional problems or other mental health issues (Breslau & Victoria, 2006; Ehlers et al., 1998; Kleim et al., 2007; McLaughlin et al., 2013; Ozer et al., 2003; Wild et al., 2016), family history of psychopathology (Ozer et al., 2003) and lower intelligence (Breslau et al., 2006; Macklin et al., 1998). For an overview of genetic and biological risk factors see Yehuada (2001) or Segeman and colleagues (Segman et al., 2007).

1.5.1.2 Fixed predictors.

Fixed predictors relate to characteristics of the traumatic event or to cognitive processing during the event. Across studies, researchers agree that the type of traumatic event affects the likelihood of PTSD. Development of PTSD is most likely after interpersonal violence and combat (Alisic et al., 2014; R. Kessler et al., 2017; Kilpatrick et al., 2013; Lewis et al., 2019; McLaughlin et al., 2013). Rates of PTSD are higher in individuals who were deliberately harmed compared to individuals who experienced an accident or a natural disaster (R. Kessler et al., 1995; Norris, 1992). Whether objective injury or assault severity predict PTSD is still unclear, while subjective ratings of trauma severity, such as perceived threat to life, have consistently been related to later PTSD (Brewin et al., 2000; Dunmore et al., 2001; Ehlers et al., 1998; Halligan et al., 2003; Johansen et al., 2007; Kleim et al., 2007; Ozer et al., 2003; Razik et al., 2013). For example, in a sample of physical and sexual assault survivors, trauma severity (comprising of objective trauma severity, perceived threat to life or physical integrity

and fear or terror) explained 22% of the variance of PTSD severity after 6 months (Halligan et al., 2003).

Other predictors of PTSD are related to how individuals process the event and respond to it while it is happening (peri-traumatic processing) (Dunmore et al., 2001; Freeman et al., 2013; Halligan et al., 2003; Ozer et al., 2003). In their cognitive model (2000), described in section 1.2.2 of this chapter, Ehlers and Clark propose four maladaptive processing styles that contribute to the development of PTSD which have been supported by experimental studies. Peri-traumatic dissociation (feelings of depersonalisation, derealisation and disconnection from self or the world) has been shown to predict PTSD (Ehlers et al., 1998; Halligan et al., 2003; Holeva & Tarrier, 2001; Kleim et al., 2007; Murray et al., 2002; Nash et al., 2015; Ozer et al., 2003; Razik et al., 2013). In their meta-analysis of 68 studies of PTSD predictors, Ozer and colleagues found that peri-traumatic dissociation was the strongest (r=.35) predictor of PTSD. Other peri-traumatic modes of processing have also been shown to predict PTSD: data-driven processing (preferential processing of perceptual information instead of the meaning) (Ehring, Ehlers, et al., 2008; Freeman et al., 2013; Halligan et al., 2003), a lack of self-referential processing (inability to process the traumatic event as part of the continued autobiographical experience) (Brewin & Holmes, 2003; Ehlers et al., 2004; Freeman et al., 2013; Halligan et al., 2003; Kleim et al., 2007) and mental defeat (perceived loss of all autonomy during the trauma) (Dunmore et al., 2001; Freeman et al., 2013; Kleim et al., 2007). Mental defeat together with a lack of self-referential processing are thought to facilitate appraisals about a negative view of oneself and perceived permanent change (see section 1.5.3; malleable predictors). Other predictors not related to the cognitive model of PTSD (2000) have been associated with post-trauma circumstances such as life stress and lack of social support and could

contribute to negative appraisals in the aftermath of trauma, heightening risk for PTSD (Brewin et al., 2000; Johansen et al., 2007; Ozer et al., 2003).

1.5.2 Malleable Risk Factors

A much smaller number of studies have assessed pre-trauma risk factors for PTSD since it is difficult to assess individuals prior to trauma exposure. Risk factors have often been assessed retrospectively, after a traumatic event, which reduces accuracy since the trauma or PTSD symptoms may influence reporting. Pre-trauma risk factors can be assessed more easily in populations at high risk for exposure to traumatic events such as in emergency personnel.

A number of studies have found that pre-trauma cognitions predicted PTSD symptomatology. In a prospective study of newly recruited paramedics, Wild and colleagues (2016) found that rumination about memories of stressful events was a significant risk factor for an episode of PTSD during the 2-year study period. In a study of fire-fighters, negative pre-trauma self-appraisals (e.g. 'I am inadequate') was shown to predict as much as 20% of variance in PTSD severity (Bryant & Guthrie, 2007). Multiple psychological traits also seem to be risk factors for PTSD such as trait anger (military personnel; Lommen, Engelhard, van de Schoot, & van den Hout, 2014), neuroticism (victims of road traffic accidents; Holeva & Tarrier, 2001) and low self-efficacy (fire fighters; Heinrichs et al., 2005). For example, in a sample of 43 fire fighters, a high level of pre-trauma hostility and a low level of self-efficacy at the beginning of training accounted for 42% of the variance in PTSD after 2 years (Heinrichs et al., 2005).

1.5.3 Malleable Predictors

Multiple studies have shown that the cognitive factors of persistent PTSD proposed in the model predict PTSD (Dunmore et al., 2001; Ehlers et al., 1998; Ehring, Ehlers, et al., 2008; Halligan et al., 2003; Michael et al., 2005; Murray et al., 2002). The following section elaborates the three categories of predictors noted in the cognitive model for PTSD: the nature of the trauma memory, negative appraisals of the trauma and/or its sequelae and dysfunctional behaviours/cognitive strategies.

The nature of the trauma memory plays a role in predicting PTSD: processing during the traumatic event (noted in section 1.5.1.2; fixed predictors), such as data-driven processing and lack of self-referential processing can later influence the nature of the trauma memory, which in turn can predict PTSD (Murray et al., 2002). In addition, a disjointed trauma memory (disjointed from other autobiographical memories) and reduced memory specificity (difficulties retrieving specific memories) have been shown to predict PTSD (Kleim & Ehlers, 2008).

Negative appraisals of the trauma or its sequelae, in other words, how individuals understand and make sense of their own experience and its consequences, have been shown to contribute to the prediction of PTSD (Beierl et al., 2019; Bryant & Guthrie, 2005; Duffy et al., 2013; Dunmore et al., 2001; Ehring, Ehlers, et al., 2008; Freeman et al., 2013; Halligan et al., 2003; Lancaster et al., 2011; O'Donnell et al., 2007). For example, in a sample of 57 victims of physical or sexual assault, their appraisal of the assault sequelae significantly predicted PTSD severity 6 and 9 months after the event (Dunmore et al., 2001). In the same sample, perceived negative responses of others significantly predicted PTSD severity at both follow-ups. Processing during the traumatic event (noted in 1.5.1.2; fixed predictors), such as

mental defeat and lack of self-referential processing, can contribute to such negative appraisals (Ehlers & Clark, 2000).

Dysfunctional behaviours and cognitive strategies, such as rumination, maladaptive responses to intrusions, ongoing dissociation or avoidance are also related to the prediction of PTSD. These strategies are often intended to control existing symptoms or the sense of current threat (Ehlers & Clark, 2000). Rumination is defined as repetitive, self-focused, negative thinking about past experiences (e.g. Nolen-Hoeksema, 1991; Papageorgiou & Wells, 2003) such as the traumatic event. Rumination was among the strongest predictors of subsequent PTSD symptoms in survivors of motor vehicle accidents (MVAs) (Ehlers et al., 1998; Ehring, Frank, et al., 2008; Murray et al., 2002; Steil & Ehlers, 2000), emergency workers (Clohessy & Ehlers, 1999; Razik et al., 2013) and assault survivors (Kleim et al., 2007; Michael et al., 2007). One prospective study of assault survivors found that certain characteristics of rumination predicted PTSD 6-months later, among them, 'why' and 'what if' questions (Michael et al., 2007). This characteristic, also referred to as 'abstract thinking' will be discussed in more detail in section 1.6. and chapters 3 and 4. In the study by Michael and colleagues (2007) characteristics of rumination explained more variance of PTSD than the presence of rumination alone.

Maladaptive responses to intrusive memories also predict PTSD (Ehlers et al., 1998; Freeman et al., 2013; Kleim et al., 2012). In a longitudinal study of MVAs, negative interpretations of intrusions at 3 months was one of the strongest predictors of PTSD symptoms at 1 year (Ehlers et al., 1998). Experiencing intrusive memories with a sense of 'nowness' (as if they are happening in the here and now) (Duffy et al., 2013; Dunmore et al., 2001; Michael et al., 2005) and strong distress associated with intrusions also predicted PTSD (Mayou et al., 1993; Steil & Ehlers, 2000). In multiple

studies, the attempts to suppress intrusive memories was associated with later PTSD severity (Clohessy & Ehlers, 1999; Duffy et al., 2013; Ehring, Ehlers, et al., 2008).

Another important predictor appears to be persistent post-trauma dissociation: Dissociation four weeks after a road traffic accident predicted chronic PTSD 6 months later (Murray et al., 2002) which is in line with studies that have found ongoing dissociation to predict PTSD (Ehring, Ehlers, et al., 2008; Halligan et al., 2003; Kleim et al., 2012). Finally, dysfunctional behaviours aimed to control symptoms such as avoidance and safety-seeking significantly predicted PTSD severity (Dunmore et al., 2001; Ehring, Ehlers, et al., 2008; Nash et al., 2015; Razik et al., 2013).

Some studies have assessed all of these cognitive factors together and found them to be highly predictive of PTSD: in a sample of survivors of a bombing, six cognitive variables from Ehlers and Clark's model accounted for 63% of PTSD variance 9 months later (Duffy et al., 2013). These six variables were: negative beliefs about oneself and the symptoms of PTSD, beliefs about the world being an unsafe place, rumination, thought-emotion suppression, nowness of the memory and a muddled memory. In a prospective study comparing different predictors of PTSD in a sample of assault survivors, Kleim and colleagues (Kleim et al., 2007) found that the best predictors were four cognitive variables based on Ehlers and Clark's model, specifically mental defeat during the trauma, negative appraisals of the self and of PTSD symptoms, 'nowness' of intrusive trauma memories, and rumination about the trauma. Finally, in a recent path analysis, taking into account the most comprehensive set of Ehlers and Clark's proposed cognitive variables so far, Beierl and colleagues (Beierl et al., 2019) found that their path analytic models explained 52% of the variance in PTSD symptom severity 6 months after the traumatic event. Across studies, cognitive factors seem to be more accurate predictors of PTSD symptoms and severity than initial PTSD symptoms

or Acute Stress Disorder (ASD) (Beierl et al., 2019; Ehlers et al., 1998; Ehring, Ehlers, et al., 2008; Freeman et al., 2013; Kleim et al., 2007, 2012, 2012; Shalev, 1992).

Interventions that address malleable risk factors and predictors may help to prevent the development of PTSD, especially in groups known to be at high risk for PTSD such as emergency workers. Part of the current thesis focuses on better understanding and assessing rumination in student paramedics. Rumination is characterised by more abstract and less concrete thinking which will be reviewed in detail in the following section.

1.6 Concrete and Abstract Thinking

1.6.1 Introduction

Rumination is a significant malleable risk factor and predictor of PTSD. As previously defined, rumination refers to repetitive, self-focused, negative thinking about past experiences (e.g. Nolen-Hoeksema, 1991; Papageorgiou & Wells, 2003). This definition is closely related to the concept of worry which is repetitive thinking about potential negative events (e.g. Borkovec et al., 1998). Based on these definitions, the only difference between the two concepts is that rumination is past-oriented and worry is future-oriented. Some literature considers rumination as well as worry to be part of the larger umbrella concept of repetitive negative thinking (RNT; Ehring & Watkins, 2008; McEvoy et al., 2010; J. M. Smith & Alloy, 2009; Watkins, 2008; Watkins & Moulds, 2005, 2007). Although different definitions of RNT exist, all include repetitive thoughts that are uncontrolled, focused on negative content and difficult to disengage from (Ehring & Watkins, 2008). This is supported by the findings that rumination and worry are highly correlated with each other (Beck & Perkins, 2001; Fresco et al., 2002; Segerstrom et al., 2000).

In the literature, rumination is most commonly shown as a predicting and maintaining factor of major depression (Broderick & Korteland, 2004; Nolen-Hoeksema, 2000; Nolen-Hoeksema et al., 1994, 2007; Robinson & Alloy, 2003). Rumination has also been associated with the risk (Wild et al., 2016), prediction (Ehlers et al., 1998; Kleim et al., 2007; Michael et al., 2007) and maintenance of PTSD (Ehring, Frank, et al., 2008; Mayou et al., 2002). Worry, on the other hand, has historically been associated with the prediction and maintenance of anxiety and is a hallmark symptom of generalised anxiety disorder (GAD; American Psychiatric Association, 2013). Since the concepts of rumination and worry have emerged in the literature in distinct research domains, the majority of research available still assesses them separately. However, some researchers have demonstrated that worry and rumination are transdiagnostic processes underlying multiple disorders (Gruber et al., 2008; Mansell et al., 2008; McLaughlin & Nolen-Hoeksema, 2011; Nolen-Hoeksema et al., 2008) or that RNT specifically is a transdiagnostic factor underlying various disorders including depression, GAD, PTSD and obsessive-compulsive disorder (Ehring et al., 2011; Ehring & Watkins, 2008; Kircanski et al., 2015; McEvoy et al., 2010, 2013; Segerstrom et al., 2000; Wahl et al., 2019). This has been supported by structural equation modelling and factor analyses showing evidence of a single RNT factor (Arditte et al., 2016; Hur et al., 2017). Researchers further argue that rumination and worry not only share commonalities but that different forms of RNT are characterised by the same processes of reduced concreteness and increased abstract thinking (Ehring & Watkins, 2008).

1.6.2 Defining Concrete and Abstract Thinking

Initial empirical evidence for the relationship between reduced concreteness and RNT stems from research by Stöber and his colleagues who developed the ‘theory of

reduced concreteness' in reference to anxious worry (Stöber, 1998, 2000; Stöber & Borkovec, 2002). They defined concrete thinking as 'distinct, situationally specific, unequivocal, clear and singular' and abstract thinking as 'indistinct, cross-situational, equivocal, unclear and aggregated.' Building on this, Watkins and his team suggested that the theory of reduced concreteness can similarly be applied to depressive rumination (e.g. Watkins, 2008; Watkins, Moberly, & Moulds, 2008). In Watkins' research, the two processing modes are defined as an 'abstract, verbal–analytical, evaluative variant, consistent with the phenomenology of depressive rumination focusing on causes, meanings, and consequences of symptoms and feelings' and a 'concrete, experiential variant, inconsistent with the phenomenology of depressive rumination focusing on the experience of their symptoms and feelings' (Watkins, 2009; Watkins et al., 2008).

Vallacher and Wegner point out that this abstract thinking is not to be confused with the traditional difference between more abstract and more concrete thinking where any action (e.g. voting) can be thought of in a specific, concrete way (e.g. marking a ballot) or a general, abstract way (e.g. influencing the election) (1989; Kross, Ayduk, & Mischel, 2005). Instead, abstract and concrete thinking is seen in the context of dysfunctional, repetitive negative thinking.

Drawing on the existent literature, in this thesis, concrete thinking is defined as thinking that is focused on 'how' an event is happening, on the direct experience and means to desired ends (e.g., steps needed to achieve a goal). For example: 'How can I best learn from my mistake? What is the first step I can take to solve this problem?' Abstract thinking is defined as being characterized by generalised thoughts focused on 'why' and 'what if' questions with no obvious answer, on causes, meanings and consequences. For example: 'Why is this always happening to me? What if I never get

it right?' This definition is in accordance with previous literature on concrete and abstract thinking (Strack et al., 1985; Trope & Liberman, 2003; Vallacher & Wegner, 1989; Watkins, 2008; Watkins et al., 2008; White & Wild, 2016).

1.6.3 Abstract Thinking and Worry

Over the past 30 years, a number of studies have highlighted the association between anxiety-related worry and abstract thinking. On the forefront of this was Joachim Stöber with his 'theory of reduced concreteness of worry' (Stöber et al., 2000) who developed a questionnaire of concrete and abstract thinking: the Problem Elaboration Questionnaire (PEQ; Stöber, 1998; Stöber & Borkovec, 2002). Across studies, problem elaborations (using the PEQ or 'catastrophising interviews') were significantly less concrete when participants worried a lot about the problems compared to those they didn't worry about (McGowan et al., 2017; Stöber et al., 2000). Researchers therefore argued that worry is characterised by abstract thinking (Goldwin & Behar, 2012; Stöber, 2000; Stöber & Borkovec, 2002) which in turn maintains worrisome thoughts because abstract worries are harder to correct by external experiences and fear-incongruent information than concrete worries (Foa & Kozak, 1986; Stöber, 1998).

These hypotheses were supported by studies in clinical anxiety. Stevens and colleagues (2018) found that participants with high GAD symptoms who were asked to worry generated significantly more abstract predictions of their worries (as measured by the PEQ) than participants with low GAD symptoms. Similarly, the problem elaborations (PEQ) of a clinical sample with GAD were more abstract than those of a non-clinical control group (Stöber & Borkovec, 2002) but became significantly more concrete after cognitive behavioural therapy (CBT) treatment. First studies have tested

concreteness training as a therapeutic intervention. After a 4-week guided, self-help concreteness training, palliative care patients experienced a greater reduction of anxiety than a waitlist control (Galfin et al., 2012).

1.6.4 Abstract Thinking and Rumination

Building on this research of worry, Watkins and colleagues applied the theory of reduced concreteness to depressive rumination (Watkins & Moulds, 2005, 2007). Experimentally inducing worry or rumination in students both lead to greater abstract thinking (using the PEQ rating scale) compared to baseline thinking (Goldwin & Behar, 2012). Research on abstract rumination was immediately extended to clinical populations and tested for its use in therapeutic interventions, always measuring concreteness using the PEQ. A pilot study found that participants with depression showed reduced concreteness in problem elaboration compared to participants who had previously or never been diagnosed with depression (Watkins & Moulds, 2007). Watkins and his colleagues developed Rumination Focused CBT (RFCBT; Watkins et al., 2007) in order to directly address abstract rumination as a mechanism maintaining psychopathology. This focused on modifying the *process* of thinking from abstract to concrete, compared to standard CBT for depression which emphasises modifying the *content* of thoughts. Case studies (N=14) found significant improvement in rumination and depression symptoms following RFCBT. Watkins and colleagues (Watkins et al., 2009) further tested concreteness training as a facilitated self-help intervention. Participants were thereby instructed to focus on sensory details ("what"), specific context and exact next steps to take ("how"). In participants with dysphoria, this lead to an increase in concrete thinking and greater decrease in rumination than a no-intervention waitlist control, and a greater decrease in depression symptoms than a

placebo intervention and the waitlist control. In a randomised controlled trial of a clinical population with major depression (Watkins et al., 2012), the same facilitated self-help concreteness training plus treatment as usual (TAU) significantly increased concreteness and decreased rumination and overgeneralisation compared to a relaxation control training plus TAU. Both trainings decreased depression symptoms at post-intervention and 6-month follow-up compared to TAU only. A recent randomised controlled trial found internet-based RFCBT to decrease the risk of depression by 34% relative to usual care (L. Cook et al., 2019). Watkins and colleagues concluded that rumination is maladaptive and unconstructive when characterised by abstract, evaluative thinking which is implicated in the onset and maintenance of depression (Rimes & Watkins, 2005; Watkins, 2008, 2009; Watkins et al., 2009) and predicts poorer long-term outcomes (Watkins & Moulds, 2005).

Initial research has linked abstract thinking to PTSD and PTSD related symptoms. Abstract thinking after a trauma analogue film led to a significantly longer maintenance of negative mood and arousal than concrete thinking and distraction (Ehring, Szeimies, et al., 2009). Abstract processing during an analogue trauma film increased rumination while concrete processing did not show this relationship (Schaich et al., 2013). As noted in section 1.5.3, a study examining features of rumination, found that 'why' and 'what if' questions were among specific characteristics that predicted PTSD more accurately than the mere presence of rumination (Michael et al., 2007). Combining the frequency of rumination and abstract thinking predicted PTSD better than rumination alone (Ehring, Frank, et al., 2008).

Only a few studies did not support the relationship between abstract thinking and psychopathology (Kircanski et al., 2015; Wahl et al., 2019). Using their own 4-item measure of abstractness, Wahl and colleagues did not find greater abstractness in

clinical groups compared to community control groups. Kircanski and colleagues, who asked participants to rate their own abstractness and concreteness when prompted, did not find greater abstractness during rumination. However, given the limitations of relying on self-assessment for ratings of the abstractness or concreteness of one's thoughts, the authors believed it would be premature to reject the theory of maladaptive abstractness in RNT based on these findings.

Overall, there appears to be strong support for the role of abstract thinking in rumination but our understanding of abstract thinking in the context of PTSD is still limited. The current thesis aims to measure and better understand concrete and abstract thinking and its relationship with PTSD (see Chapters 3 and 4).

1.7 Intrusive Memories

This section will give an overview of intrusive memories: what they are, the cognitive theory underlying their development, how they predict PTSD and how they are related to ruminative thinking.

1.7.1 Defining Intrusive Memories

Distressing, intrusive memories are hallmark symptoms of PTSD. They are spontaneous memories that come to mind when they are not deliberately recalled (Brewin et al., 2010). They are sensory experiences, most commonly visual memories, but can take other forms such as hearing sounds or experiencing physical reactions or emotions similar to those experienced during the traumatic event (Ehlers et al., 2002; Ehlers & Steil, 1995). Intrusive memories are part of the re-experiencing symptoms that make up PTSD (American Psychiatric Association, 2013). Other re-experiencing symptoms included in this cluster are distressing dreams and flashbacks (dissociative

reactions in which individuals feel as if the traumatic event is recurring). Intrusive memories are highly distressing (American Psychiatric Association, 2013) and often experienced as happening in the 'here and now' (nowness) instead of as a memory of the past (Ehlers et al., 2004; Hackmann et al., 2004).

1.7.2 Cognitive Theory of Intrusive Memories in PTSD

There are different cognitive theories behind the occurrence of intrusive memories, related to how information is processed. The Ehlers and Clark cognitive model of PTSD proposes that there is strong perceptual priming (implicit memory) for stimuli that were temporarily associated with the trauma during the traumatic event (e.g. bright headlights during a motor vehicle accident). There is a reduced perceptual threshold for these stimuli after the trauma so they more easily trigger the trauma memory. Implicit memories, such as these stimuli, are not well discriminated from other memories (Baddeley, 1997) and are therefore more easily triggered through vague similarities (e.g. bright light from a torch could trigger vivid memories of the headlights). Because of this poor stimulus discrimination, neutral stimuli in daily life are perceived as similar to those during the traumatic event. Techniques that teach stimulus discrimination have therefore been successful in reducing intrusive memories in patients receiving cognitive therapy for PTSD. Chapter 5 will discuss and evaluate stimulus discrimination in an analogue trauma experiment.

Ehlers and Clark (2000) also suggest that trauma memories are not fully elaborated or integrated into individuals' autobiographical memory and into the context of time, place, preceding and subsequent information (Ehlers et al., 2004). For example, individuals may experience the memories as being in the 'here and now' (nowness) or fail to link them to subsequent information (e.g. "I survived, I'm safe now"). If fully

elaborated, this could inhibit the triggering of intrusive memories (Conway & Pleydell-Pearce, 2000). The lack of elaboration may help to explain the sense of 'nowness' and current threat.

Intrusive memories often represent stimuli that were present shortly before the traumatic event or shortly before moments with the strongest emotional impact. (e.g. car headlights right before impact or realising that they couldn't move their legs) (Ehlers et al., 2002; Holmes et al., 2005). Through temporal association with the traumatic event, these stimuli can be understood as 'warning signals' that help warn the individual of impending danger. (Ehlers et al., 2002; Speckens et al., 2007). This, combined with the sense of 'nowness' described above can help explain why intrusive memories induce a sense of current threat and danger (Ehlers & Clark, 2000). Associative learning sets expectations of what is likely to happen (e.g. danger) and triggers the corresponding emotions so that behavioural responses can be quickly activated. Individuals may experience the emotional response associated with the trigger and may not even be aware that their emotional reaction is due to the trigger linked to the traumatic event (referred to as 'affect without recollection') (Ehlers et al., 2004). In summary, according to Ehlers and Clark, perceptual priming connected to poor trigger discrimination, a lack of elaboration and associative learning contribute to the development and maintenance of intrusive memories.

1.7.3 Intrusive Memories as a Predictor of PTSD

Re-experiencing symptoms immediately after a traumatic event are considered a natural response (Eberly et al., 1991). Most people naturally process the trauma and incorporate it into their autobiographical memory. Researchers therefore agree that symptoms immediately after the trauma such as acute stress disorder (ASD, symptoms

lasting less than a month; American Psychiatric Association, 2013), are not the best predictors of PTSD (e.g. Kleim et al., 2007). Instead, re-experiencing symptoms that persist more than a month seem to predict long-term PTSD.

Specific characteristics of intrusive memories seem to be a strong predictor of PTSD severity (Ehlers & Steil, 1995). The distress associated with intrusive memories and their 'nowness' are consistent predictors of PTSD (Ehlers & Steil, 1995; Michael et al., 2005). For example, two studies of assault survivors (Michael et al., 2005) explored which characteristics of intrusive memories predict PTSD: The presence of intrusive memories only explained 9% of the variance of PTSD severity 6 months after the assault. However, the distress caused by the intrusions, their 'nowness', and their lack of a context explained 43% of the variance of PTSD severity. Another study assessed survivors of road traffic accidents and found that the initial distress of intrusive memories predicted PTSD severity 12 months later (Mayou et al., 1993).

1.8 The Link Between Intrusive Memories and Rumination

While rumination is repetitive, negative and circular thinking, often of extensive duration (Newby & Moulds, 2012; Nolen-Hoeksema, 1991), intrusive memories are involuntary, predominantly sensory experiences of short duration (Speckens et al., 2007). Understanding the difference between intrusive memories and rumination is of clinical importance as they affect each other and require different therapeutic and preventative interventions. The literature demonstrates that intrusive memories increase rumination and vice versa (Newby & Moulds, 2012). These relationships will be discussed in the following sections.

1.8.1 Intrusive Memories Increase Rumination.

Intrusive memories often prompt individuals to ruminate about the traumatic event (Ehlers & Clark, 2000). Once the memory has come to mind, it may be difficult to disengage from it again. For example, individuals may dwell on why the event happened to them, how it could have been avoided or how life would have been better if the trauma had never occurred (Michael et al., 2005; Steil & Ehlers, 2000). Rumination is considered a common but unhelpful strategy to attempt to cope with intrusive memories (Clohessy & Ehlers, 1999). For example, assault survivors with PTSD indicated that they more frequently used rumination to try to get rid of intrusive memories, compared to survivors without PTSD (Michael et al., 2007). Rumination may also maintain negative appraisals about the trauma such as 'the world is unfair.' By ruminating, individuals are stuck in a repetitive, negative cycle which prevents memories being elaborated and integrated into the individual's autobiographical memory base (Ehlers & Clark, 2000).

1.8.2 Rumination Increases Intrusive Memories.

Engaging in rumination may provide internal retrieval cues that trigger unwanted trauma memories (Ehlers & Clark, 2000). For example, assault survivors with PTSD reported more frequently than survivors without PTSD that rumination triggered intrusive memories about their assault (Michael et al., 2007). Rumination may represent a form of cognitive avoidance which prevents the processing of the trauma memory so that memories continue to intrude (Ehlers & Clark, 2000; Ehlers & Steil, 1995; Watkins, 2004; Williams & Moulds, 2007). One study (Ehring, Fuchs, et al., 2009) tested the effects of rumination on intrusive memories, using distressing non-traumatic life events as trauma analogues (e.g. a serious relationship breakup, the illness of a

loved one). Participants were randomly assigned to either a rumination task (64-item questionnaire of typical ruminative thoughts e.g. why did this happen to me?) or distraction task (general knowledge questionnaire). Participants instructed to ruminate displayed more intrusive memories than participants who used distraction. These findings are supported in a structural equation model which showed that maladaptive coping strategies, including rumination, directly predicted intrusive memories (Regambal & Alden, 2009).

1.8.3 Concrete and Abstract Thinking Related to Intrusive Memories

Many studies have assessed or facilitated rumination through inducing abstract thinking. In one study (Santa Maria et al., 2012) participants were instructed to write about a distressing life event they had experienced, either in an abstract-evaluative ('Why did it happen? Why didn't I behave differently?) or a concrete-experiential way (How did I feel during the event? What exactly can I do to deal with such a situation differently in the future?). Intrusive images and sounds significantly decreased in the concrete thinking group after the writing activity but remained the same in the abstract thinking group. Concrete thinking also led to a significantly greater reduction in intrusive memories compared to abstract thinking 36 hours later. A similar relationship between abstract thinking and intrusive memories could be seen after a non-traumatic induced experience of failure. Writing down more abstract-analytical thoughts in response to the question 'why did you feel this way?' compared to concrete-experiential writing 'how did you feel moment-by-moment' led to more intrusive memories in high trait ruminators (Watkins, 2004).

The majority of studies examining the effects of ruminative, abstract thinking on intrusive memories have done so in a controlled setting using trauma analogue

experiments, specifically trauma films (for reviews see Holmes & Bourne, 2008; E. L. James et al., 2016). Such studies using trauma films have repeatedly found that rumination increased intrusive memories. A study (Zetsche et al., 2009) examined the effects of rumination on mood and intrusive memories after exposure to a trauma film of real-life road traffic accidents. Some of the 101 participants were instructed to ruminate after the film by asking 'why' and 'what if' questions about the film. Others were asked to integrate the memory of the film by thinking about the film chronologically and discriminating between the film and their own road traffic memories. The third group was distracted with a mental quiz. As predicted, participants who were instructed to ruminate scored higher on a self-reported measure of intrusions. An exploratory analysis indicated that increased rumination correlated with increased intrusion frequency across all conditions. A similar study (Ball & Brewin, 2012) asked participants to ruminate using 'why' and 'what if' questions either about an analogue trauma film or an unrelated topic (the financial crisis), immediately after the film and daily for 5 minutes for the remainder of the week. These groups were compared to each other and a non-rumination control group. As predicted, both rumination groups reported more intrusive memories compared to the control group but frequency did not differ between the rumination groups.

The same results as these cognitive responses to intrusions could be found in verbal and written processing of a trauma film. A study (Luo et al., 2013; experiment 1) assessed the effects of different verbal processing on intrusive memories after an analogue trauma film of a traffic accident. Participants verbally described the film either in an abstract way with a why-focus ('why did the traffic accident occur'), or in a concrete way with a what-focus ('what happened to the people in the film') or a no-narration task. In line with other studies, ruminative why-focus led to a greater number

of intrusive memories compared to the what-focused or no-narration group. Similarly, in a different study, participants who read concrete statements about an accident experienced fewer intrusive memories compared to participants who read unrelated statement and compared to participants who read abstract, ruminative statements (Ehring, Szeimies, et al., 2009).

This directional effect was also found in studies that induced rumination during an analogue trauma instead of afterwards (Ehring, Szeimies, et al., 2009; White & Wild, 2016). To assess the effects of trait rumination and intrusive memories, participants were trained in either an abstract or a concrete thinking before watching a trauma film depicting sexual violence (Irreversible; Noé, 2003). As hypothesized, abstract thinking but not concrete thinking related to the number, vividness and distress of intrusive memories (Schaich et al., 2013). The authors suggest that concreteness may buffer against the negative effects of rumination on PTSD. However, since the findings were only correlational, no causal conclusions could be drawn. In a similar study by White and Wild (2016), healthy students who thought more abstractly during an analogue trauma film reported more intrusive memories than participants who applied more concrete thinking. This suggests that concrete thinking styles can be trained and have the potential to be used preventatively as they may protect against the development of intrusions.

Only a few studies did not find this clear relationship between abstract, ruminative thinking and increased intrusive memories. One study (Ehring, Szeimies, et al., 2009) found that distraction (reading about a trip and answering questions about it), after a trauma analogue film, led to the greatest number of intrusions and concrete thinking led to significantly fewer intrusions than distraction. However, different than hypothesised, there was no difference between abstract and concrete thinking. The

authors offer multiple explanations for the unexpected findings: In the distraction group, no further processing of the analogue trauma took place while participants in the abstract and concrete thinking group were instructed to think about the trauma, which might have aided the processing and decreased intrusions. Another explanation could be that their definition of concrete and abstract thinking differed from Watkins' definition (Watkins, 2008) used in most of the recent literature that found that rumination leads to increased intrusive memories. Despite this, there remains overwhelming consistency in studies that suggest that ruminating and thinking more abstractly contributes to an increase in intrusive memories.

In summary, the literature suggests that rumination and intrusive memories are closely related and influence each other's frequency. Understanding this relationship is essential when investigating or targeting these processes in relation to the prevention of PTSD. Three chapters are dedicated to better understanding rumination and intrusive memories in student paramedics: Chapter 3 describes the validation of a new measure of concrete and abstract thinking. Chapter 4 assesses how this new measure correlates with and predicts PTSD symptom severity. Chapter 5 induces intrusive memories through an analogue trauma film to evaluate a technique to decrease intrusive memories and assess rumination in response to intrusions. Since this thesis takes a two-pronged approach to addressing poor mental health in student paramedics, one chapter (Chapter 2) is dedicated to investigating a simple tool to improve general wellbeing in this population.

2 Chapter 2: Daily Planning Ahead to Improve the Mental Health of Student Paramedics: A Randomised Controlled Experiment

2.1 Introduction

Rates of mental health problems amongst young adults (aged 20-24) have dramatically increased over the past 10 years (Thorley, 2017) with university students suffering higher rates of mental health problems than the general population (Ibrahim et al., 2013; Macaskill, 2013; Stallman, 2008; Stewart-Brown et al., 2000; Thorley, 2017). University students also experience high rates of emotional distress, often related to worries concerning study or work problems, or financial issues (Stewart-Brown et al., 2000). Such emotional distress may contribute to mental health problems or exacerbate existing mental health symptoms (Andrews & Wilding, 2004). Academic stress and poor mental health have a significant impact on students' wellbeing (Ansari et al., 2011; Cooke et al., 2006; Denovan & Macaskill, 2017; Ibrahim et al., 2013), physical health (Ansari, Oskrochi, & Haghgoo, 2014; Opoku Acheampong et al., 2017) and academic performance (Andrews & Wilding, 2004; Harvey et al., 2011; Hysenbegasi et al., 2005). University students appear to experience lower wellbeing than young adults as a whole, and their wellbeing has decreased compared to previous years (Thorley, 2017). Students training to be paramedics may be at particular high risk of developing mental health problems since they experience the daily stressors linked to the demands of university as well as the role of a paramedic. Wild et al. (2016) found that 10% of a sample of 453 student paramedics developed PTSD or major depression within the first two years of training. Simple tools that aim to reduce psychological distress may improve overall

wellbeing for this young population and may have a role in reducing risk for mental ill health over time.

2.1.1 Planning Ahead

Multiple studies report poor time management as one of the strongest contributing factors to stress (Souza et al., 2016; Wolf et al., 2015). Interventions that aim to teach strategies to manage time may reduce levels of psychological distress and improve wellbeing. Planning ahead is a strategy in which individuals are taught to plan their next day, often including an enjoyable activity in their plan. Research suggests that planning ahead may demonstrate multiple benefits. These are discussed below.

2.1.2 Psychological Distress

In a randomised controlled trial of arts and science students, Meier (2014) found that daily planning ahead was more effective in reducing psychological distress than a positive attribution exercise ('Three Good Things'; Seligman, Steen, Park, & Peterson, 2005). Holland (2017) found that daily planning ahead significantly reduced psychological distress compared to a bibliotherapy exercise and a waitlist control. All effects were maintained at 3-week follow-up. Planning ahead may reduce psychological distress by increasing participants' perceived control over time which has been shown to mediate the relationship between time management and wellbeing (Claessens et al., 2004; Jex & Elacqua, 1999; Macan, 1994).

Time management has been included into broader stress management interventions which have been shown to reduce subjective stress levels (Light & Bincy, 2012; Ridge et al., 2011; West et al., 1984; Zetterqvist et al., 2003), as well as reduce the stress hormone cortisol (Iglesias et al., 2005). One study found that stress

management training (planning ahead, time-management, problem solving and relaxation techniques) only reduced stress, as measured by the General Health Questionnaire (GHQ; Goldberg & Williams, 1988), if scores were clinically significant at the start of the intervention (Gardner et al., 2005). However, it is important to bear in mind that these studies evaluated stress management as a whole and thus, it is difficult to draw conclusions about time management techniques per se. Further, since the researchers failed to compare their interventions to a control group, we cannot be confident whether the observed changes were due to the stress management intervention, non-specific factors or to the passage of time. One randomised controlled trial of an evidence-based time management intervention (which included prioritising, goal setting, structuring the day and self-monitoring) showed that training in time management decreased perceived stress (which the authors referred to as 'increased wellbeing') compared to a no training control group (Häfner & Stock, 2010). However, Kearns and Gardier (2007) reported that the planning and organising aspects of time management correlated with perceived work effectiveness but did not reduce work-related stress. This discrepant finding may be due to the failure to use validated measures of time management, which makes it difficult to compare to studies which have used validated measures. It may also be a result of the authors' focus on work-specific rather than overall stress.

2.1.3 Wellbeing

Tennant and colleagues, who developed the widely used Warwick-Edinburgh Mental Wellbeing Scale (WEMWBS; Tennant et al., 2007), defined wellbeing to include positive affect (feelings of optimism, cheerfulness, relaxation), satisfying interpersonal relationships and positive functioning (energy, clear thinking, self-

acceptance, personal development, competence and autonomy). Although Meier (2014) and Holland's (2017) studies did not demonstrate improvements in wellbeing through planning ahead, possibly since wellbeing scores were above the population mean (McManus, Bebbington, Jenkins, Brugha, et al., 2016) at the outset, planning ahead may nevertheless have potential to improve wellbeing. If planning ahead decreases stress, this may improve positive emotions and wellbeing (Zhang & Zheng, 2017). The inclusion of an enjoyable activity in a daily plan may also improve wellbeing since leisure activities have been shown to increase happiness and wellbeing (Kaya, 2016; Zhang & Zheng, 2017). Research supports the benefits of time management for wellbeing. In a sample of university students, Bond and Feather (1988) found that greater 'time structuring' (students perceiving their time to be structured and purposive) was related to a greater sense of purpose in life, self-esteem, general health and optimism about the future. Participants who engaged in planning ahead in a study by Macan et al. (1990) reported improvements in life satisfaction. Similarly, one study showed that greater use of time management strategies was associated with lower levels of emotional exhaustion (Peeters & Rutte, 2005).

2.1.4 Mindfulness

Brown and Ryan (2003) developed the Mindful Attention Awareness Scale (MAAS), a self-report measure designed to assess different aspects of mindful attention, such as awareness of one's emotions as they are experienced, and the capacity to focus on what is taking place in the present moment. They define mindfulness as attention to and awareness of what is occurring in the present. Holland (2017) found that planning ahead increased levels of self-reported mindful attention, not only compared to a no-intervention control group but also compared to bibliotherapy. Planning one's day can

include breaking down large tasks and assigning specific times to activities. As individuals have already decided what comes next, they do not need to expend extra cognitive effort in thinking or worrying about their next activities. Instead, their mind is free to focus on the here and now and may therefore be more mindful and aware of the moment.

2.1.5 Worry

Meier (2014) and Holland (2017) found a significant relationship between planning ahead and reductions in psychological distress in their samples of students. It is possible that planning ahead may reduce psychological distress by reducing levels of worry although this is yet to be assessed. When students make plans for the next day, this may reduce levels of worry associated with revision, exams and meeting deadlines. It is also possible that planning ahead facilitates concrete (rather than abstract thinking associated with worry) since making plans may lead to a focus on specific steps needed to achieve a goal. This hypothesis is in line with the broader literature that suggests that time management may influence worry. One study, using a quasi-experimental design, tested time management training (planning and prioritising) in office employees and found that participants showed less worry after training compared to a control group (Van Eerde, 2003). Kelly (2003) reported that greater perceived structure and purpose of time was associated with less worry. Kelly suggests that the reason for these findings may be that creating structure and order of time is likely to decrease uncertainty which may reduce worry (Dugas et al., 2001).

2.1.6 Limitations of Existing Literature

There are various limitations to the current literature on planning ahead and time

management which need to be taken into consideration when interpreting the findings. First, almost all of the studies merged multiple techniques into one broad time management assessment or training programme which included techniques such as planning ahead, goal setting and prioritising. It is therefore impossible to discern which time management techniques led to mental health improvements or whether the findings were due to the combined use of multiple time management techniques. Second, most studies were cross-sectional which highlighted relevant correlations but were unable to make inferences about the causal effects of time management. More longitudinal studies are needed to assess the causal effects of time management. Third, of the few experimental studies available, many lacked comparisons with a control group which left it unclear whether changes were due to the intervention. More studies assessing interventions not only within participants but between groups are needed. Finally, it is important to note that many measures and time management trainings were not based on empirical evidence. Measures were created for the purpose of the studies. However, definitions of time management varied, and reliability and validity were weak. Many of the definitions relied on common sense, clinical experience, or popular self-help literature. Methodologically sound studies are needed to examine the impact of specific time management techniques.

The current study aimed to address these limitations by assessing the specific time management technique of daily planning ahead instead of time management in general. Compared to the majority of studies in this field, the study adopts a randomised controlled design. This allows a comparison of daily Planning Ahead with an alternative intervention (reading about mental health) and a waitlist control to assess whether or not any observed effects are superior to psychoeducation and whether or not any observed effects are due to the intervention rather than the passage of time. The study tests

relevant psychological measures such as wellbeing, psychological distress, mindfulness and worry using well validated and widely used measures. Finally, the current study aimed to assess the potential benefits of planning ahead in student paramedics, a population likely to be at higher risk of stress and mental ill health than university students in standard programmes. To the author's knowledge, this is the first study to assess the effects of daily planning ahead on mental health in this population.

2.1.7 Hypotheses

The primary hypothesis is that Planning Ahead will lead to greater improvements in self-reported wellbeing and mindfulness, and greater reductions in psychological distress and worry, compared to the Reading and Waitlist interventions at post-intervention. The secondary hypothesis is that effects on mental health will be maintained from post intervention to follow-up. That is, all three groups (Planning Ahead, Reading and Waitlist) will maintain their post-intervention/post-wait levels of wellbeing, psychological distress, mindfulness and worry.

2.2 Methods

2.2.1 Sample Size

A power analysis was conducted based on the results of Meier (2014), which compared Planning Ahead to a 'three good things' control intervention and a waitlist group, with changes in wellbeing as the primary outcome. She had not found a significant change in wellbeing, with a medium effect size of f=0.317. Based on the hypothesis that planning ahead would demonstrate greater change in wellbeing compared to reading, and with an α error probability of .05 and power of .80, using G*Power, the total required sample size was estimated to be N=81 participants.

2.2.2 Participants

All participants were British student paramedics and were recruited through a short in-person presentation to the paramedic programmes at the different universities (listed in Table 1). Participation in the study was on a voluntary basis and participants received no remuneration.

Table 1
Number of participants at randomisation (N=82)

University	Number of participants randomised
Anglia Ruskin	25
Brighton	14
Brookes	7
Portsmouth	8
Surrey	16
The West of England	9
Wolverhampton	3
Total	82

Figure 2 shows the flow of participants through the study. Originally, 274 participants registered interest by signing up to receive more information and the participant information sheet. Following this, 103 students signed up for the study, gave their consent and completed screening measures. All participants were screened for PTSD and depression using the PTSD checklist for DSM-5 (PCL-5; Blevins, Weathers, Davis, Witte, & Domino, 2015) and the Patient Health Questionnaire (PHQ-9; Kroenke & Spitzer, 2002). Twenty participants scored above 39 on the PCL-5, above the cut-off of 9 on the PHQ-9 or or indicated suicidal ideations (PHQ-9 item 9) and were called for an individual risk assessment. The cut-off for the PCL-5 was in line with recommendations at the time of the study, by the Veterans Association's National Center for PTSD who developed the scale. The recommendations have since changed to

a cut-off of 33. If participants were currently receiving cognitive behavioural therapy (CBT) treatment, or indicated that they would like to start treatment during the time of the study, they were excluded from the study and signposted to appropriate services. After individual risk assessments and with the approval of a clinical psychologist, 15 of these 20 students were included in the study. The remaining five participants were excluded from participating because they were receiving CBT at the time. Thirteen participants dropped out without reason (non-response) or withdrew due to other commitments. Eighty-five participants completed the baseline with three further participants withdrawing at this point because of the demands of university work. The remaining 82 participants were randomly allocated to the three intervention groups on a 1:1:1 ratio: Planning Ahead (n=29), Reading (n=25), and Waitlist (28). Randomization was stratified by gender using minimisation.

Of the 82 randomised participants, 34 (41.5%) were male and 48 (58.5%) were female. The majority, 76 students (92.7%), were White British, three individuals (3.6%) had another White background and the remaining 3 students (3.6%) were White-mixed (White & Asian/Black African/Caribbean). The mean age was 27.8 (SD = 8.57) with a median of 25 and a mode of 21.

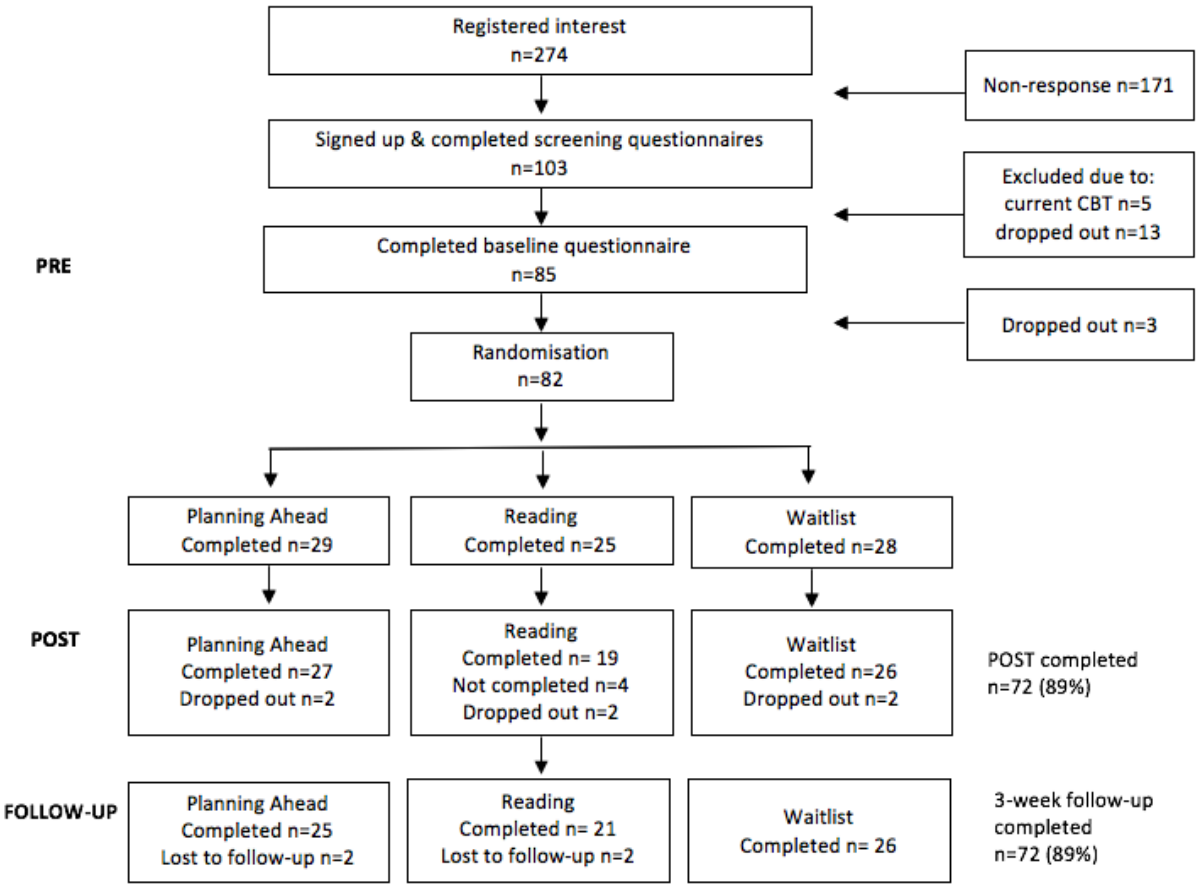


Figure 2. Trial profile showing participant flow at each timepoint by intervention group (Planning Ahead, Reading and Waitlist).

2.2.3 Primary Outcome Measures

Qualtrics software was used collect data online from participants. The same measures of wellbeing, psychological distress and mindfulness as in Holland (2017) were used to allow for comparison, with the addition of a measure of worry. As in Holland's (2017) study, outcome measures were collected at three time points: pre-intervention (pre-randomisation), post-intervention and at 3-week follow-up, as shown in Figure 3.

2.2.3.1 Wellbeing.

Wellbeing was measured using the *Warwick-Edinburgh Mental Wellbeing Scale* (WEMWBS; Tennant et al., 2007) which asks participants about 14 positively worded

thoughts and feelings (e.g. I've been feeling optimistic about the future). Participants rate the items on a 5-point scale ranging from 1=*none of the time* to 5=*all of the time*, where higher scores indicate greater wellbeing. The WEMWBS had good internal consistency with Cronbach's alpha α=.89 for a student sample and α=.91 for a population sample (Tennant et al., 2007). For the present sample at baseline, Cronbach's alpha was α=.90.

2.2.3.2 Psychological distress.

The *General Health Questionnaire 12* (GHQ-12; Goldberg & Williams, 1988) was used to measure general psychological distress and psychiatric symptoms. It consists of 12 items that ask whether the participants' current state is different from usual (e.g. have you recently felt you couldn't overcome your difficulties?) with answers from 0=*much less than usual* to 3=*more than usual*. Higher scores indicate greater distress. The questionnaire has been widely used and is well validated with good internal consistency (Cronbach's alpha ranges from α=.82 to .86). For the present sample at baseline, Cronbach's alpha was α=.87.

2.2.3.3 Mindfulness.

Self-reported mindfulness was measured using the 15-item *Mindful Attention Awareness Scale* (MAAS; Brown & Ryan, 2003). The MAAS consists of 15 items and asks about the frequency of experiences (e.g. I rush through activities without being really attentive to them), ranging from 1 (almost always) to 6 (almost never) where higher scores indicate greater levels of mindful attention. Internal consistency of the MAAS is good (Cronbach's alpha α=.82 student sample; α=.87 general adult sample). For the present sample at baseline, Cronbach's alpha was α=.87.

2.2.3.4 Worry.

Worry was measured using the Penn State Worry Questionnaire (PSWQ; T. J. Meyer et al., 1990), a 16-item self-report questionnaire of worry. Scores range from 16-80. Questions are scored from 1=not at all typical of me to 5=very typical of me with five items reverse scored. The PSWQ was shown to have high internal consistency (α=.93) and good test-retest reliability. For the present sample at baseline, Cronbach's alpha was α=.69. The score could have been improved to α=.74 by excluding item 11. However, for consistency across studies where the measure has been validated and used as a whole, all items were included in the current analysis.

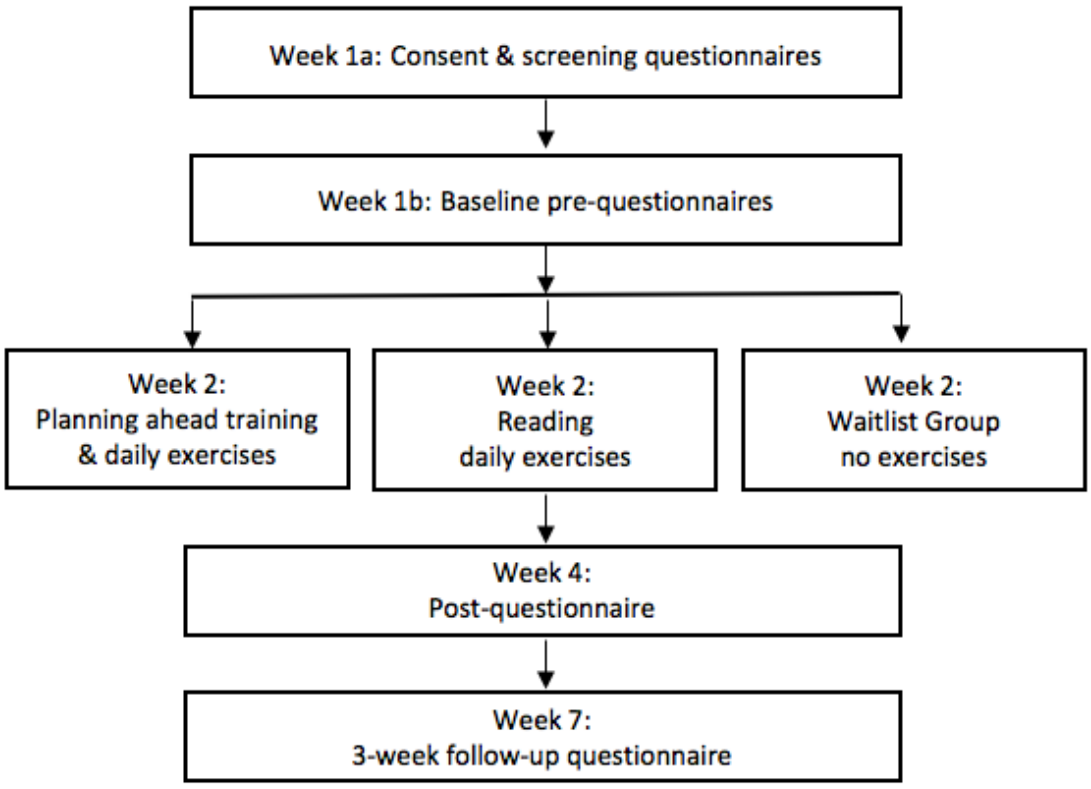


Figure 3: Timeline of the planning ahead study including time points for outcome measures at pre, post and 3-week follow-up and the two-week intervention period.

2.2.4 Secondary Measures: Compliance

At post-intervention and follow-up, participants in the Planning Ahead and Reading group were asked a compliance question to assess how much they had

participated in their assigned mental exercise. (‘how many days out of 14 did you complete your mental exercise (i.e., planning ahead or reading the expert information)?’. Participants also recorded where they spent the majority of their time for the duration of the study: in classes, on placement or on holiday, to gather data on whether or not this affected compliance. Qualitative feedback was collected to understand what may have influenced participation in the respective daily exercise (‘Is there anything you'd like to share that may have influenced your participation in the daily exercises?’).

2.2.5 Procedure

The Medical Sciences Inter-Divisional Research Ethics Committee at the University of Oxford granted approval (CUREC 2 ethics approval R49867/RE002). Informed consent was given by all participants. After completing the screening and baseline measures, participants in the Planning Ahead group worked through a 20-minute online module, which included the planning ahead instructions (see Appendix 1) and a video of how to create a daily plan. The current study improved upon Holland’s (2017) Planning Ahead instruction by giving participants the option to access more detailed, evidence-based information on planning ahead. For example, the module included advice on how to plan ahead based on literature, such as breaking down large tasks (Buehler et al., 1994; Kruger & Evans, 2004), specifying where and when actions should take place (Kirschenbaum et al., 1982; Woolfolk & Woolfolk, 1986) and blocking off time for large tasks (Gardner et al., 2005; Kearns & Gardiner, 2007). Similar planning ahead techniques have been used in previous studies (Gardner et al., 2005; Kirschenbaum et al., 1982; Meier, 2014; Woolfolk & Woolfolk, 1986).

After completing the online module, participants were asked to set aside 10 minutes every day for two weeks, before going to bed, to plan ahead for the next day. Instructions specified completing the exercise before going to bed instead of every evening to account for student paramedics' night shifts. Participants were also instructed to include at least one enjoyable activity in their plan for the next day (e.g., Iwasaki, 2001; Kaya, 2016; Zhang & Zheng, 2017). From the second day onwards, participants were asked to begin their 10 minutes by reflecting on the day that had just passed, thinking about what they did and didn't manage to do and adjusting their plan for the next day accordingly (Buehler et al., 1994). During the two-week intervention period, participants were reminded via text message every three days to practice Planning Ahead. The reminders given to participants were identical to those given to participants in Meier's (2014) and Holland's (2017) study.

The reading activity consisted of reading material about stress linked to mental health and wellbeing for 10 minutes before going to bed. The information was taken from the mental health charity Mind (March, 2015) and is publicly available at https://www.mind.org.uk/ . Any references to planning ahead were excluded from the orginal text. The reading information covered topics such as "Signs of Stress", "Dealing with Stress – Triggers of Stress", "Dealing with Stress – Addressing Some of the Causes", "Treatment for Stress", "How to Cope with Stress as a Student" and understanding mental health disorders such as anxiety and depression. It also included encouragements to try mindfulness and links to further mental health resources and support. Every three days, participants were reminded via text message to read their assigned mental health information. The Waitlist condition consisted of waiting for six weeks and completing all outcome measures. After the end of the study, they received an email that allowed them access to the Planning Ahead online instructional module.

2.2.6 Data Analysis

Analyses were conducted using the statistics software SPSS version 22 (IBM Corp., 2017) and RStudio (RStudio Team, 2018). Multiple imputations (MI) were performed to account for missing data of wellbeing (WEMWBS), stress (GHQ), worry (PSWQ) and mindfulness (MAAS) over the course of the intervention (imputed at post-intervention and follow-up). Predictive mean matching (pmm) from the R package mice (multivariate imputation by chained equations) v2.30 (van Buuren & Groothuis-Oudshoorn, 2011) was used to generate imputations. Intention-to-treat analysis was applied.

In the current sample, the GHQ variables (pre, post and follow-up) showed non-normal distribution (showing skewness or kurtosis above 1.69). Residuals of the models were visually inspected. Since they were found to be satisfactory, no transformation was performed.

Chi Square tests and one-way analyses of variance (ANOVAs) were conducted to assess if the three intervention groups differed on any of the demographic factors (age, gender, ethnicity or university).

To assess the primary hypothesis, greater improvement/reduction of the outcome measure from pre to post, a 2x3 repeated measures ANOVA (within-subjects factor: time [pre-intervention, post-intervention]; between-subjects factor: condition [Planning Ahead, Reading, Waitlist]) was conducted to investigate whether there were significant differences in changes in outcome measures (wellbeing, psychological distress, mindfulness and worry) between the three conditions at post-intervention. If there were significant time by condition interaction effects, follow-up one-way ANOVAs of

change scores were conducted. If the ANOVAs were significant, LSD contrast analyses were performed.

To assess hypothesis 2, whether the effects were maintained at follow-up, a second 2x3 repeated measures ANOVA was conducted, which included the post-intervention and the follow-up measures for each outcome measure (wellbeing, psychological distress, mindfulness and worry). If there were significant time by condition interaction effects, follow-up one-way ANOVAs of change scores were conducted. If the ANOVAs were significant, LSD contrast analyses were performed. It was hypothesised that there would be no significant time or time x condition interaction from post to follow-up, which would indicate the maintenance of gains during the follow-up period.

To further investigate the effects of the interventions, group differences at post and at follow up were assessed. Univariate analyses of covariance (ANCOVAS) were conducted for each outcome measures (wellbeing, distress, mindfulness and worry) at post and at follow-up with pre-training scores on these measures entered as covariates.

For all analyses, statistics were reported including means (*M*), standard deviation (*SD*) and p-values. Effect sizes were calculated using Cohen's *d* (Cohen, 1988). Using Cohen's *d* statistic, *d*=0.20-0.40 represents a small effect, *d*=0.50-0.70 represents a medium effect and *d*=0.80 or larger represents a large effect (Cohen, 1988). Cohen's *d* was calculated as $d=M_{initial} - M_{post}/SD_{pooled}$, with $SD_{pooled}=SQRT((SD_{2initial}+SD_{2post})/2)$, according to Van Etten and Taylor (1998).

Secondary analyses were conducted to better understand participants' compliance. The number of days out of 14 they completed their exercise was calculated and analysed using crosstabulation. A chi square analysis assessed group differences in where participants spent the duration of the study (in classes, on placement or on

holiday). Thematic content analyses were conducted to assess the themes linked to participants' perceptions of what influenced their completion of the daily exercises. Twenty percent of their written comments were independently rated to assess interrater reliability.

2.3 Results

2.3.1 Demographic Characteristics

Sample characteristics for the full sample (N=82) including dropouts are shown in Table 2.

Table 2
Demographic characteristics of all randomised participants (N=82)

	Planning Ahead Group n= 29	**Reading Control Group n=25**	**Waitlist Group n=28**
Age: *M (SD)*	28.07 (7.35)	26.80 (8.64)	28.57 (9.83)
Gender			
No. females (%)	17 (58.62)	14 (56)	17 (60.71)
Ethnicity (%)			
White British	28 (96.55)	22(88.00)	26 (92.86)
Another White background	1 (3.45)	2 (8.00)	0
White & Asian	0	1 (4.00)	0
White & Black African	0	0	1 (3.57)
White & Black Caribbean	0	0	1 (3.57)
University (n, %)			
Anglia Ruskin	7 (24.14)	8(32)	10 (35.71)
Brighton	5 (17.24)	4(16)	5 (17.86)
Brookes	3 (10.34)	1 (4)	3 (10.71)
Portsmouth	3 (10.34)	2 (8)	3 (10.71)
Surrey	8 (27.59)	4(16)	4 (14.29)
West England	2 (6.90)	4(16)	3 (10.71)
Wolverhampton	1 (3.45)	2 (8)	0

2.3.2 Comparing Dropouts and Non-Dropouts

Six participants dropped out after baseline measures (completed no post-intervention and no follow-up questionnaires). Two of them had been randomised into the Planning Ahead group, 2 into Reading, and 2 into the Waitlist group). These 6 did not complete the intervention or any outcome measures. Independent sample t-tests showed that there were no significant differences between these 6 dropouts and non-dropouts for the screening measures (PCL-5 and PHQ-12) or the baseline measures of WEMWBS, MAAS and PSWQ and demographic characteristics (age, ethnicity, university, gender). There was also no difference on frequency of participants in each condition as dropouts and non-dropouts were roughly balanced across conditions. There was, however, a significant difference for the baseline measure of GHQ with the 6 dropouts showing a greater average GHQ (M=29.00, SD=5.69) than the non-dropouts (M=24.49, SD=5.28), $t(80)=2.004$, p=.048, indicating greater psychological distress in the dropouts.

Eight participants had missing data: at post-intervention 4 participants in the Reading group did not complete questionnaires and at 3-week follow-up, 2 participants in the Planning Ahead group and 2 in the Reading group were lost to follow-up. Multiple imputations (MI) were performed to account for these overall eight missing time points (post and follow-up) as well as for the n=6 dropouts described above, using predictive mean matching (pmm) to generate imputations. An intention to treat analysis was used. The final sample consisted of N=82 with n=29 in the Planning Ahead group, n=25 in the Reading group and n=28 in the Waitlist group.

2.3.3 Primary Outcome Measures

See Table 3a for means and standard deviations of each outcome measures of

the full sample (N=82) after multiple imputations. See Appendix 2, Table 3b for means and standard deviations pre-imputations.

Table 3a
Means and standard deviations of outcome measures at pre-intervention, post-intervention, and 3-week follow-up by intervention group (N=82)

	Planning Ahead (n=29)			Reading Control (n=25)			Waitlist (n=28)		
	Pre	Post	Follow-up	Pre	Post	Follow-up	Pre	Post	Follow-up
Measure	Mean *(SD)*	Mean *(SD)*	Mean *(SD)*	Mean *(SD)*	Mean *(SD)*	Mean *(SD)*	Mean *(SD)*	Mean *(SD)*	Mean *(SD)*
WEMWBS	47.24 (8.65)	51.62 (9.59)	51.21 (46.86)	47.72 (8.36)	47.92 (9.72)	48.56 (12.10)	49.28 (6.13)	46.78 (7.07)	46.85 (8.98)
GHQ	25.38 (5.13)	21.38 (4.98)	21.55 (5.43)	25.48 (6.16)	23.68 (4.61)	23.92 (3.68)	23.64 (4.95)	24.61 (3.35)	24.64 (5.74)
MAAS	52.55 (11.24)	56.76 (12.48)	59.21 (12.56)	52.56 (13.22)	53.48 (12.82)	54.84 (13.70)	57.93 (12.60)	58.61 (12.31)	56.07 (13.26)
PSWQ	45.24 (9.08)	45.38 (10.21)	44.34 (9.00)	46.04 (8.05)	47.64 (7.79)	44.56 (10.19)	44.96 (7.82)	45.75 (7.51)	45.75 (7.77)

Note. Missing data were replaced with imputed values using pmm.

2.3.3.1 Wellbeing.

A 2x3 repeated measures ANOVA was conducted to assess the effects of the conditions on wellbeing as measured by the WEMWBS from pre to post-intervention. When a significant time by condition interaction was found, follow-up ANOVAs were conducted to investigate the degree of change between the intervention groups from pre to post (change scores). There was a main effect of group from pre to post-intervention, $F(2,79)=7.113$, $<.001$. LSD post-hoc tests revealed that participants in the Planning Ahead group (M=4.38, SD=8.23) showed significantly greater improvements (change score) in wellbeing compared to the Reading group (M=.20, SD=5.66). Planning Ahead also showed significantly greater improvements in wellbeing compared to the Waitlist group (M=-2.50, SD=6.49) from pre to post-intervention. There was no statistically significant difference between the Reading and the Waitlist group. The within-group effect size from pre to post-intervention for the Planning Ahead group was medium,

Cohen's *d*=0.48, for the Reading group it was small to no effect, Cohen's *d*=0.02, and for the Waitlist group it was small, Cohen's *d*=0.38. Participants in the Planning Ahead group moved from below the population mean of 49.9 (Morris & Earl, 2017) to above the population mean with an average post-intervention wellbeing score of 51.56.

To see whether the intervention effects significantly changed from post to follow-up, a second repeated measures ANOVA was conducted, which included the post-intervention and the follow-up measures. There was no main effect of time, $F(2,79)=.016$, $p=.898$. There was also no time by condition interaction effect from post to follow-up, $F(2,79)=.152$, $p=.859$, suggesting that there were no significant changes from post to follow-up.

In summary, change scores showed significant increase in wellbeing from pre to post intervention for Planning Ahead compared to the Reading and Waitlist group. Change scores showed no significant change from post to follow-up. See Figure 4.

To further assess the potential effects of the intervention, group differences were assessed for wellbeing at each time point. A univariate ANCOVA was performed at post-intervention with pre-intervention wellbeing entered as a covariate. There was a significant effect of the intervention group on levels of wellbeing at post, after controlling for wellbeing at pre-intervention, $F(1,78)=6.521$, $p=.002$, Cohen's *d*=.817. The covariate, wellbeing at pre-intervention, was significantly related to participant's wellbeing at post-intervention, $F(1,78)=59.879$, $p<.001$, Cohen's *d*=1.751. Planned contrasts revealed that Planning Ahead showed significantly greater wellbeing at post-intervention compared to the Waitlist, $p=.001$, 95% CI [2.809 9.926] and compared to Reading, $p=.029$, 95% CI [.416 7.703]. There were no significant differences between Reading and Waitlist, $p=.216$, 95% CI [5.993 1.377].

A second univariate ANCOVA was performed at follow-up with pre-intervention wellbeing entered as a covariate. There was a significant effect of the intervention group on levels of wellbeing at follow-up, after controlling for wellbeing at pre-intervention, F(1,78)=4.536, p=.014, Cohen's *d*=.681. The covariate, wellbeing at pre-intervention, was significantly related to the participant's wellbeing at follow-up, F(1,78)=61.171, p<.001, Cohen's *d*=1.773. Planned contrasts revealed that Planning Ahead showed significantly greater wellbeing at follow-up compared to the Waitlist, *p*=.003, 95% CI [2.070 10.144], however not compared to Reading, *p*=.145, 95% CI [-1.076 7.193]. There were no significant differences between Reading and Waitlist, *p*=.151, 95% CI [-7.230 1.132].

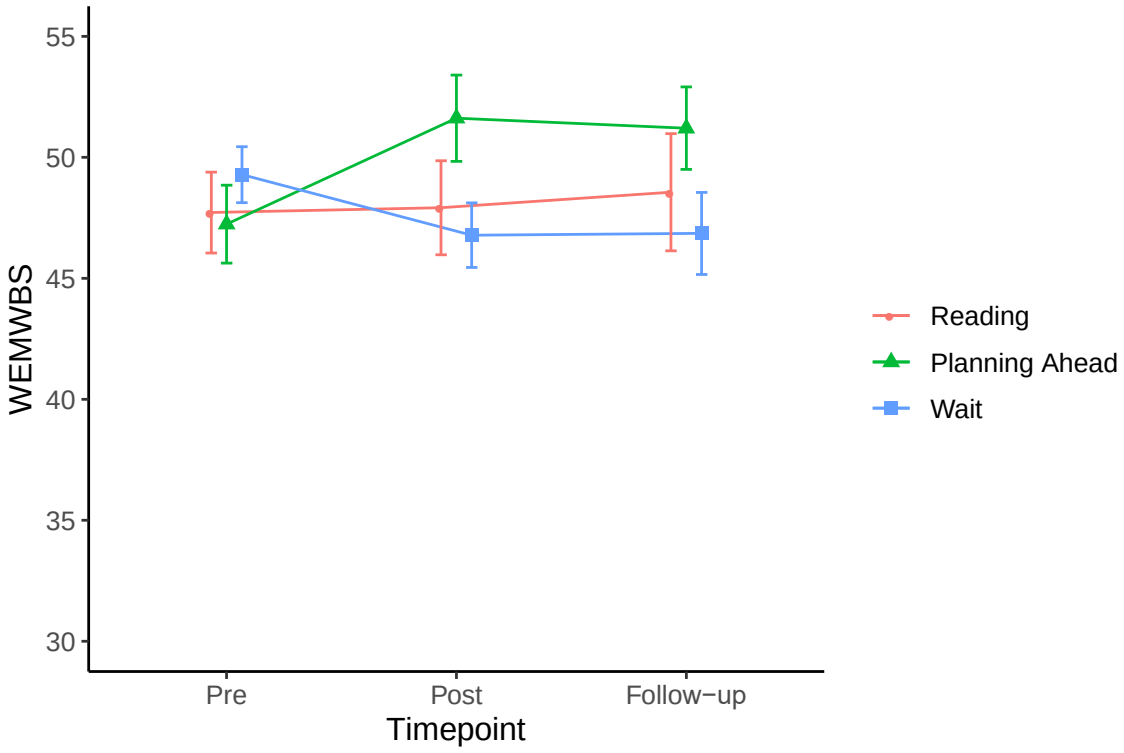


Figure 4. WEMWBS scores at pre, post and 3-week follow-up for all groups: Planning Ahead, Reading, and Waitlist group (N=82). Error bars are shown.

2.3.3.2 Psychological distress.

A 2x3 repeated measures ANOVA was conducted to assess the effects of the interventions on psychological distress as measured by the GHQ from pre to post-intervention. When a significant time by condition interaction effect was found, follow-up ANOVAs were conducted to investigate the degree of change between the intervention groups from pre to post (change scores). There was a main effect of group from pre to post-intervention, $F(2,79)=7.217$, $p=.001$. LSD contrasts revealed that participants in the Planning Ahead group ($M=.964$, $SD=5.167$) showed significantly greater reductions in psychological distress compared to the Waitlist group ($M=.964$, $SD=5.167$), but not compared to the Reading group ($M=-1.80$, $SD=5.20$). Participants in the Reading group also benefited from significantly greater reductions in psychological distress than the Waitlist group. The within-group effect size from pre to post-intervention for the Planning Ahead group was medium, Cohen's $d=0.79$, for the Reading group it was medium, Cohen's $d=0.72$, and for the Waitlist group it was small, Cohen's $d=0.23$.

A second 2x3 repeated measures ANOVA was conducted to assess the change in psychological distress from post-intervention to follow-up. There was no main effect of time $F(2,79)=.071$, $p=.790$. There was also no time by condition interaction effect, $F(2,79)=.011$, $p=.989$. There was however a main effect of group at follow up, $F(2,79)=4.757$, $p=.011$. See Figure 5.

To further assess the effects of the interventions, a univariate ANCOVA was performed at post with pre-intervention psychological distress entered as a covariate. There was a significant effect of the intervention group on levels of psychological distress at post, after controlling for psychological distress at pre-intervention, $F(1,78)=7.628$, $p=.001$, Cohen's $d=.886$. The covariate, psychological distress at pre-

intervention, was significantly related to the participant's psychological distress at post, F(1,78)=26.977, p<.001, Cohen's *d*=1.176. Planned contrasts revealed that Planning Ahead showed significantly lower psychological distress compared to the Waitlist, p<.001, 95% CI [-5.957 -1.921] and compared to Reading, *p*=.032, 95% CI [-4.319 -.199]. There were no significant differences between Reading and Waitlist, *p*=.115, 95% CI [-.417 3.776].

A second univariate ANCOVA was performed at follow-up with pre-intervention wellbeing entered as a covariate. There was a significant effect of the intervention group on levels of psychological distress at follow-up, after controlling for psychological distress at pre-intervention, F(1,78)=5.043, p=.009, Cohen's *d*=.721. The covariate, psychological distress at pre-intervention, was significantly related to the participant's psychological distress at follow-up, F(1,78)=20.308, p<.001, Cohen's *d*=1.022. Planned contrasts revealed that Planning Ahead showed significantly lower psychological distress compared to the Waitlist, *p*=.002, 95% CI [-6.259 -1.407], however not compared to Reading, *p*=.065, 95% CI [-4.801 .151]. There were no significant differences between Reading and Waitlist, *p*=.237, 95% CI [-1.013 4.028].

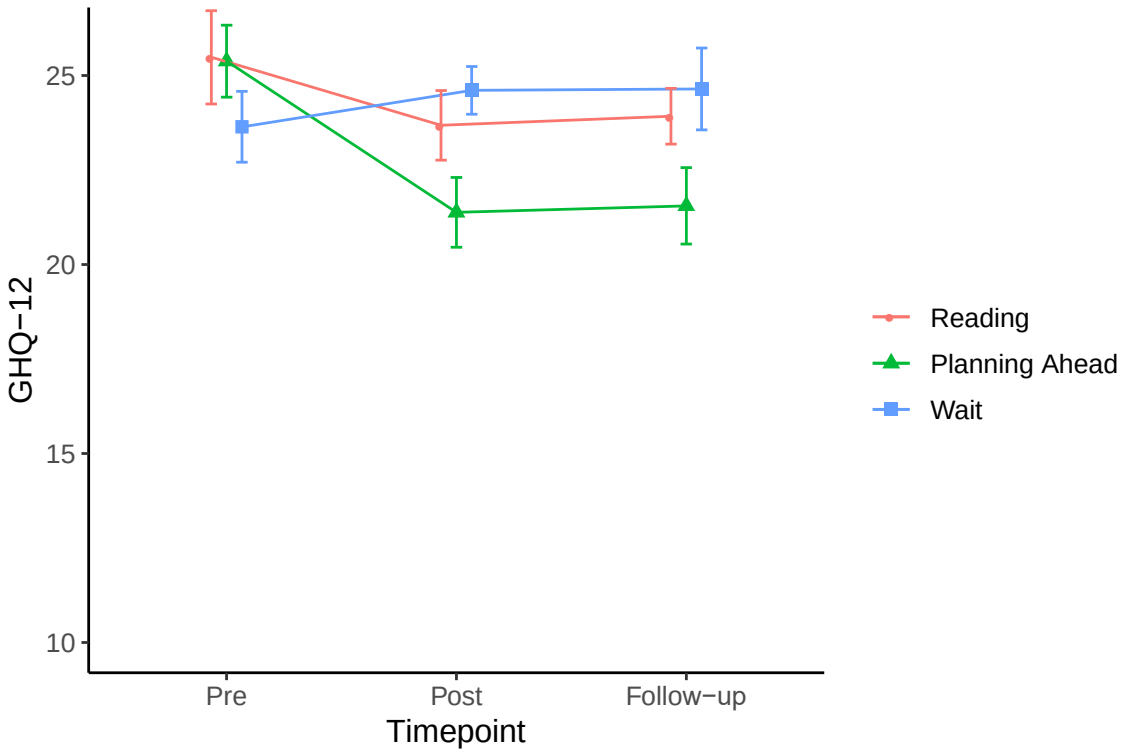


Figure 5. GHQ-12 scores at pre, post and 3-week follow-up for all groups: Planning Ahead, Reading and Waitlist (N=82). Error bars are shown.

2.3.3.3 Mindfulness.

A 2x3 repeated measures ANOVA was conducted to assess the effects of the interventions on self-reported mindfulness as measured by the MAAS from pre to post-intervention. There was no main effect of time (only a trend towards significance) $F(2,79)=3.669$, $p=.059$ and no significant time by condition interaction effect, $F(2,79)=1.315$, $p=.274$, indicating that the degree to which mindfulness changed over time from pre to post was not linked to the interventions. There was also no significant main effect of group, $F(2,79)=1.451$, $p=.211$.

A second 2x3 repeated measures ANOVA was conducted to assess the effects of the conditions on mindfulness from post to follow-up. There was no main effect of time $F(2,79)=.229$, $p=.633$ and no significant time by condition interaction effect (only a trend towards significance), $F(2,79)=3.012$, $p=.055$, indicating that the degree to which mindfulness changed over time from post to follow-up was not linked to the

interventions. There was also no significant main effect of group, $F(2,79)=.717$, $p=.482$. In summary, change scores showed no significant change in mindfulness from pre to post intervention and no significant change from post to follow-up. See Figure 6.

To further investigate potential effects of the interventions, group differences at post and at follow up were assessed whilst controlling for baseline scores in mindful attention. A univariate ANCOVA was performed at post with baseline mindful attention entered as the covariate. The covariate, mindfulness at pre-intervention, was significantly related to the participant's mindfulness at post, $F(1,78)=89.192$, $p<.001$, Cohen's $d=2.137$. However, there was no significant effect of the intervention groups on levels of mindfulness at post, after controlling for mindfulness at pre-intervention, $F(1,78)=1.023$, $p=.364$, Cohen's $d=.327$.

A second univariate ANCOVA was performed at follow-up with pre-intervention mindful attention entered as a covariate. The covariate, mindfulness at pre-intervention, was significantly related to the participant's mindfulness at follow-up, $F(1,78)=60.674$, $p<.001$, Cohen's $d=1.766$. There was a significant effect of the intervention group on levels of mindfulness at follow-up, after controlling for mindfulness at pre-intervention, $F(1,78)=3.345$, $p=.036$, Cohen's $d=.594$. Planned contrasts revealed that Planning Ahead showed significantly greater mindfulness at follow-up compared to Waitlist, $p=.011$, 95% CI [1.602 12.253], however not compared to Reading, $p=.111$, 95% CI [-1.021 9.766]. There were no significant differences between Reading and Waitlist, $p=.360$, 95% CI [-8.078 2.969].

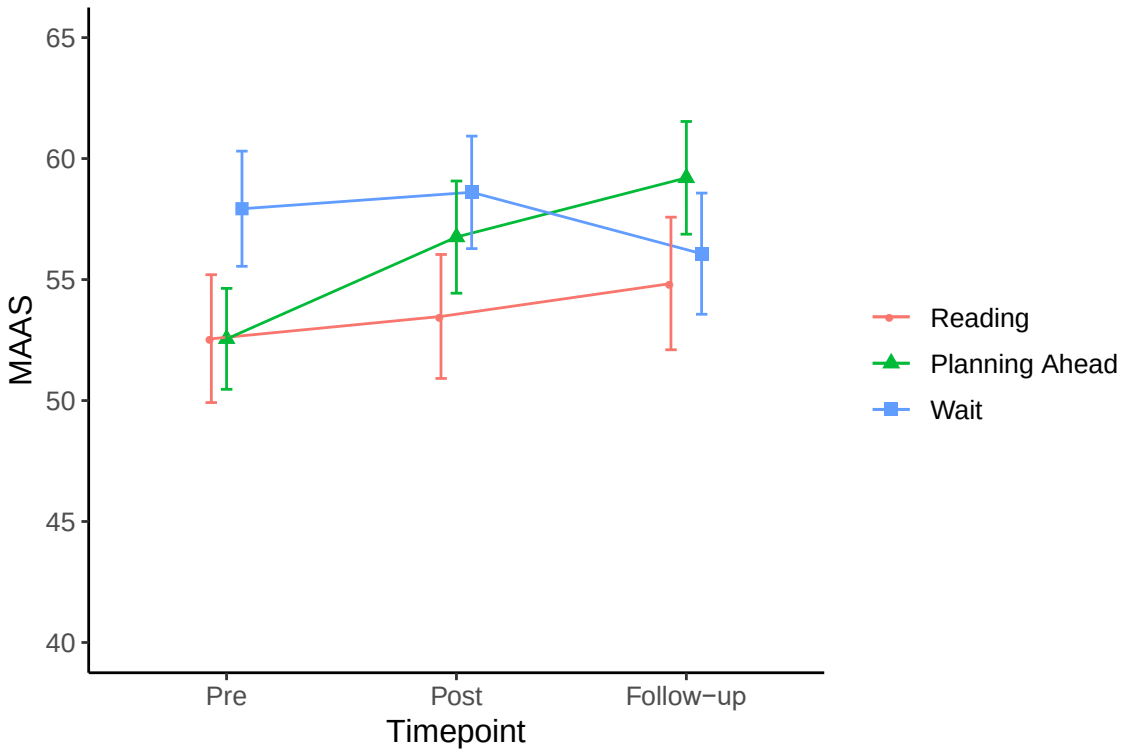


Figure 6. MAAS scores at pre, post and 3-week follow-up for all groups: Planning Ahead, Reading, and Waitlist group (N=82). Error bars are shown.

2.3.3.4 Worry.

A 2x3 repeated measures ANOVA was conducted to assess the effects of the interventions on worry as measured by the PSWQ from pre-intervention to post-intervention. There was no main effect of time $F(2,79)=1.131$, $p=.29$. There was also no significant time by condition interaction effect, $F(2,79)=.281$, $p=.756$, suggesting that changes in worry were not specific to any particular intervention. There was also no significant main effect of group, $F(2,79)=.332$, $p=.719$.

A second 2x3 repeated measures ANOVA was conducted to assess the effects of the conditions on worry from post-intervention to follow-up. There was no main effect of time $F(2,79)=.2.763$, $p=.100$. There was also no time by condition interaction effect, $F(2,79)=1.156$, $p=.320$, suggesting that there were no changes in worry from post to follow-up. There was also no significant main effect of group, $F(2,79)=.176$, $p=.839$. In

summary, change scores showed no significant change in worry from pre to post intervention and no significant change from post to follow-up. See Figure 7.

To further assess the potential effects of the intervention, group effects at post and at follow-up were tested. A univariate ANCOVA was performed at post with pre-intervention worry entered as a covariate. The covariate, worry at pre-intervention, was significantly related to the participant's worry at post, $F(1,78)=56.112$, $p<.001$, Cohen's $d=1.695$. There was no significant effect of the intervention group on levels of worry at post-intervention, after controlling for worry at pre-intervention, $F(1,78)=.467$, $p=.629$, Cohen's $d=.220$.

A second univariate ANCOVA was performed at follow-up with pre-intervention worry entered as a covariate. The covariate, worry at pre-intervention, was significantly related to the participant's worry at follow-up, $F(1,78)=69.791$, $p<.001$, Cohen's $d=1.891$. There was no significant effect of the intervention group on levels of worry at follow-up, after controlling for worry at pre, $F(1,78)=.700$, $p=.500$, Cohen's $d=.271$.

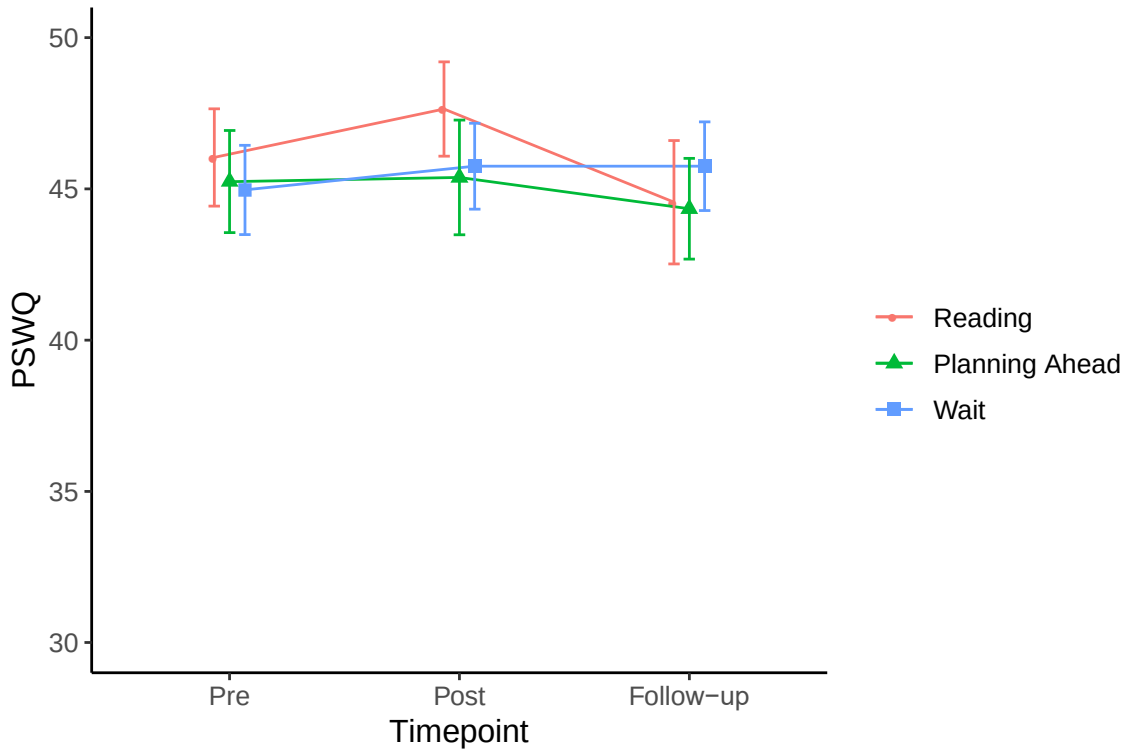


Figure 7. PSWQ scores at pre, post and 3-week follow-up for all groups: Planning Ahead, Reading, and Waitlist group (N=82). Error bars are shown.

2.3.4 Secondary Analyses: Compliance

Multiple analyses were completed of the dataset pre-imputations to understand the compliance of participants to their respective intervention. A one-way ANOVA showed no significant differences between the groups in the number of days the exercise was completed. A paired sample t-test showed a significant decrease of compliance from post to follow-up, $t(40)=5.677$, $p<.001$. At post-intervention, participants in the Planning Ahead group (n=27) on average planned ahead 9.85 (*SD*=3.80) out of 14 days (70.36%) and participants in the Reading group (n=17) read the information on average on 11 (*SD*=4.36) out of 14 days (78.57%). Since Qualtrics software records the number of seconds a participant has a webpage open, the amount of time participants in the Reading group spent on each page of web-based information could be estimated. This amounted to an average of 9 minutes reading the information per day and a median of 1 minute. At 3-week follow-up, participants (n=26) planned

ahead less than 50% of the time, reporting they had planned ahead on average 6.42 (*SD*=5.13) out of 14 days (45.86%) and participants in the control group (n=19) re-read the information on average 5.16 (*SD*=5.42) out of 14 days (36.86%). These analyses was conducted pre-imputations.

A Chi Square test revealed that there were no significant differences between the Planning Ahead and the Reading groups on where participants had spent the majority of their study time, $\chi 2(2)=0.684$, $p=.710$.

2.3.5 Qualitative Findings

At follow-up, participants who had been allocated to an exercise (planning ahead or reading) were given the option to note if anything had affected their compliance to the training. Feedback was optional with only n=31 participants leaving a comment (Planning Ahead n=17, Reading n=14). Using thematic content analysis (TCA), comments were sorted into different topics. The majority (n=20) stated that practical issues had affected compliance, the most common of which were time constraints and shift work, five participants indicated limited participation due to failure to follow the instructions of the exercise (i.e. only planned when they felt the need to instead of every day), n=1 stated that planning before going to bed led to worry and trouble sleeping, n=2 indicated that there were not enough reminders, while n=1 said the reminders were useful. Finally, n=3 stated that they complied because of their interest in the topic and n=1 because they felt positive effects of the planning ahead exercise. Part of the participant feedback (20%, n=7) was independently rated by a second, blind rater. Results showed 100% inter-rater agreement.

2.4 Discussion

The study aimed to investigate the effects of daily Planning Ahead on measures of wellbeing, psychological distress, mindfulness and worry in a sample of student paramedics. It was hypothesised that Planning Ahead would lead to greater improvements in self-reported wellbeing and mindfulness, and greater reductions in psychological distress and worry compared to the Reading and Waitlist interventions. The secondary hypothesis was that effects on mental health would be maintained from post-intervention to follow-up.

2.4.1 Wellbeing

As predicted, Planning Ahead led to significantly greater increases in wellbeing compared to the Reading and Waitlist groups, from pre to post-intervention. The within group effect sizes were medium for Planning Ahead and small for Reading and Waitlist. Participants in the Planning Ahead group demonstrated greater wellbeing compared to the Reading and Waitlist groups, after the intervention. There were no significant changes from post to follow-up which may indicate that effects were maintained at follow-up. Analysis of group differences demonstrated that Planning Ahead led to significantly greater improvements in wellbeing compared to reading or waitlist at post-intervention. However, group differences were not maintained at follow-up with participants in the Planning Ahead group showing significantly greater wellbeing than the Waitlist group, but no longer showing significant differences to the Reading intervention. Inspection of the group means at post and follow-up suggest that participants in Planning Ahead remained relatively stable whilst participants in the Reading intervention improved slightly during follow-up, leading to reductions in group

differences between the Planning Ahead and Reading groups at the follow-up assessment.

The benefits of planning ahead on wellbeing are consistent with the broader literature on time management tools, which include planning ahead (Bond & Feather, 1988; Macan et al., 1990; Peeters & Rutte, 2005; Van Eerde, 2003; Zhang & Zheng, 2017). It is possible that planning ahead may increase perceived control of time, which may improve the feeling of wellbeing. Macan's model of time management (1994) posits that perceived control of time mediates the relationship between time management behaviour and wellbeing, and research lends initial support for this model with perceived control of time being found to partially mediate the relationship between time management behaviour and wellbeing (Claessens et al., 2004; Jex & Elacqua, 1999).

Meier (2014) and Holland (2017), who evaluated the same method of Planning Ahead, did not find a link between planning and wellbeing. The effects seen in the current study may be due to the addition of detailed instructions on how to plan ahead. For example, these instructions included advice on how to block time for large tasks and how to break complex tasks into smaller steps.

2.4.2 Psychological Distress

Planning Ahead led to a greater reductions in psychological distress compared to the Waitlist group from pre to post-intervention. The within group effect sizes were medium for the Planning Ahead and Reading groups and small for the Waitlist group. However, contrary to prediction, Planning Ahead and Reading were not significantly different. These findings are similar to Holland (2017) who found that Planning Ahead reduced psychological distress to a greater extent than a no-intervention control group

but not significantly more than an alternative cognitive intervention (bibliotherapy). There were no significant changes from post to follow-up which may indicate that effects were maintained at follow-up. Group differences showed a slight change from post to follow-up: at post, participants in the Planning Ahead group showed significantly lower psychological distress than participants in the Reading and Waitlist group. At follow-up, the difference to Waitlist was maintained but the differences to Reading were no longer significant. Inspection of the group means at post and follow-up suggest that participants in the Planning Ahead and Reading interventions demonstrated small increases in psychological distress, leading to reductions in their group differences at this time point.

The reductions in psychological distress through planning ahead are consistent with the broader literature on time management (Claessens et al., 2007; Häfner & Stock, 2010; Jex & Elacqua, 1999; Macan et al., 1990; Nonis et al., 1998). The most likely reason that the Reading condition also reduced psychological distress is that the reading information in the brief module largely focused on understanding and dealing with the causes and signs of stress. For example, the topics covered included "Signs of Stress", "Dealing with Stress – Triggers of Stress", "Dealing with Stress – Addressing Some of the Causes", "Treatment for Stress", "How to Cope with Stress as a Student" and understanding mental health disorders such as anxiety and depression. Although the information was broad with generic examples, advice on coping with stress was as specific as "identifying your triggers", "addressing some of the causes" and "accepting the things you can't change." The reading information may therefore have reduced psychological distress by explaining, normalising and validating participants' stressful feelings and teaching practical coping skills.

2.4.3 Mindfulness

Planning Ahead led to an increase in self-reported mindfulness. However, contrary to prediction, Planning Ahead did not lead to a significantly greater increase in mindfulness from pre to post-intervention compared to the Reading and Waitlist group. The within group effect sizes were small in all three groups. Although participants who learned to plan ahead increased their mindful attention and those in the wait condition became less mindful over time, there were no significant changes from post to follow-up. However, group differences at follow-up showed significantly greater mindfulness in the Planning Ahead group compared to the Waitlist group, with no significant difference to the Reading group, suggesting that over time participants in Planning Ahead benefited from improvements in mindful attention. . These findings are inconsistent with Holland (2017) who found Planning Ahead to increase mindfulness more than bibliotherapy and a wait-list condition at post-intervention. In our study, reading the psychoeducation material about stress also led to significant increases in mindfulness from post-intervention to follow-up.

Based on the group differences, Planning Ahead appears to have led to a cumulative improvement in mindfulness over time showing increases in mindfulness by three week follow-up. Planning Ahead included breaking large tasks into smaller chunks and assigning specific times to activities. As participants had already planned what to do their next day, perhaps they did not need to expend extra cognitive effort in thinking or worrying about their next activities. Instead, their mind was free to focus on the here and now and to be more aware of the moment.

2.4.4 Worry

Contrary to prediction, Planning Ahead did not lead to a significant change in worry compared to the Reading and Waitlist Groups at post-intervention or at follow-up. Similarly, there were no significant group differences at post or at follow-up. The current findings are contrary to those by Van Eerde (2003) who found that time management training decreased worry. However, in Van Eerde's (2003) study, planning ahead was only one of multiple techniques taught in the time management training so no conclusions about the role of planning ahead can be drawn. Kelly (2003) concluded that increased 'perception of structure and purpose of time' correlated with decreases in worry, although time management behaviour (such as prioritising) did not. However, planning ahead was not evaluated directly in Kelly's (2003) research and it is unclear whether planning ahead would be categorised as 'increased perception of structure and purpose of time' or as a time management behaviour.

Literature shows that worry can be decreased by training to think more concretely, such as focusing on "how" an event is happening, on the direct experience and means to desired ends such as the steps needed to achieve a goal (Strack et al., 1985; Watkins, 2008; Watkins et al., 2008; White & Wild, 2016). It is unclear whether or not planning ahead increased concrete thinking in this study since the content of the daily plans was not monitored. Participants may or may not have 'broken down their day' into smaller 'steps to achieve a goal.'

Finally, it is natural for students to worry. According to Stewart-Brown and colleagues (2000), students primarily worry about longer-term issues, such as the outcome of studies, or work or financial issues. It is likely that Planning Ahead is not an effective strategy for helping students to disengage from these longer-term worries.

2.4.5 Compliance

Analyses showed that compliance was overall high during the 2-week intervention period but that participants engaged significantly less often with the exercises after post-intervention when they no longer received regular SMS reminders. Whether participants were based at university, placement or on holiday for the duration of the study had no effect on compliance. The most commonly reported reason for difficulty complying was 'practical issues' such as time constraints due to placement and night shifts. Some participants did not follow the instructions of daily practice or commented on the lack of reminders. It would be interesting to see if future research could improve compliance. This study scheduled reminders to participants every three days until post-intervention and then none afterwards. Some students requested more regular reminders when the optional feedback was collected. SMS reminders likely increase compliance and hence, may be necessary during follow-up periods.

2.4.6 Strengths and Limitations

The current study addressed multiple gaps in the literature by evaluating a specific time management technique (Planning Ahead), applying a randomised controlled design, and using validated measures of mental health. It is also the first study to assess planning ahead in student paramedics, a population at higher risk of developing mental health problems than the general population.

There are several limitations worth considering. The analysis of the current study could be criticised since it did not use linear mixed effects models (LME). LME would automatically estimate missing data and include it in the analysis. LME would also take into account the nested data structure of time points within participants. However, since the data was missing mostly at random (for all demographics and all

baseline data except GHQ), multiple imputations as done in the current study estimated the missing data in the same way. Further, LME is not recommended for small sample sizes (Maas & Hox, 2005; Paccagnella, 2011), as LME can lead to biased standard errors. A further limitation is the use of multiple uncorrected analyses which can inflate Type 1 error.

Compliance to the exercise was not as high as it could have been. Since the active phase of this study was only two weeks long, perhaps students did not benefit from sufficient time to form the habit of Planning Ahead. A study (Lally et al., 2010) investigating the success of a new behaviour becoming a habit, found that it takes anywhere from 18 to 254 days to form a new habit. Future studies could therefore benefit from a longer intervention period as well as more frequent reminders so increase compliance.

The current study is not able to differentiate whether the effects of the Planning Ahead intervention were due to daily planning or the daily enjoyable activity included in the plan. While the current study focused on planning ahead, there is a wide range of research that supports the claim that enjoyable leisure activities are beneficial for or correlated with wellbeing and lower levels of stress (Kaya, 2016; Souza et al., 2016; Zhang & Zheng, 2017). Research by Misra and McKean (2000) found that engaging in leisure activities correlated with reductions in academic stress, although greater use of time management showed even stronger correlations with reductions in stress. The authors therefore suggest leisure activities in combination with time management behaviours as an effective strategy to reduce stress. It may nevertheless be useful to individually assess the effects of daily planning ahead and of planned enjoyable activities to clarify the specific effects of each.

Another limitation is that the current study did not assess the extent to which participants applied the techniques they learned, only how frequently they completed the assigned exercise. For example, it is unclear how closely participants followed the instructions of Planning Ahead, or whether participants in the Reading intervention followed any of the advice provided on dealing with stress.

Finally, it is important to note that dropouts and non-dropouts differenced significantly on the measure of psychological distress with the 6 dropouts showing higher psychological distress. This is a potential source of bias in the results. Other studies have similarly found that participants with higher symptom severity are more likely to drop out (Beierl et al., 2019). However, as there were only 6 dropouts these differences should not be overestimated.

2.4.7 Conclusion

Student paramedics are at an increased risk of stress and mental ill health since they face the daily stressors linked to the demands of university as well as those linked to paramedic life. Simple, practical ways to alleviate stress and increase wellbeing are urgently needed. The current study suggests that whilst students are practising Planning Ahead, they may benefit from improvements in wellbeing with medium effect and similarly benefit from reductions in psychological distress. In the longer-term, there may be some effect on self-reported mindfulness. Reading about stress and how to manage it may also helpful in reducing psychological distress by post-intervention with a small effect size. However, reading psychoeducation material had no effect on improving wellbeing or mindfulness. These results suggest that Planning Ahead is possibly more effective as a means for improving psychological outcomes than

accessing psychoeducation about stress and mental health. However, further research is needed to confirm the preliminary findings.

3 Chapter 3: Development and Validation of a Measure of Concrete and Abstract thinking (CAT) for Student Paramedics

3.1 Overview

As discussed in Chapter 1, there is good evidence for the role of rumination and worry (repetitive negative thinking) in the development and maintenance of common mental health problems, such as major depressive disorder, post-traumatic stress disorder (PTSD) and generalised anxiety disorder (GAD) (e.g., Ehring & Watkins, 2008; Ehring et al., 2011; McLaughlin & Nolen-Hoeksema, 2011; Segerstrom, Tsao, Alden, & Craske, 2000; Wahl et al., 2019). Rumination and worry are characterised by increases in abstract-analytical thinking and decreases in concrete-experiential thinking (Ehring, Frank, et al., 2008; Ehring & Watkins, 2008; Stöber & Borkovec, 2002; Watkins, 2009; Watkins & Moberly, 2009). Abstract-analytical thinking is a mode of processing, characterised by generalised thoughts conveying overall meaning as well as "why?" and "what if?" questions with no obvious answer (Watkins, 2008). It is hypothesised that this thinking style inhibits emotional processing of fearful imagery, strengthening anxious meanings and interfering with problem solving (Behar et al., 2012; Stöber, 1998; White & Wild, 2016). Concrete-experiential thinking, on the other hand, focuses on "how" an event is happening, on direct experience, and on means to desired ends (e.g., steps needed to achieve a goal) (White & Wild, 2016). Concrete-experiential thinking is associated with adaptive psychological coping, including increases in problem solving ability (Watkins & Moulds, 2005) and proactive behaviour (Dey et al., 2019). Since concrete thinking seems to facilitate problem-solving and

adaptive coping, this mode of thinking may also relate to general resilience and self-efficacy, although this is yet to be tested. One of the issues facing the investigation of abstract and concrete thinking is the reliability of the self-report measures aimed to quantify the relative abstractness or concreteness of reported thoughts.

Most studies aiming to assess the abstractness or concreteness of specific thoughts have administered the problem elaboration questionnaire (PEQ; Stöber & Borkovec, 2002) which has a number of limitations including a complicated, lengthy and at times, unreliable scoring procedure. A measure of concrete and abstract thinking developed specifically for at risk populations, which overcomes the limitations of existing measures, may provide an alternative to the PEQ and fill a gap in the literature. For example, no measure exists to assess modes of thinking for specific high risk populations, such as student paramedics. In this chapter, the development and validation of the concrete and abstract thinking questionnaire (CAT) for student paramedics will be described.

3.1.1 Existing Measures of Concrete and Abstract Thinking

The majority of studies investigating concrete and abstract thinking have administered the PEQ, which asks participants to elaborate on two problems they 'are currently worried about' as well as on 'three potential negative consequences' for each problem. The elaborations are then scored for concreteness using Stöber's concreteness rating scale (1996) from 1=abstract to 5=concrete. Abstract thinking is defined as 'indistinct, cross-situational, equivocal, unclear, aggregated' and concrete thinking as 'distinct, situationally specific, unequivocal, clear, singular.' A total concreteness score for major worries is calculated by summing up the ratings of the two problem elaborations. A concreteness score for consequences is calculated by summing the six

potential negative consequences.

Although the PEQ is well validated and widely used, it has a number of limitations. First, the PEQ instructs participants to elaborate on two problems they are currently worried about. This wording may directly encourage participants to worry and may thereby induce a more abstract focus thus biasing responses towards abstract content. Second, since no word minimum/maximum or time limit is given, elaborations may greatly vary in length which again may influence scoring. One-word or short answers provide little range for scoring compared to a detailed elaboration. Third, applying a 5-point scale with only two anchors at the extreme ends (1 and 5) heightens subjectivity in scoring. Different raters may understand the scale differently or interpret elaborations differently. Fourth, the definitions of concrete and abstract thinking used in the PEQ differ from definitions adopted in more current research, such as research conducted by Watkins and colleagues (Watkins et al., 2008), which may limit the comparability of results. For example, the PEQ describes abstract as 'cross-situational and aggregated'. Cross-situational and aggregated thoughts preclude the possibility of being scored as concrete although they could indeed be concrete according to the definition of Watkins and colleagues. For example, the thought "how can I best schedule my time to revise for my upcoming exam, write my essay and go to the gym?" would be scored as abstract according to the PEQ because it is aggregated and cross-situational. It would be scored as concrete according to Watkins and colleagues because it focuses on "how" and is a means to a desired end. Finally, the questionnaire can be lengthy to administer and lengthy to score (in excess of 30 minutes depending on the length of participants' problem elaborations).

A few studies have assessed concrete and abstract thinking using other methods. In one study (Kross et al., 2005) participants were instructed to focus on a negative

interpersonal experience and the reasons underlying their feelings about the interpersonal event ('why-focus'). Participants were then asked to describe in writing the stream of thoughts they experienced during the task which was rated for abstractness or concreteness on a scale of 0 (not at all) to 2 (very much). Concreteness was defined as 'what' statements that described a specific chain of events, behaviours, or emotions experienced, and abstractness as an 'insight statement' where participants understood the causes underlying an event as well as a 'closure statement' where participants assessed past experience from a broad perspective (e.g., "Looking back at it now, I can see why it happened . . ."). This scoring method was not further validated and not compared to other measures. The researchers' definition of concrete and abstract thinking differs from definitions in the wider literature in that they limit concrete thinking to 'what' statements and specific experiences while Watkins and colleagues have focused more on 'how' questions and on a means to a desired end. The authors' definition of abstract thinking focuses on 'closure statements' and on taking a broader perspective 'looking back'. For example, a broader perspective thought could be 'Looking back, I can see that I failed because I didn't follow the instructions properly,' which would be scored as concrete according to Watkins and colleagues because the thought clearly answers a question rather than posing a question with no obvious answer or rather than focusing on the meaning of the failure. Yet, according to Koss et al. (2005), the thought would be scored as abstract since it is a closure statement.

In a study assessing rumination and worry in daily life (naturalistic experiences) participants rated their own thoughts when prompted, using a 5-point scale (1 very concrete/specific, 5=very abstract/general) (Kircanski et al., 2015). No further details of this measure or definitions were provided in the paper. Contrary to the broader literature, rumination was not found to be abstract or overgeneral. The authors raise the

question as to whether participants experience their thoughts (worry and rumination) differently in a naturalistic setting than in the laboratory settings of previous studies, but do not discuss the potential limitations of their self-report measure. Relying on participants to rate their own abstractness or concreteness of thoughts requires meta-cognitive awareness, an ability to step back and evaluate one's thinking, which may lead to inaccuracies in the assessment of self-reported thoughts.

Barnard, Watkins and colleagues developed an 84-item measure titled the Cambridge-Exeter Repetitive Thought Scale (CERTS; Barnard et al., 2007). Part of this focuses on assessing the ruminative process (concrete and abstract thinking). However, factorial validity appears not satisfactorily stable and the measure is unpublished. A shorter version, the Mini-CERTS (Douilliez et al., 2014; Kornacka, 2019; Kornacka et al., 2016), was developed, however, it was only validated and published in French and Polish and could therefore not be considered for the current study.

Finally, Wahl and colleagues (2019) assessed abstractness with four items asking participants to endorse statements such as "my dwelling is usually very abstract" on a scale of 0 (never) to 4 (always) and provided definitions of concrete and abstract thinking: "Concrete means that the consequences are very detailed and many aspects will be considered. For example, if you are thinking about losing your job, 'concrete' means that you are dwelling on whether you can still afford to have a car and to take vacations. (…) Abstract means that you are thinking about losing your job in a very general way." There was good internal consistency (Cronbach's α=.85) and reasonable factorial validity. However, the measure relies heavily on participants' accurate understanding and assessment of their episodes of abstract and concrete thinking. With this measure, Wahl and colleagues did not see greater abstractness in clinical populations (depression, GAD and OCD) compared to a community control group,

findings that are at odds with the wider literature. The authors report participants' reliance on retrospective self-report as a limitation and possible explanation for failing to find an association between mode of thinking and clinical presentation. Since this measure was published in February 2019, it was not available when the current study was conducted.

In summary, measures of abstract and concrete thinking are limited by varying definitions of abstract and concrete thinking that do not always fit the current literature, by relying on participants to identify and rate the degree of 'abstractness' or 'concreteness' of their thinking, and/or in some instances, by poor validity. Perhaps a more promising way forward would be to develop a measure with participants, first identifying common situations they would be likely to experience, and then common abstract and concrete thoughts likely to occur in such situations.

3.1.2 Aims of the Present Study

This chapter describes the development and initial validation of a measure designed to assess concrete and abstract thinking in student paramedics. The concrete and abstract thinking questionnaire (CAT) is a scenario-based questionnaire which includes scenarios relevant to university and paramedic life and a range of abstract and concrete thoughts which might occur in such scenarios.

The aims of the present study are to (1) assess its psychometric properties, (2) investigate the relationship between the CAT and existing measures of concrete and abstract thinking, rumination and worry as well as measures of psychopathology (depression, PTSD, GAD) and measures of self-efficacy and resilience, and (3) propose a 'best version CAT.'

It is hypothesised that the abstract score on the CAT will correlate positively with the abstract subscale of the PEQ and with measures of rumination, worry, depression, PTSD and GAD, and correlate negatively with measures of self-efficacy and resilience.

3.2 Method

3.2.1 Participants

All participants were British student paramedics. The inclusion criteria were that participants were student paramedics in any year of study for a 3-year Bachelor in Paramedic Science and were above 18 years of age. There were no exclusion criteria based on psychopathology. Recommendations for factor analysis (Nunnally, 1978) suggest recruiting a sample size that includes 10 times as many participants as questionnaire items. Adjusting for a potential 20% rate of attrition, we aimed to recruit 200 participants. The final sample included N=205 student paramedics from 15 universities with an age range of 18 to 54 (*M*=24.91, *SD*=6.77). The majority were female (62%) and White British (92.20%). See Table 4 for demographic details.

3.2.2 Procedure

The Medical Sciences Inter-Divisional Research Ethics Committee at the University of Oxford granted approval (CUREC 2 ethics approval R57540/RE002). An online survey consisting of each of the four versions of the CAT and ten additional questionnaires was sent to 11 universities. Paramedic lecturers sent an email invitation for the study to their students or posted it in their online learning environment. Some students forwarded the survey to student paramedics at other universities (Anglia Ruskin, Brighton, Portsmouth and Suffolk). Informed consent was given by all

participants. A sample of 205 participants completed the approximately 30-minute set of questionnaires online using Qualtrics software and 198 participants (96.56%) completed the questionnaires again, two weeks later. The seven participants who dropped out from the first to the second time point could not be reached. Upon completing the second set of questionnaires, participants received a £20 Amazon voucher.

Table 4
Demographic information

Age: *Mean (SD)*	24.91 (6.77)
Gender: No. females (%)	128 (62.40)
Ethnicity *n* (%)	
White British	189 (92.19)
White Irish	3 (1.46)
Eastern European	4 (1.95)
Another white background	4 (1.95)
Caribbean	1 (0.49)
White & Asian	2 (0.98)
White & Black Caribbean	2 (0.98)
University *n* (%)	
Anglia Ruskin	2 (0.98)
Canterbury Christ Church	34 (16.59)
Edge Hill	35 (17.07)
Glasgow Caledonian	14 (6.83)
St George's London	13 (6.34)
Teesside	13 (6.34)
Bradford	14 (6.83)
Brighton	1 (0.48)
Central Lancashire	13 (6.34)
Cumbria	18 (8.78)
Lincoln	8 (3.90)
Plymouth	26 (12.68)
Portsmouth	1 (0.49)
Suffolk	1 (0.49)
Wolverhampton	12 (5.85)
Year of Study (%)	
1st year	53 (25.86)
2nd year	97 (47.32)
3rd year	52 (25.37)
other	3 (1.34)

3.2.3 Development of the CAT

The *concrete abstract thinking questionnaire (CAT)* consists of 4 versions. Versions were displayed to participants in the same order: 1, 2, 3 and 4. Each version has 4 scenarios with 8 possible responses consisting of 4 abstract thoughts and 4 concrete thoughts except for version 2 of the questionnaire, which due to an oversight, contains 5 abstract and 5 concrete items. See the complete CAT questionnaire in Appendix 2.

An initial pool of scenarios was generated, drawing on previous research, such as the worry scenarios included in The Worry Domains Questionnaire (Stöber & Joormann, 2001; Tallis et al., 1992) and examples of concrete and abstract thinking provided in published articles (Strack et al., 1985; Watkins et al., 2008). The CAT scenarios differed from previous research (Stöber & Joormann, 2001; Tallis et al., 1992) in that they did not ask participants to describe a worry scenario but rather presented participants with a difficult situation likely to occur at university (e.g., submitting an essay late) or in the work of a paramedic (e.g., trying to intervene with a patient in cardiac arrest) that *could* trigger worry or rumination. These initial scenarios were evaluated by N=16 student and qualified paramedics and rated on a scale from 0-100% on how realistic they were and how likely they would cause individuals to worry or ruminate. If scenarios were rated as less than 60% realistic, they were replaced with new scenarios proposed by the paramedics and re-evaluated.

The concrete and abstract thoughts for each scenario were developed with the help of a clinical psychologist (Dr. Jennifer Wild). Concrete and abstract thinking were defined as follows: Concrete thinking focuses on "how" an event is happening, on the direct experience and means to desired ends (e.g., steps needed to achieve a goal), while abstract thinking is characterised by generalised thoughts focused on "why" and "what

if" questions with no obvious answer, on causes, meanings and consequences (Strack et al., 1985; Watkins, 2008; Watkins et al., 2008; White & Wild, 2016).

Instructions to the CAT guided participants to read the scenarios, imagine they were happening to them, and to select the likely thoughts they would have. The order of the abstract and concrete thoughts was counter-balanced. Abstract scores ranged from 0-4 for each scenario; and concrete scores ranged from 0-4 for each scenario, giving a maximum sum out of 16 for an abstract score and a maximum sum out of 16 for the concrete score for each version. A ratio of abstract to concrete thinking could be calculated for each scenario by dividing the number of abstract responses endorsed by the number of concrete responses endorsed.

3.2.4 Existing Measures Used in Current Study

To examine the psychometric properties of the CAT, participants also completed the following measures:

The Problem Elaboration Questionnaire (PEQ; Stöber & Borkovec, 2002)*:* The PEQ asks participants to describe two major problems about which they are currently worried, as well as three potential negative consequences for each of the two problems. For scoring, abstract thinking is defined as 'indistinct, cross-situational, equivocal, unclear, aggregated' and concrete thinking as 'distinct, situationally specific, unequivocal, clear, singular.' Answers were scored on Stöber's (1996) concreteness rating scale with higher scores indicating greater concreteness: 1 = *abstract,* 2 = *somewhat abstract,* 3= *neither-nor*, 4 = *somewhat concrete,* 5 = *concrete*. Watkins and Moulds (2005) adopted Stöber's (1996) scoring in their study, giving the following example to illustrate scoring 'I think I am heading nowhere in life and career and relationships' (which is rated as 1, abstract), whereas 'I demanded the housekeeper do

up my bootlace, my mother took exception and struck me' is rated as 5 (concrete). A total concreteness score for major worries is calculated by summing the concreteness ratings for the two problems about which participants currently worry. Similarly, a total concreteness score for negative consequences is calculated by summing the concreteness ratings for the six negative consequences that participants have generated. In the present sample a random 10% of the PEQ data were scored by a second, independent rater. This showed good inter-rater reliability: problem elaboration; ICC= .80, p<.001, 95% CI [.49, .92] and consequence elaboration ICC=.81 p<.001, 95% CI [.53, .93].

The Penn State Worry Questionnaire (PSWQ): The PSWQ (T. J. Meyer et al., 1990) is a 16-item self-report questionnaire to assess worry with scores ranging from 16-80. Questions are scored from 1-5 with 1 = *not at all typical of me* and 5 = *very typical of me*. The PSWQ has shown to have high internal consistency (α=.93) and good test-retest reliability *r*=.92. For the present sample, Cronbach's alpha was α=.92.

Ruminative Response Scale (RSS) - Brooding Subscale; The RSS (Treynor et al., 2003) is the most widely used measure of rumination, divided into two subscales: brooding and reflective pondering. It is a 22-item scale with scores from 1-4 with 1 = *almost never* to 4 = *almost always*. The overall scale showed good internal consistency with the (α=.90) and a test-retest correlation of *r*=.67 (Nolen-Hoeksema, 1999). For the five items of the brooding subscale, internal consistency was α=.77 and test-retest correlation *r*=.62 (Treynor et al., 2003). In the current study, only the brooding subscale (to reduce questionnaire burden) was used with Cronbach's alpha α=.78.

Perseverative Thinking Questionnaire (PTQ): The PTQ (Ehring et al., 2011) is a 15-item measure of repetitive thinking independent of disorder, covering worry and rumination. Items are rated on a scale from 0 = *never* to 4 = *almost always*. The PTQ

has demonstrated high internal consistency α=.93-.95, for example α=.94 in a non-clinical sample of students, acceptable test-retest reliability *r*=.69-.75 (Ehring et al., 2011) as well as good predictive validity in the prediction of symptom levels of anxiety and depression .86-.93 (Topper et al., 2017). For the present sample, Cronbach's alpha was α=.96.

PTSD Scale for DSM-5 (PCL-5): To assess symptoms of PTSD, participants completed the PCL-5 (Blevins et al., 2015). The PCL-5 is a 20-item measure of PTSD symptoms directly corresponding to the DSM-5 PTSD criteria (American Psychiatric Association, 2013). It was selected because it is the most up-to-date validated measure of PTSD and is widely used. Initial psychometric evaluation of the PCL-5 with university students exposed to trauma showed strong internal consistency (α=.94), and test-retest reliability (*r*=.82; Blevins et al., 2015). Symptoms are rated on a scale from 0 = *not at all* to 4 = *extremely.* A total score of 33 or more (out of a maximum score of 80) has been recommended as the preliminary clinical cut-off with higher scores indicting greater PTSD symptoms. For the present sample, Cronbach's alpha was α=.95.

Patient Health Questionnaire (PHQ-9): To assess the severity of depressive symptoms over the previous two weeks, participants completed the PHQ-9 (Kroenke et al., 2001). The PHQ-9 is a 9-item self-report questionnaire based on DSM-IV (American Psychiatric Association, 1994) criteria for depression. Scores range from 0 = *not at all* to 3 = *nearly every day*, with a score of 10 or more on the PHQ-9 indicating possible clinically significant depression with a sensitivity and specificity of 88% (Kroenke et al., 2001). Kroenke and team reported good internal reliability (α=.89) and test-retest reliability with a kappa of .84 after 48 hours. It discriminates well between individuals with and without major depressive disorder (MDD). For the present sample, Cronbach's alpha was α=.85.

Generalised Anxiety Disorder Scale (GAD-7): The GAD-7 (Spitzer et al., 2006) is a 7-item questionnaire assessing the frequency of generalised anxiety symptoms over the previous week. Scores ranging from 0 = *not at all to* 3 = *nearly every day* are summed to produce an overall score, with a maximum score of 21, higher scores indicating more severe anxiety symptoms. When used as a screening tool, a score of 8 or higher indicates possible clinically significant GAD with a sensitivity of 89% and specificity of 82%. The GAD-7 showed excellent internal consistency (α=.92), good test-retest reliability (ICC=.83) and good convergent validity with two measures of anxiety (Beck Anxiety Inventory (*r*=.72) and the anxiety subscale of the Symptom Checklist-90 *(r*=.74). For the present sample, Cronbach's alpha was α=.91.

General Self-Efficacy Scale (GSE): The GSE (Schwarzer & Jerusalem, 1995) is a 10-item scale of self-efficacy with scores ranging from 1= *not at all true* to 4 = *exactly true*. The total score ranges between 10 and 40 with a higher score indicating greater self-efficacy. The scale has good internal reliability with Cronbach's alphas between α=.76 and .90. It has shown to correlate with measures of optimism, work satisfaction and to negatively correlate with depression, stress, health complaints, burnout, and anxiety. For the present sample, Cronbach's alpha was α=.84.

Two measures were selected to assess resilience since it is unclear which one most sensitively measure resilience in student paramedics. The *Resilience Scale* is a 25-item scale that measures resilience by asking participants to rate responses to statements on a seven-point Likert scale from 0 = *strongly disagree* to 7 = *strongly agree*. Higher scores indicate greater resilience. The Resilience Scale showed good internal consistency (α=.91) in an elderly, non-clinical sample (Wagnild & Young, 1993). Test-retest reliability was assessed in a different study of pregnant and postpartum women (Killien & Jarrett, 1993, as cited by Wagnild & Young, 1993) and ranged from .67 to

.84. For the present sample, Cronbach's alpha was α=.94.

The *Connor-Davidson Resilience Scale (CD-RISC;* Connor & Davidson, 2003) is a commonly used self-report measure of resilience with 25 items scored on a five-point Likert scale from 0 = *not true at all* to 4 = *true nearly all the time*. Higher scores indicate greater resilience. The scale showed good reliability and validity. Internal consistency was high with Cronbach's α=.89 and item-total correlation ranged from .30 to .70 in a non-clinical sample. Test-retest reliability in a clinical sample with PTSD and GAD showed a high level of agreement with ICC=.87. For the present sample, Cronbach's alpha was α=.91.

3.2.5 Analysis

3.2.5.1 Preliminary analyses.

Descriptive statistics were used to characterize the full sample by gender, ethnicity, age, university and year of study.

3.2.5.2 Order effect and correlation between the CAT versions.

The four CAT versions were correlated to see how they relate to each other. In addition, the number of abstract and concrete items endorsed in version 1 and version 4 were compared to assess whether or not there was an order effect, specifically whether participants endorsed significantly more or less items in version 1 compared to version 4.

3.2.5.3 Use of ratios instead of raw scores.

The abstract and concrete raw scores (number of items endorsed) correlated significantly with each other (r=0.237, p<.001). In other words, participants who endorsed a lot of abstract items also endorsed a lot of concrete items, meaning that thinking abstractly in response to problem scenarios does not preclude the possibility of

also having concrete thoughts for the same scenario. Therefore, the current study calculated the overall *ratio* of abstract to concrete thoughts for each participant to give an indication of whether participants think *more* concretely or *more* abstractly. These will be referred to as 'abstract ratio' and 'concrete ratio' with higher scores indicating greater abstractness or concreteness respectively.

3.2.5.4 Total endorsement.

The total number of items endorsed in the CAT was correlated with the CAT abstract ratio and sum scores of other outcome measures to explore patterns in endorsement.

3.2.5.5 Reliability.

3.2.5.5.1 Internal consistency.

Internal consistency was evaluated using Cronbach's alpha, where a score greater than α=.80 indicates good internal consistency (Nunnally & Bernstein, 1994). Internal consistency was calculated for all abstract items and all concrete items, as well as for each of the four versions of the CAT and the 'best version CAT.'

3.2.5.5.2 Test-retest reliability.

Using the 198 participants (96.6% of total sample) who completed the CAT a second time, two weeks after initial completion, the intraclass correlation coefficient (ICC) was calculated to assess test-retest reliability for the full sample and the 'best version CAT.'

3.2.5.6 Validity.

3.2.5.6.1 Convergent validity.

To examine convergent validity, correlations were conducted to assess the relationship between the CAT and the PEQ (Stöber & Borkovec, 2002) as well as with measures of worry (PSWQ; Meyer et al., 1990), rumination (RRS-Brooding subscale;

Treynor et al., 2003) and repetitive thinking (PTQ; Ehring et al., 2011) which have previously been shown to correlate highly with reduced concreteness (abstract thinking). To assess slightly broader constructs which have shown to correlate with rumination or worry, correlations were calculated between the CAT and measures of PTSD (PCL-5; Blevins et al., 2015), depression (PHQ-9; Kroenke et al., 2001) and GAD (GAD-7; Spitzer et al., 2006).

Constructs that were expected to have a negative correlation with the abstract scores of the CAT were also assessed. Correlations were conducted between the CAT, specifically measures of self-efficacy (GSE; Schwarzer & Jerusalem, 1995), and resilience (Resilience Scale; Wagnild & Young, 1993 and CD-RISC; Connor & Davidson, 2003).

3.2.5.6.2 Factorial validity.

Confirmatory factor analyses (CFAs) were conducted instead of exploratory factor analyses (EFAs) since items were developed with a strong theoretical and empirical foundation and categorised as concrete or abstract thoughts. CFAs were conducted for each of the 16 scenarios to estimate their fit and factor loading onto the two factors of concreteness and abstractness. A weighted least squares means and variance adjusted (WLSMV) estimation was applied because the CAT items are binary (yes/no, whether or not participants endorsed a thought) (Muthén, 1993; Muthén, du Troit, & Spisic, 1997). As the chi-square statistic increases with sample size and leads to rejection of the hypothesized model even with good fit (Bentler & Bonett, 1980) additional fit indices were examined: the Comparative Fit Index (CFI) with a good fit of .95, the Root Mean Square Error of Approximation (RMSEA) with a good fit of .05 for sample sizes smaller than 250, and the Standardized Root Mean Square Residual (SRMR) with a good fit of .08 (Hu & Bentler, 1998; Schermelleh-Engel et al., 2003).

Variances of the latent variables were set to one. A 'best version CAT' was established using the four scenarios with the best fit, parameter estimation, and factor loading. Analyses are reported below for the CAT versions as they were administered as well as the 'best version CAT' which emerged from CFA analyses.

Analyses were conducted using SPSS (Version 25; IBM Corp., 2017), the R 'lavaan' package (Version: 0.6-3; Rosseel, 2012) and Rstudio (Version 1.1.463; RStudio Team, 2018).

3.3 Results

3.3.1 Preliminary Analyses

3.3.1.1 Correlation between CAT versions.

To assess the association between the different CAT versions, the abstract ratios were correlated showing significant low to medium correlation from *r*=.31-.66 (CAT version 1 and CAT version 2 *r*=.55; CAT version 1 and CAT version 3, *r*=.58; CAT version 1 and CAT version 4, *r*=.31; CAT version 2 and CAT version 3, *r*=.66; CAT version 2 and CAT version 4, *r*=.40; and CAT version 3 and CAT version 4, *r*=.49). See Table 5.

Table 5
Correlations (r) between the CAT versions

	CAT version 1	CAT version 2	CAT version 3	CAT version 3
CAT version 1	1.00	0.55	0.58	0.31
CAT version 2		1.00	0.66	0.40
CAT version 3			1.00	0.49
CAT version 4				1.00

3.3.1.2 Order effect of the CAT versions.

There was a significant decrease in endorsement in abstract items from version 1 *(M*=7.00; *SD*=4.08) to version 4 (*M*=5.72; *SD*=3.83), *t*(204)=4.99, *p*<.001. Contrary to this pattern, there was a significant increase in endorsement of concrete items from version 1 *(M*=7.53; *SD*=3.71) to version 4 (*M*=5.72; *SD*=3.63), *t*(204)=-9.37, *p*<.001. It would appear that during the course of questionnaire completion, participants endorsed fewer abstract and more concrete thoughts, suggesting that exposure to the scenarios and thought responses of all of the four versions of the CAT in one sitting may lead participants to think more concretely.

3.3.1.3 Total endorsement.

The total number of endorsed items correlated moderately with the overall abstract ratio *r*=0.33, *p*<.001. This indicates that participants who endorsed more thoughts overall also thought more abstractly. The total endorsed scores correlated with the PTQ (*r*=.22, *p*<.001), the RRS (*r*=.27, *p*<.001), and the PSWQ (*r*=.23, *p*<.001) and none of the other measures. This indicates that participants who worry and ruminate more also endorse more thoughts overall.

3.3.2 Reliability

3.3.2.1 Internal consistency.

Using the entire sample (N=205) the CAT demonstrated good internal consistency of the abstract items (65 items**),** Cronbach's α=.95, and the concrete items (65 items) with Cronbach's α=.93. Internal consistency was also good for each version: Version 1 (17 items each), abstract α=.95, concrete α=.76, Version 2 (16 items each) abstract α=.84, concrete α=.75, Version 3 (16 items each), abstract α=.83, concrete=.80

and version 4 (16 each), abstract α=.83 and concrete α=.79. There was good internal consistency for the 'best version CAT' with abstract α=.87 and concrete α=.85.

3.3.2.2 Test-retest reliability.

The CAT demonstrated good test-retest reliability as measured by intraclass correlation coefficients (ICC) between both time points. Sum scores for all abstract items were correlated with the sum scores two weeks later, ICC= .90, p<.001, 95% CI [.77, .88]. Similarly, sum scores for all concrete items were correlated with the sum scores two weeks later: ICC = .87, p<.001, 95% CI [.79, .91]. The overall abstract ratio was correlated with the overall abstract ratio two weeks later, ICC= .82, p<.001, 95% CI [.77, .86].

There was also good test-retest reliability for the 'best version CAT' for abstract items, ICC= .88, p<.001, 95% CI [.84, .91] and concrete items, ICC= .85, p<.001, 95% CI [.80, .89]. There was adequate test-retest reliability for the abstract ratio of the 'best version CAT', ICC= .75, p<.001, 95% CI [.69, .81].

3.3.3 Validity

3.3.3.1 Convergent validity.

See Table 6 for an overview of all correlations.

3.3.3.1.1 Problem Elaboration Questionnaire (PEQ).

The sum of problem descriptions and the sum of consequence descriptions of the PEQ scores did not correlate significantly with the overall abstract ratio of the CAT: PEQ sum of problem descriptions, *r*=-.06, *p*=.40, PEQ sum of consequence descriptions, *r*=.03, *p*=.68.

Similarly, the sum of problem descriptions and the sum of consequence descriptions of the PEQ did not correlate significantly with the abstract ratio of the 'best

version CAT': PEQ sum of problem descriptions, r=-.06, p=.34, PEQ sum of consequence descriptions, r=.06, p=.38.

The sum of problem descriptions and the sum of consequence descriptions of the PEQ showed a moderate, significant correlation with each other r=.36, p<.001. In the current sample, the PEQ sums did not correlate with any of the other measures (PSWQ, RRS, PTQ, PCL-5, PHQ-9, GAD-7, GSE, the Resilience Scale or the CD-RISC) except for a weak, significant correlation between the PEQ sum of consequence descriptions and the PCL-5; r=-.18, p<.001, in the expected direction that more abstract PEQ scores correlated with higher PCL-5 scores.

3.3.3.1.2 Perseverative Thinking Questionnaire (PTQ).

The CAT abstract ratio correlated highly with the PTQ in the expected direction indicating that greater abstract thinking was associated with greater repetitive negative thinking, r=.54, p<.001. Similarly, the abstract ratio for the 'best version CAT' correlated highly with the PTQ in the expected direction indicating that greater abstract thinking was associated with greater repetitive negative thinking, r=.52, p<.001.

3.3.3.1.3 Penn State Worry Questionnaire (PSWQ).

The CAT abstract ratio correlated moderately to highly with the PSWQ in the expected direction indicating that greater abstract thinking was associated with greater worry, r=.49, p<.001. Similarly, the abstract ratio for the 'best version CAT' correlated highly with the PSWQ in the expected direction indicating that greater abstract thinking was associated with greater worry, r=.50, p<.001.

3.3.3.1.4 Rumination Response Scale (RRS) – Brooding Subscale.

The CAT abstract ratio correlated moderately to highly with the RRS in the expected direction indicating that greater abstract thinking was associated with greater rumination and brooding, r=.48, p<.001. Similarly, the abstract ratio for the 'best

version CAT' correlated moderately with the RRS in the expected direction indicating that greater abstract thinking was associated with greater rumination and brooding, r=.42, p<.001.

3.3.3.1.5 PTSD Scale for DSM-5 (PCL-5).

The CAT abstract ratio correlated weakly to moderately with the PCL-5 in the expected direction indicating that greater abstract thinking was associated with greater PTSD symptoms, r=.26, p<.001. Similarly, the abstract ratios for the 'best version CAT' correlated weakly to moderately with the PCL-5 in the expected direction indicating that greater abstract thinking was associated with greater PTSD symptoms, r=.23, p=.001.

3.3.3.1.6 The Patient Health Questionnaire (PHQ-9).

The CAT abstract ratio correlated weakly to moderately with the PHQ-9 in the expected direction indicating that greater abstract thinking was associated with greater depression symptoms, r=.26, p<.001. Similarly, the abstract ratio for the 'best version CAT' correlated moderately with the PHQ-9 in the expected direction indicating that greater abstract thinking was associated with greater depression symptoms, r=.32, p<.001.

3.3.3.1.7 Generalised Anxiety Disorder Scale (GAD-7).

The CAT abstract ratio correlated moderately with the GAD-7 in the expected direction indicating that greater abstract thinking was associated with greater generalised anxiety, r=.39, p<.001. Similarly, the abstract ratio for the 'best version CAT' correlated moderately with the GAD-7 in the expected direction indicating that greater abstract thinking was associated with greater generalised anxiety, r=.41, p<.001.

3.3.3.1.8 General Self-Efficacy Scale (GSE).

The CAT abstract ratio correlated moderately with the GSE in the expected direction indicating that greater abstract thinking was associated with lower self-efficacy, r=-.33, p<.001, and this relationship held true for the 'best version CAT', r=-.32, p<.001.

3.3.3.1.9 Resilience Scale.

The CAT abstract ratio correlated moderately with the Resilience Scale in the expected direction indicating that greater abstract thinking was associated with lower resilience, r=-.34, p<.001. Similarly, the abstract ratio for the 'best version CAT' correlated moderately with the Resilience Scale in the expected direction indicating that greater abstract thinking was associated with lower resilience, r=-.30, p<.001.

3.3.3.1.10 Connor-Davidson Resilience Scale (CD-RISC).

The CAT abstract ratio correlated moderately with the CD-RISC in the expected direction indicating that greater abstract thinking was associated with lower resilience, r=-.43, p<.001. Similarly, the abstract ratio for the 'best version CAT' correlated moderately with the CD-RISC in the expected direction indicating that greater abstract thinking was associated with lower resilience, r=-.40, p<.001.

Table 6

Correlations between the CAT abstract ratio and other measures (N=205)

Measure	*r*	*p*
PEQ problem elaboration	-.06	.358
PEQ consequence elaboration	.03	.680
PSWQ	.49	<.001
RSS	.48	<.001
PTQ	.54	<.001
PCL-5	.25	<.001
PHQ-9	.25	<.001
GAD-7	.39	<.001
GSE	-.33	<.001
Resilience Scale	-.34	<.001
CD-RISC	-.43	<.001

Note. PEQ=Problem Elaboration Questionnaire; PSWQ=Penn State Worry Questionnaire; RSS=Rumination Response Scale-Brooding Subscale; PTQ=Perseverative Thinking Questionnaire; PCL-5=PTSD Scale for DSM-5; PHQ-9 =Patient Health Questionnaire; GAD-7=Generalised Anxiety Disorder Scale; GSE=General Self-efficacy Scale; CD-RISC=Connor-Davidson Resilience Scale.

3.3.3.2 Factorial validity.

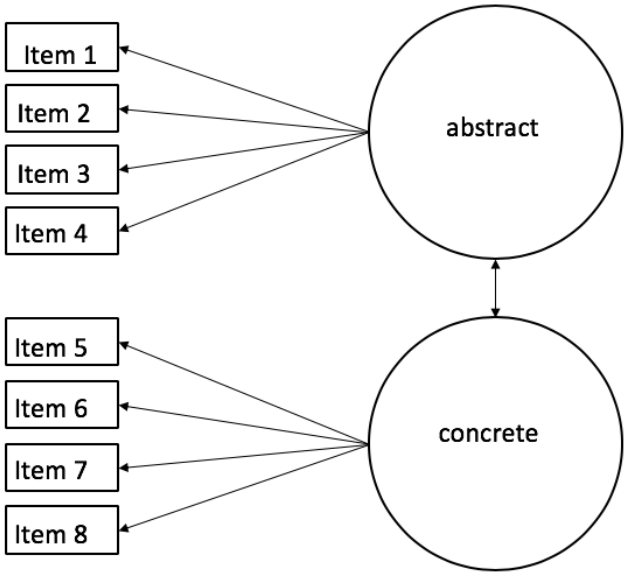
Confirmatory factor analyses (CFAs) were conducted for each of the 16 scenarios of the CAT to assess factorial validity. Model 1 represents a two-factor model where 8 of the items load onto concrete thinking and 8 onto abstract thinking. Sixteen CFAs were conducted, each with 8 items (4 abstract, 4 concrete) (with the exception of version 1 scenario 2 which included 5 abstract and 5 concrete items). Fit indices of the confirmatory factor analyses per scenario are shown in Table 7.

Table 7

Results of scenario-wise confirmatory factor analyses (CFAs)

Scenario	$\chi 2$	**CFI**	**RMSEA (90% CI)**	**SRMR**
1_1	$\chi 2(19)=37.72$, $p=006$	.87	.07	.12
1_2	$\chi 2(34)=111.99$, $p=.000$	.79	.11	.14
1_3	$\chi 2(20)=52.47$, $p=.014$	.85	.09	.14
1_4	**$\chi 2(19)=31.77$, $p=.033$**	**.97**	**.06**	**.10**
2_1	$\chi 2(20)=45.26$, $p=.005$	.76	.07	.11
2_2	$\chi 2(19)=44.08$, $p=.001$	.92	.08	.11
2_3	**$\chi 2(19)=31.33$, $p=.037$**	**.96**	**.06**	**.09**
2_4	$\chi 2(20)=25.63$, $p=.141$	.99	.04	.10
3_1	**$\chi 2(19)=23.80$, $p=.204$**	**.99**	**.03**	**.07**
3_2	**$\chi 2(19)=12.84$, $p=.847$**	**1.00**	**.00**	**.06**
3_3	$\chi 2(19)=31.39$, $p=.037$	.90	.06	.10
3_4	$\chi 2(19)=82.36$, $p=.000$	.75	.13	.15
4_1	$\chi 2(19)=62.61$, $p=.000$	.63	.11	.14
4_2	$\chi 2(19)=87.68$, $p=.000$	.77	.13	.17
4_3	$\chi 2(19)=82.72$, $p=.000$	.71	.13	.18
4_4	$\chi 2(19)=107.98$, $p=.000$	.44	.15	.19

Note: $\chi 2$ = robust chi-square statistic; CFI = Comparative Fit Index; RMSEA = Root Mean Square Error of Approximation; SRMR = Standardized Root Mean Square Residual. 'Best version CAT' items are highlighted in bold.



Model 1. Hypothesised model of concrete and abstract factors loading onto items of the CAT questionnaire.

The fit for Model 1 of the CAT considering all scenarios together was inadequate, indicated by lower CFI, higher RMSEA, lower SRMR values and estimation problems for some scenarios. Four scenarios: 1_2, 3_3, 3_4, and 4_1 could not be calculated because of estimation problems or problems with factor loadings that could not be solved by taking out items. Six scenarios: 1_1, 2_1, 2_2, 4_2, 4_4, and 4_4 had bad fit but could be improved to perfect fit by taking out one specific abstract and one concrete item resulting in scenarios with six items. Six scenarios had good fit: 1_3, 1_4, 2_3, 2_4, 3_1, and 3_2.

Based on these findings, a 'best-version' CAT is proposed which includes four scenarios with the best fit based on the CFI, RMSEA and SRMR, parameter estimation, factor loading and content of the scenarios. This version includes two scenarios related to student life and two related to paramedic work. The factor loading of the items of this version ranged from .33 to .95. Specifically for CAT version 1 scenario 4 the abstract

factor loading range was .71-.94, the concrete factor loading range .45-.80, for CAT version 2 scenario 3 the abstract factor loading range was .73-.88, concrete factor loading .33-.84, for CAT version 3 scenario 1 the abstract factor loading range was .77-.89, the concrete factor loading range .50-.88 and for CAT version 3 scenario 2 the abstract factor loading range was .33-.66, and concrete factor loading range .40-89. See table 8 for factor loadings of each item of the 'Best version CAT.' The concrete and abstract factors were negatively correlated with each other ranging from *r*=-.33-39 although one scenario had a positive correlation between the factors of *r*=.51. See Appendix 3 for the 'best version CAT.'

Table 8
Factor loading of 'Best Version CAT' items

Version Scenario	Abstract item nr	Abstract factor loading	p-value	Concrete item nr	Concrete factor loading	p-value
Version 1 Scenario 4	1	0.707	<.001	2	0.508	<.001
	3	0.939	<.001	5	0.795	<.001
	4	0.840	<.001	6	0.654	<.001
	7	0.802	<.001	8	0.453	<.001
Version 2 Scenario 3						
	2	0.730	<.001	1	0.329	.004
	4	0.748	<.001	3	0.590	<.001
	5	0.739	<.001	6	0.677	<.001
	7	0.877	<.001	8	0.844	<.001
Version 3 Scenario 1						
	1	0.766	<.001	2	0.818	<.001
	3	0.890	<.001	5	0.881	<.001
	4	0.893	<.001	6	0.496	<.001
	7	0.789	<.001	8	0.758	<.001
Version 3 Scenario 2						
	1	0.330	.005	3	0.555	<.001
	2	0.573	<.001	4	0.889	<.001
	5	0.662	<.001	6	0.598	<.001
	7	0.559	<.001	8	0.472	<.001

3.4 Discussion

An online study evaluated the validity and reliability of a new concrete and abstract thinking questionnaire (CAT) developed for student paramedics. The CAT demonstrated good internal consistency and test-retest reliability and good convergent validity with measures of RNT, worry, rumination, PTSD, depression, GAD, self-efficacy and resilience but not with the existing measure of concrete and abstract thinking (PEQ), which appears to have relied on a different definition of concrete and abstract thinking. There was insufficient factorial validity for the overall CAT but good factorial validity for the 'best version CAT'. The author recommends only the use of the 'best version CAT.'

3.4.1 Reliability

The CAT showed good reliability with high internal consistency and good test-retest reliability for both the overall CAT and the 'best version CAT.'

3.4.2 Validity

The CAT exhibited good convergent validity relative to other measures of related concepts. As predicted, the abstract ratio of the CAT correlated positively with measures of repetitive negative thinking (PTQ), rumination (RRS), worry (WEWEBS), depression (PHQ-9), PTSD (PCL-5) and anxiety (GAD-7). Specifically, the CAT showed a strong correlation with repetitive negative thinking, specifically worry and rumination, cognitive processes characterised by abstract thinking. The CAT correlated moderately with depression and anxiety, disorders characterised by rumination and worry. The CAT showed a weak correlation with PTSD, a disorder that is not directly characterised by abstract thinking but where rumination has shown to increase risk and

maintenance of PTSD symptoms. These correlations are in line with previous research showing clear relationships between these concepts and disorders (Ehring & Watkins, 2008; Stöber et al., 2000; Watkins & Moulds, 2007).

As predicted, the abstract ratio of the CAT correlated negatively with measures of self-efficacy (GSE) and resilience (The Resilience Scale; CD-RISC). To the author's knowledge, this is the first study that has shown a relationship between these concepts, although correlations with other measures of adaptive coping such as problem solving have been reported (Watkins & Moulds, 2005).

The CAT exhibited insufficient convergent validity relative to an existing measure of concrete and abstract thinking, the PEQ. The PEQ consist of a sum of problem descriptions and a sum of consequence descriptions. Contrary to prediction, the abstract ratio of the CAT failed to correlate with either PEQ sum. In the current sample, the PEQ sums also failed to correlate significantly with measures of RNT, rumination, worry, depression, GAD, self-efficacy and resilience. This is inconsistent with previous literature where the PEQ correlated significantly with RNT, rumination and worry, depression and GAD (Stöber & Borkovec, 2002; Watkins & Moulds, 2005). However, it is consistent with research by Ehring, Frank and Ehlers (2008). In their study of abstract thinking and rumination following traumatic road traffic accidents, they found that the trauma-focused PEQ failed to correlate with rumination. While Stöber and Borkovec's PEQ asks about *any* worries the participant has, the trauma-focused PEQ used by Ehring, Frank and Ehlers (2008) and the CAT refer to *specific* scenarios or traumatic events. Ehring, Frank and Ehlers (2008) suggest that focusing on worries related to a specific scenario could lead to fewer abstract thoughts than focusing on any worries. It is possible that asking participant to direct their thinking to a specific scenario may focus their thoughts and facilitate problem-solving, which would be

associated with greater concrete and fewer abstract thoughts. In the current study, it was also found that over time, participants did endorse greater concrete thoughts in response to specific scenarios.

The lack of correlation between the CAT and the PEQ may relate to the different definitions employed to define concrete and abstract thinking. Stöber and Borkovec (2002) define abstract thinking as 'indistinct, cross-situational, equivocal, unclear, aggregated' and concrete thinking as 'distinct, situationally specific, unequivocal, clear, singular.' The definitions used in the current study adopted those of current research whereby abstract thinking was defined as generalised thoughts focused on 'why' and 'what if' questions with no obvious answer, on causes, meanings and consequences. Concrete thinking was defined as thoughts that are focused on 'how' an event is happening, on the direct experience and means to desired ends (e.g., steps needed to achieve a goal) (Strack et al., 1985; Watkins, 2008; Watkins et al., 2008; White & Wild, 2016). According to Stöber and Borkovec, if thoughts are 'cross-situational and aggregated,' (that is, they span different situations and sum up multiple ideas or actions) they are always scored as abstract although they may be indicative of concrete thinking. For example, if a participant were to note the following worry description: "Ensuring I pass assignments and meet clinical practice milestones" according to Stöber and Borkovec's (2002) definitions, this description would be scored as abstract because multiple assignments and milestones meet their definition of 'cross situational and aggregated.' However, this example would be scored as concrete according to the definition used in developing the CAT because it focuses on the specific steps (passing assignments) needed to achieve a goal (meeting milestones).

It is possible, of course, that the primary researcher and the blind second rater scored PEQ items in a way that differs from previous studies. However, both raters

followed the written instructions by Stöber and Borkovec (2002) and Watkins and Moulds (2005) and achieved high inter-rater reliability, which make this explanation unlikely.

The CAT did not show adequate overall factorial validity as some CAT scenarios showed inadequate model fit. Furthermore, modification indices suggested potential cross-loadings of items between the two factors, meaning that items could load on both factors instead of on the specified abstract or concrete factors. Even though the items in question were not ambiguous from a clinical view (clearly concrete or abstract), they appear so on a statistical level. Six of the 16 scenarios showed estimation problems so that the calculated fit and parameter results were not reliable. This could have different explanations. It could be that the WLSMV estimation method usually requires large sample sizes (N=500) (Bandalos, 2014; Forero et al., 2009) and the current sample size may have been too small. A WLSMV estimation was applied because the CAT items are binary. It was deemed more important to use the WLSMV because of the binary data since other estimators could have biased the estimations.

Four scenarios form the 'best version CAT' showed very good factorial validity based on fit, parameter estimation, factor loading and scenario content. The content is balanced across university and paramedic scenarios. In three out of the four 'best version CAT' scenarios the concrete and abstract factors were negatively correlated with each other as expected. However, version 3 scenario 2 (Your computer crashed with your essay on it and you don't have a back-up) had a positive correlation between the two factors. This scenario is deemed to be common among university students and likely to elicit abstract thoughts in the immediate aftermath followed quickly by concrete thoughts given that essays are linked to deadlines, which necessitate active problem-solving.

3.4.3 Preliminary Analyses

The four CAT versions correlated moderately with each other, indicating that they are related but not as closely that they could be considered to be measuring concrete and abstract thinking in exactly the same way. This may be due to the inadequate factorial validity of some scenarios, with some versions including more and some versions fewer of these inadequate scenarios. This means that the four versions are not recommended to be used separately or interchangeably. Instead, all analyses were conducted with scores from the full (16 scenarios) CAT and the 4-scenario 'best version CAT.'

Comparison of the CAT version 1 with the CAT version 4 indicated that during the course of questionnaire completion, participants endorsed fewer abstract and more concrete thoughts. It is possible that participants benefited from a learning effect whereby completing all four versions of the CAT in one sitting shifted their responses in the direction of endorsing more concrete items and fewer abstract items. Given that the pattern of responding changed over the course of one sitting with the completion of all four versions of the CAT suggests that a four scenario version should be given at any one time. It is unlikely that this pattern of responding had an effect on the 'Best Version CAT' since the 'best scenarios' were found to be reasonably well dispersed among the CAT versions.

Individuals who endorsed a high number of items overall also showed greater abstract thinking (CAT), RNT, including rumination and worry. Presenting options of possible thought responses for each scenario might encourage individuals who tend to worry and ruminate to endorse more thought responses. It is possible that they may endorse items they believe they should be thinking as well as items that they typically

think. It is also possible, of course, that participants who worry and ruminate do experience concrete thoughts in response to the presented scenarios but give their abstract thoughts more attention.

3.4.4 Limitations and Suggestions for Future Research

There are several limitations to the CAT. First, the full CAT (4 versions) does not show sufficient factorial validity and only the 'best version CAT' is recommended for further use. The original aim of developing multiple valid versions of the questionnaire was not met and leads to the potential limitation of a learning effect if the 'best version CAT' is used repeatedly with the same population. Despite the 'best version CAT' showing good validity and reliability with the current sample, caution should be taken when interpreting the results. A major limitation of the 'best version CAT' is that no revalidation analysis of only the 'best version CAT' was conducted in a new sample. The current sample size would not have been large enough to split into two samples and replicate analyses in the second sample.

A second limitation is running multiple factor analyses (one for each scenario) instead of one validation of the overall abstract and concrete factors of all CAT scenarios. A factor analysis with second order factors was not planned and with 16x4 abstract items the CFA would not have been in line with the power analysis but would have required a much larger sample. One option could have been item parcelling; to parcel (count together) all abstract and all concrete items and run one large factor analysis. The author decided against this analysis as parcelling can camouflage a range of misspecifications in a confirmatory factor analysis and could lead to misleadingly good fit indices, parameter estimate bias or camouflage potential cross-loadings (Bandalos, 2002; Marsh et al., 2013), especially in a relatively small (N<500) sample.

However, the lack of an analysis of the overall abstract and concrete factors remains a limitation of the CAT's validity.

Third, contrary to predictions, the CAT did not correlate with the PEQ, a measure of concrete and abstract thinking. There may be explanations for this including that the PEQ perhaps did not best capture abstract or concrete thinking in this sample, which would be consistent with the finding that it failed to correlate with measures of rumination or repetitive negative thinking. However, it is important to consider the possibility that the CAT did not measure the constructs of abstract and concrete thinking as intended but some different factor that correlates highly with repetitive negative thinking. Since no CFA was conducted to assess an overall factor of abstract thinking, we cannot be certain that the CAT overall measures abstract thinking. The CFA only confirmed that abstract and concrete items in the 'best version CAT' loaded onto two distinct factors within each scenario.

Fourth, whilst the abstract factor correlated with measures of rumination, we cannot exclude the possibility that it was measuring symptoms of rumination rather than abstract thinking. While most definitions of rumination have focused on abstract thinking (e.g. Watkins & Moulds, 2005), one study has examined other symptoms or characteristics of rumination such as the compulsion to continue ruminating, unproductive thoughts, negative feelings during rumination, and negative feelings after rumination (Michael et al., 2007). It would also be worth further investigating the content and cognitive themes associated with rumination in PTSD. It is possible that they are more important to the prediction and maintenance of PTSD than the abstract nature of ruminative thoughts.

Fifth, since measures of psychopathology were not assessed at a second timepoint, which followed two weeks after the initial administration of the four versions of the CAT, predictive validity could not be evaluated.

Sixth, although scenarios provide a good alternative to elaborating a problem in an open-ended response format, there are limitations with this approach. The instructions ask participants to 'imagine' themselves in the situations. Participants may find specific scenarios easier to imagine than others. What participants imagine they would think may not always match what they would actually think in response to a given scenario. For example, participants may endorse thoughts they believe they 'should' think in such situations. However, this is an issue common to most measures and the instructions clearly ask participants to only endorse thoughts they would most likely have without indicating the abstract-concrete distinction or that some answers may be "better" than others. Since the CAT scenarios were developed with user advisory feedback from paramedics and student paramedics who rated the scenarios for how realistic they were, and since all 205 participants endorsed a wide range of thought responses (instead of only one or two), the thought responses were deemed to be sufficiently realistic and suitable.

Seventh, since participants only had the option of endorsing or choosing not to endorse an item, they could not select a hierarchy of thoughts (i.e. they could not rate the degree to which they agreed with an item (i.e. very much, moderately) or indicate the likely frequency of the item (i.e. never, sometimes, always) on a Likert scale). Whilst the current scoring is binary rather than continuous, it does provide a ratio of abstract to concrete thinking and a simple method for scoring.

Finally, the current scenarios allow only some generalisation across other professions. The 'best version CAT' items include scenarios on receiving bad marks, a

computer crashing without backup, resuscitation and recognising symptoms of poor health in a patient. The CAT could therefore be used for student paramedics across the UK and likely in other Western countries that combine studies with paramedic training. It could potentially also be applied to other students in ambulance or rescue work or medical students. For other emergency workers such as fire and police personnel, new scenarios would need to be developed.

3.4.5 Conclusion

The 'best version CAT' provides a user-friendly, valid, reliable and population-specific measure of concrete and abstract thinking. Its development followed a systematic approach: first forming scenarios with user advisory feedback, developing items in collaboration with a clinical psychologist and in adherence to a clear definition, then evaluating the full four-version CAT, and finally developing the 'best version CAT' on the basis of rigorous analyses. However, findings of this study and the 'best version CAT' should be considered with care due to limitations such as the lack of re-validation of the 'best version CAT', lack of correlation with a previous measure of abstract and concrete thinking, the limitations of running multiple factor analyses and the limitations of using a scenario-based measure and binary responses. The author recommends further research to evaluate the 'best version CAT' to assess concrete and abstract thinking in student paramedics.

The 'best version CAT' could have potential utility in future research. An application of the measure could be to investigate the potential relationship between abstract and concrete thinking and the development of psychopathology in student paramedics, as well as to evaluate the effectiveness of interventions aimed at modifying abstract thinking and concrete thinking with training.

4 Chapter 4: Abstract Thinking and Rumination as Predictors of PTSD

4.1 Introduction

As described in chapter 1 (Sections 1.5.2 and 1.5.3), rumination has been established as a risk factor and predictor of PTSD in emergency workers (Clohessy & Ehlers, 1999; Razik et al., 2013; Wild et al., 2016). Whilst rumination is characterised by abstract-analytical thinking (e.g. Ehring & Watkins, 2008), research on the role of abstract thinking in PTSD has been limited. The majority of studies that have investigated the role of abstract thinking in PTSD have conducted experiments using analogue trauma rather than conducting studies with at-risk populations in naturalistic settings. The current study aims to assess abstract thinking as a predictor of PTSD symptom severity in student paramedics, a population at high risk of developing PTSD, using the newly developed and validated measure of concrete and abstract thinking (CAT; chapter 3).

4.1.1 Rumination as Risk Factor and Predictor of PTSD

Rumination is defined as repetitive, self-focused, negative thinking about past experiences. In the case of PTSD, it describes dwelling about the traumatic event (e.g. Nolen-Hoeksema, 1991; Papageorgiou & Wells, 2003). Rumination was found to be a risk factor (Wild et al., 2016) and predictor (Clohessy & Ehlers, 1999; Razik et al., 2013) of PTSD in emergency workers as well as in other populations (Duffy et al., 2015; Ehlers et al., 1998; Kleim et al., 2007) (see Chapter 1, section 1.5.3.).

Rumination is also a common response to intrusive memories, a hallmark symptom of PTSD, where intrusive memories can trigger episodes of ruminating about

the trauma e.g. why it happened, what the person could have done differently (Steil & Ehlers, 2000). Rumination in response to intrusive memories has been found to correlate with PTSD severity (Clohessy & Ehlers, 1999; Steil & Ehlers, 2000) and has been found to be a significant predictor of PTSD (Beierl et al., 2019; Ehlers et al., 1998; Kleim et al., 2012; Michael et al., 2005).

4.1.2 Abstract and Concrete Thinking

Rumination is characterised by increases in abstract-analytical thinking and decreases in concrete-experiential thinking (Ehring, Frank, et al., 2008; Ehring & Watkins, 2008; Stöber & Borkovec, 2002; Watkins, 2009; Watkins & Moberly, 2009). Abstract thinking involves generalised thoughts focused on 'why' and 'what if' questions with no obvious answer, on causes, meanings and consequences. For example: 'Why is this always happening to me? What if I never get it right?' Concrete thinking focuses on 'how' an event is happening, on the direct experience and means to desired ends (e.g., steps needed to achieve a goal). For example: 'How can I best learn from my mistake? What is the first step I can take to solve this problem?' (Strack et al., 1985; Trope & Liberman, 2003; Vallacher & Wegner, 1989; Watkins, 2008; Watkins et al., 2008; White & Wild, 2016).

As rumination is *characterised* by abstract thinking, it can be difficult to disentangle abstract thinking from rumination. Whilst abstract thinking is a feature of rumination, rumination is a behaviour, a habit of repetitive negative thinking from which it is difficult to disengage. It is possible to think in an abstract way without ruminating, such as philosophising about the implications of world events and to disengage from such thinking. Individuals who ruminate will find it difficult to disengage from abstract thinking. The argument in the current thesis is that rumination

and abstract thinking largely overlap. The definitions described above posit that abstract thinking is a specific, maladaptive thinking style which characterises rumination. Rumination is a behaviour, a habit that encompasses this thinking style and the behaviour of engaging in such thinking without readily disengaging from it.

One may question why it is necessary to investigate abstract thinking separately to rumination. Investigating core features of rumination, such as abstract thinking, further elucidates our understanding of the possible mechanisms by which rumination may exert adverse consequences and guides the development of interventions to target those mechanisms. Literature in the areas of depression and anxiety, suggest that abstract thinking characterises rumination, which maintains depression, and could be targeted with training in concrete thinking. For example, as described in chapter 1, Watkins and colleagues used concreteness training to decrease symptoms of depression (Watkins et al., 2009; Watkins & Moberly, 2009) and to prevent depression in high ruminators (L. Cook et al., 2019).

4.1.3 Abstract Thinking and PTSD

While the role of abstract thinking in depression and anxiety disorders is well established (e.g. L. Cook et al., 2019; Stöber & Borkovec, 2002; Watkins & Moberly, 2009; Watkins & Moulds, 2007) (see Chapter 1 section 1.6.3 and 1.6.4), little is known about the role of abstract thinking in PTSD. The majority of studies assessing abstract thinking in the context of PTSD have used analogue trauma to simulate actual trauma (e.g. Ehring, Szeimies, et al., 2009; Schaich et al., 2013) and have found a relationship between abstract thinking and PTSD. For example, abstract thinking was found to increase intrusive memories after analogue trauma exposure (Ball & Brewin, 2012; Luo et al., 2013; White & Wild, 2016) or non-traumatic negative experiences (Santa Maria

et al., 2012; Watkins, 2004). (See Chapter 1, section 1.8.2 for details). One study claimed that concreteness may buffer the impact of rumination on intrusive memories (Schaich et al., 2013). This statement was based on a study which showed that abstract thinking led to a significant correlation between rumination and intrusive memories (frequency and distress) while concrete thinking did not.

4.1.4 Abstract Thinking as a Predictor of PTSD

Few studies have investigated abstract thinking as a predictor of PTSD. One study of assault survivors found that characteristics of rumination predicted greater variance in PTSD than the presence of rumination alone (Michael et al., 2007). Specifically, the study found that 'why' and 'what if' questions (similar to the definition of abstract thinking), were among the characteristics that significantly predicted PTSD. In a study of road traffic accident survivors, combining self-reported rumination frequency and abstract thinking predicted PTSD better than rumination frequency alone (Ehring, Frank, et al., 2008).

Establishing abstract thinking as a predictor of PTSD could have useful clinical implications. This would be especially relevant for high-risk populations such as student paramedics. Across studies, paramedics show a higher prevalence of PTSD than other emergency workers and higher than the general population (Bennett et al., 2004; Petrie et al., 2018). No studies have yet assessed abstract thinking as a predictor of PTSD in student paramedics.

Abstract thinking and rumination are not symptoms of PTSD. However, abstract thinking and rumination may contribute to PTSD via similar mechanisms. First, abstract thinking about the trauma or its consequences may trigger rumination and subsequent intrusive memories. Intrusive memories themselves may trigger episodes of abstract

thinking which develop into episodes of rumination when individuals are unable to disengage from their abstract thoughts about the trauma. Based on Ehlers and Clark's (2000) cognitive model of PTSD, rumination may provide internal retrieval cues that trigger intrusive memories. An analogue study supported the theory that rumination increases intrusive memories (Ehring, Fuchs, et al., 2009). Thus, one potential mechanism through which abstract thinking contributes to PTSD is via rumination and the mechanism through which rumination contributes to PTSD is via an increase in intrusive memories. Second, abstract thinking and rumination may lower mood and both have been associated with depression and low mood (Nolen-Hoeksema, 1991; Watkins & Moulds, 2007; Watkins & Teasdale, 2001). Since PTSD symptoms include strong negative feelings and trouble experiencing positive feelings (American Psychiatric Association, 2013; Blevins et al., 2015), it is possible that abstract thinking and rumination contribute to PTSD by increasing negative feelings or low mood. Third, abstract thinking and rumination may represent a form of cognitive avoidance which prevents the processing of the trauma memory or updating of negative appraisals (Ehlers & Clark, 2000; Ehlers & Steil, 1995; Watkins, 2004; Williams & Moulds, 2007). PTSD symptoms include strong negative beliefs about oneself, other people or the world, or blaming oneself or someone else for the traumatic experience (American Psychiatric Association, 2013; Blevins et al., 2015). It is possible that abstract thinking and rumination contribute to PTSD by increasing negative appraisals and beliefs or stopping the memory from being processed. In summary, although it is yet to be established how abstract thinking and rumination contribute to PTSD, possible mechanisms could be via intrusive memories, by exacerbating low mood, or by maintaining negative cognitions, hindering the memory from being updated.

Chapter 3 described the development and validation of a new measure of abstract and concrete thinking, the Concrete and Abstract Thinking Questionnaire (CAT), designed to assess abstract and concrete thinking in situations relevant to student paramedics. The current study builds on this chapter by using the CAT in a longitudinal study of student paramedics. The aim of the current study was to test whether the CAT predicted PTSD symptom severity and whether it did so over and above established measures of rumination.

4.1.5 Hypothesis

The hypothesis was that abstract thinking (measured by the CAT 'best scenario') would significantly predict PTSD symptom severity at follow-up (6-weeks and 6-months) over and above established measures of rumination.

4.2 Method

The current study used data from a longitudinal study of resilience in student paramedics. Participants were recruited from 10 universities across England and completed questionnaires assessing mental health, resilience and rumination. This chapter will describe the methods relevant to the current study.

4.2.1 Sample Size

A power analysis was conducted based on the results of Wild and colleagues (2016). In their 2-year prospective study of newly recruited paramedics, Wild et al. (2016) found that rumination (RIQ; Clohessy & Ehlers, 1999) was a significant risk factor for PTSD with a zero-order correlation of r=.243 (f_2=.0627). Based on this effect size and on an α error probability of .05 and a power of .95, using G*Power, the total

required sample size was calculated to be N=322 participants. Adjusting for an expected drop-out rate of 20%, the sample for the current study was estimated to be N=403.

4.2.2 Participants

Ethical approval was gained from The Medical Sciences Inter-Divisional Research Ethics Committee at the University of Oxford, 17 August 2017, ref: R44116/RE001. Students aged 18 and above, who were training to be paramedics through a 3-year university programme and who were in years 1, 2 or 3 of their studies were eligible for the study. As student paramedics, participants took part in university teaching as well as paramedic placements where they could be exposed to traumatic events. Recruitment took place at their respective universities over the course of 12 months. All participants were screened for PTSD and depression using the PTSD checklist for DSM-5 (PCL-5; Blevins, Weathers, Davis, Witte, & Domino, 2015) and the Patient Health Questionnaire (PHQ-9; Kroenke & Spitzer, 2002). If participants scored 33 or above on the PCL-5, above the cut-off on the PHQ-9 (10 or above) or indicated suicidal ideations (PHQ-9 item 9) they were called for an individual risk assessment. Participants were excluded from the study if their symptoms were interfering with their lives and they wanted treatment. If this was the case, they were offered information on how to access evidence-based treatment for these conditions in local services. All risk assessments were conducted in consultation with a clinical psychologist (Dr. Jennifer Wild).

At recruitment, 714 student paramedics completed screening measures. Of these, 130 were called for an individual risk assessment. With the approval of the clinical psychologist, 23 of these 130 students were included in the study. The remaining 107 participants were excluded from participating because they were currently receiving

CBT treatment or because their symptoms were interfering with their lives and they wanted treatment. In the latter case, they were signposted for treatment. Of the remaining students, 190 could not be reached and were not included in the study. The remaining N=417 participants completed the baseline measures. At 6-week follow-up, 9 participants could not be reached (but later completed 6-month measures) and 25 participants dropped out and N=383 (91.84%) completed the measures. At 6-month follow up, a further 27 were lost to follow-up and N=356 (85.37%) completed the final set of questionnaires. Thus, the overall attrition rate from baseline to 6-month follow-up was 14.6%. See Figure 8 for participant flow.

The majority of the 417 participants was female (66.7%), White British (85.9%) with a mean age of 23.34. Participants attended one of 10 different universities and the majority (51.8%) were in their first year of study. See table 9 for demographic characteristics (gender, age, ethnicity, university and year of study).

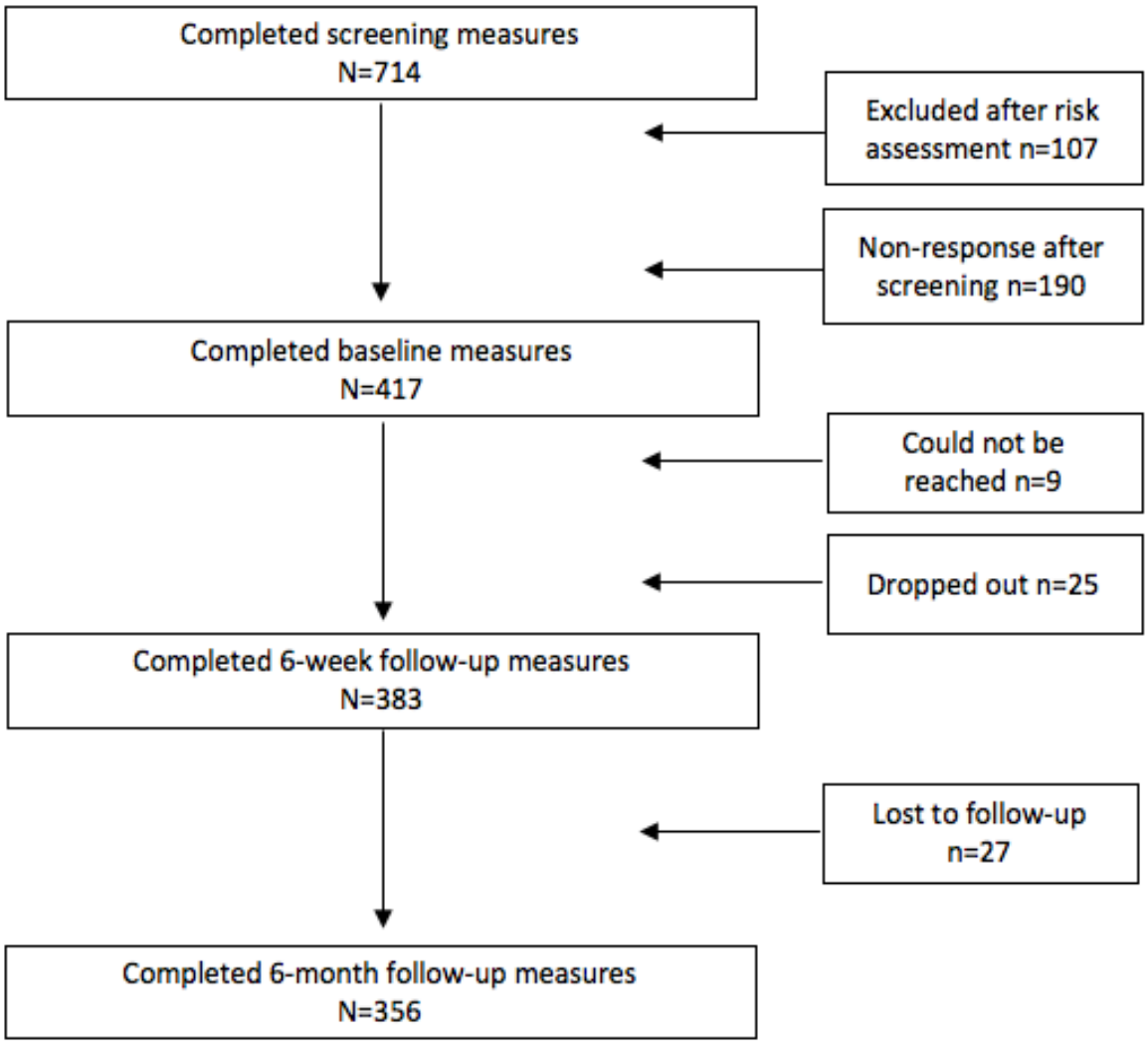


Figure 8. Participant flow.

Table 9
Demographic characteristics of all participants (N=417)

	Total
Sample size: N	417
Gender: No. females (%)	278 (66.67)
Age: *Mean (SD)*	23.34 (6.55)
Ethnicity (%)	
White/Caucasian	379 (90.89)
Asian	16 (3.84)
Black	2 (0.48)
Mixed	18 (4.32)
Other	2 (0.48)
University (%)	
Anglia Ruskin Cambridge	17 (4.07)
Anglia Ruskin Chelmsford	82 (19.66)
Bournemouth	20 (4.80)
Brighton	94 (22.54)
Brookes	39 (9.35)
Coventry	25 (5.99)
Greenwich	3 (0.72)
Hertfordshire	65 (15.59)
Surrey	14 (3.36)
Worcester	58 (13.91)
Year of study (%)	
1st	216 (51.79)
2nd	118 (28.29)
3rd	83 (19.90)

4.2.3 Measures

Participants were screened and then completed measures at baseline, 6-week follow-up and 6-month follow-up.

4.2.3.1 Screening measures.

At screening, participants completed two questionnaires to screen for PTSD and depression. The *PTSD Checklist for DSM-5* (PCL-5; Blevins, Weathers, Davis, Witte, & Domino, 2015) is a 20-item measure which assesses PTSD symptoms in the previous month. Psychometric evaluations have shown strong internal consistency (α=.94), and test-retest reliability (*r*=.82; Blevins et al., 2015). Symptoms are rated on a scale from 0=*not at all* to 4=*extremely.* A total score of 33 or above (out of a maximum score of 80) has been recommended as a preliminary clinical cut-off with higher scores indicating greater PTSD symptoms. For the present sample, Cronbach's alpha was α=.89.

The *Patient Health Questionnaire (PHQ-9)* was used to screen for depressive symptoms (Kroenke et al., 2001). The PHQ-9 is a 9-item self-report questionnaire that assesses depression symptoms over the previous two weeks. Scores range from 0=*not at all* to 3=*nearly every day*, with a score of 10 or above on the PHQ-9 indicating possible clinically significant depression with a sensitivity and specificity of 88% (Kroenke et al., 2001). Kroenke and team reported good internal reliability (α=.89) and test-retest reliability with a kappa of .84 after 48 hours. For the present sample, Cronbach's alpha was α=.77.

4.2.3.2 Concrete and Abstract Thinking Questionnaire (CAT).

In chapter 3, a new measure of concrete and abstract thinking, the *Concrete and Abstract Thinking Questionnaire (CAT)* was developed and validated. The CAT consists of potentially stressful scenarios pertaining to paramedic or student life. Each

of the scenarios lists eight possible thought responses to the scenario which are either abstract responses with 'why' and 'what if' questions (e.g. 'Why do I always do this?'), or concrete responses with 'how' and 'what' questions (e.g. 'What is the first step I can take now to get started?'). Participants are instructed to imagine the scenarios were happening to them and tick the likely thoughts they would have. The CAT is scored by calculating an overall abstract ratio (the proportion of responses that are abstract compared to concrete). A higher abstract ratio indicates greater abstract thinking.

A previous factor analysis of the CAT (chapter 3) revealed that only specific scenarios showed factorial validity and were described as a 'Best Version CAT.' See Appendix 3 for the 'Best Version CAT.' Therefore, in the current study, only the best scenarios were used as recommended in chapter 3. Initial psychometric evaluation of the 'Best Version CAT' (chapter 3) in a sample of student paramedics, showed good internal consistency of the abstract items (α=.87) and test-retest reliability of the abstract items (ICC= .88, $p<.001$, 95% CI [.84, .91]). The CAT 'best scenario' at baseline was Version 1 Scenario 4 ('You are the first to arrive on the scene of an accident. A young man is lying on the ground. You try to resuscitate him'). In the present sample, Cronbach's alpha for the 'best version' scenario abstract items at baseline was α=.71.

4.2.3.3 Measuring PTSD.

To assess symptoms of PTSD at all time points, participants completed the *PCL-5* (Blevins et al., 2015).

4.2.3.4 Trauma exposure.

Trauma exposure was measured using a 22-item unpublished trauma screener relevant to emergency workers, which includes items from the Life Events Checklist (Gray et al., 2004). It is a self-report questionnaire containing a list of traumatic events.

Respondents select ‘yes’ or ‘no’ to indicate whether they have experienced each event ‘in their entire life’ at baseline, ‘in their entire life’ (including previous 6 weeks) at 6-week follow up and ‘in the last 6-months’ at 6-month follow-up. Scores range from 0 to 22. The current study showed a range from 0 to 15. Cronbach’s alpha for the current study was α=.73. See Appendix 4 for the unpublished trauma screener.

4.2.3.5 Measuring rumination.

Two established measures were used to assess rumination. One addressed rumination in general and was developed for use with clinical depression. The other measured rumination in response to intrusive memories related to trauma or stressful events. Both questionnaires were used since rumination in general and rumination in response to intrusions have been found to predict PTSD.

Ruminative Response Scale (RSS) - Brooding Subscale; The RSS (Treynor et al., 2003) is the most widely used measure of rumination, divided into two subscales: brooding and reflective pondering. The 5-item brooding subscale showed adequate internal consistency (α=.77) and test-retest reliability (*r*=.62) (Treynor et al., 2003). In the current study, only the brooding subscale was used showing a Cronbach’s alpha of α=.79.

The *Response to Intrusion Questionnaire* (RIQ; Clohessy & Ehlers, 1999; Murray et al., 2002; Steil & Ehlers, 2000) is a 19-item self-report measure which examines responses to intrusive memories (as used in Beierl et al., 2019). It is divided into three subscales: suppression (6 items), rumination (8 items) and dissociation (5 items) which are scored on a scale from 0=*never* to 3=*always*. The scales have demonstrated adequate reliability and predictive validity in a range of studies. The internal consistency of the rumination subscale was between α = .80-.86 (Clohessy &

Ehlers, 1999; Murray et al., 2002). For the current study, only the rumination subscale was used with a Cronbach's alpha of α=.84.

4.2.4 Procedure

At recruitment, interested participants were given a web link to the study via Qualtrics, where they could read the Participant Information Sheet and complete a consent form and the screening questionnaires (PCL-5 and PHQ-9). Next, they completed baseline measures including demographic information, trauma exposure and measures of rumination (RRS and RIQ) and the CAT 'best scenario'. Participants completed the measures of trauma exposure and PCL-5 at 6-week and 6-month follow-up. The 6-week follow-up was chosen to assess PTSD symptoms in the first month since screening. The 6-month follow up is comparable to other studies in the literature on PTSD predictors (e.g. Kleim et al., 2007; Wild et al., 2016). Participation was voluntary and participants received £30 remuneration.

4.2.5 Analysis

Analyses were conducted using the statistics software SPSS version 22 (IBM Corp., 2017) and RStudio (RStudio Team, 2018). Multiple imputations (MI) were performed to account for missing data of trauma exposure, PTSD (PCL-5), rumination (RRS; RIQ) and abstract thinking (CAT 'best scenarios'). Predictive mean matching (pmm) from the R package mice (multivariate imputation by chained equations) v2.30 (van Buuren & Groothuis-Oudshoorn, 2011) was used to generate imputations.

Independent t-tests were used to assess differences between participants who dropped out by the 6-month follow-up and those who did not. Zero-order correlations assessed the relationship between predictors and outcome measures. Block hierarchical

multiple linear regressions were conducted to predict PTSD symptom severity at 6-week and 6-month follow-up. Block 1 included trauma exposure (for the 6-week regression it included lifetime exposure up to 6-weeks, for the 6-month regression it included trauma exposure in the 6-months following baseline) and the PCL-5 at baseline, block 2 included the RIQ and RRS and block 3 included the CAT 'best scenario.' Since trauma exposure at 6-weeks assessed lifetime exposure, including the previous 6 weeks, it was included in the regression analysis rather than including both baseline and 6-week trauma exposure. For consistency, the regression analysis at 6-months included the 6-month trauma screener but not the trauma screener at baseline.

Assumptions of the predictors (linearity, normal distribution of residuals, homoscedasticity, multicollinearity) were tested and found to be satisfactory. The outcome measure, PCL-5, showed some skewness and kurtosis with a skew towards lower scores. Inspection of the residuals revealed that this was borderline with some outliers. Although the predictors (CAT 'best scenario', RRS and RIQ) correlated significantly, the regression assumption of multicollinearity was not violated. There was no perfect multicollinearity, correlations were under r=.50 (only .80 and above is considered very high), the variance inflation factor (VIF) was not over 1.3 (over 10 or an average substantially above 1 is problematic) and the tolerance statistics were below 0.75 (below 0.20 is potentially problematic, below 0.10 is problematic). Based on guidelines, multicollinearity was therefore not of concern (Bowerman & O'Connell, 1990; Menard, 1995; Myers, 1990).

Chapter 1 discussed the differences between the labels of 'risk factor' and 'predictor' of PTSD as used in the current thesis. Based on the definition by Kraemer and colleagues (Kraemer et al., 1997), risk factors are variables that temporally precede individuals' exposure to a traumatic event and make them more vulnerable to PTSD.

Variables that are assessed after exposure to a traumatic event and predict PTSD are referred to as predictors. However, the statistical term used to describe the independent variables in regression analyses is 'predictors'. Therefore, this chapter adopts the term "predictor" for the independent variables tested.

4.3 Results

4.3.1 Comparing Drop-outs Versus Non-dropouts

Participants (n=356) who completed questionnaires at all three timepoints (baseline, 6-week and 6-month follow-up) were compared to participants (n=61) who had been lost to follow-up by the 6-month follow-up. Independent sample t-tests showed that there were no significant differences between the dropouts and completers on the screening measures (PCL-5 and PHQ-12), the predictors at baseline (CAT 'best scenario', RRS, RIQ), trauma exposure or demographic characteristics (age, ethnicity, university, year of study). The only exception was that the groups significantly differed by age, $t(415)=-2.167$, $p=.031$, with dropouts being significantly older ($M=25.02$, $SD=8.11$) than completers ($M=23.06$, $SD=6.22$).

4.3.2 Correlations of Predictors and Outcome Measures

Table 10 shows the means and standard deviations of the predictors and outcome measures. At baseline, trauma exposure ranged from 0 to 15 traumatic events, at 6-weeks from 0 to 14 and at 6-months from 0 to 9 on a possible scale of 0 to 22 traumatic events. Based on the trauma screener, the majority of participants noted being exposed to at least one traumatic event. At baseline, out of N=417, n=366 (87.8%) noted at least one traumatic event, while n=51 (12.2%) noted none. At 6-week follow-up, 348 (83.5%) noted at least one traumatic event, n=69 (16.5%) did not, and at 6-

month follow-up, n=275 (65.9%) noted at least one traumatic event and n=142 (34.1%) did not.

There was a significant reduction in PTSD symptom severity on the PCL-5 from 6 weeks (*M*=5.55, *SD*=8.84) to 6 months (*M*=4.28, *SD*=6.70), *t*(416)=3.012, p=.003. At 6-week follow-up, none of the participants scored above the cut-off of 33 for possible clinically significant PTSD, at 6-months, n=2 participants scored above cut-off. (These ranges and the number of participants above cut-off at 6-month follow-up were the same before and after multiple imputations.)

Table 11 shows the zero-order correlations between the trauma exposure and the outcome measures at the three time points and the predictors at baseline. All correlations between baseline measures (trauma exposure, PCL-5, CAT 'best scenario', RRS and RIQ) and the PCL-5 at 6 weeks were significant. Almost all correlations between baseline measures and the PCL-5 at 6 months were significant. Only trauma exposure at baseline did not significantly correlate with PCL-5 at 6 months. However, trauma exposure at 6-weeks correlated significantly with PCL-5 at 6-weeks and trauma exposure at 6-months correlated significantly with PCL-5 at 6 months.

Table 10
Means and standard deviations of outcome measures before multiple imputations.

Measure	Mean (SD)
Trauma exposure at baseline	3.71 (2.94)
Trauma exposure 6-week follow-up	3.16 (2.78)
Trauma exposure at 6-month follow-up	1.80 (2.07)
PCL-5 at baseline	7.52 (8.58)
PCL-5 at 6-week follow-up	5.57 (8.74)
PCL-5 at 6-month follow-up	4.34 (6.76)
RIQ at baseline	5.57 (4.77)
RRS at baseline	4.17 (3.27)
CAT 'best scenario' at baseline	21.98 (27.47)

Note: PCL-5= The PTSD Checklist for DSM-5; CAT 'best scenario'=Concrete and Abstract Thinking Questionnaire 'best scenario'; RRS=Rumination Response Scale-Brooding Subscale; RIQ=Response to Intrusions Questionnaire-Rumination Subscale.

Table 11
Zero-order correlations between predictors and outcome measures

	Zero-order correlations (N=417)					
Measure	CAT 'best scenario' at baseline	RRS at baseline	RIQ at baseline	PCL-5 at baseline	PCL-5 at 6-weeks	PCL-5 at 6-months
Trauma exposure						
Trauma exposure at baseline	-.148**	-.038	.112*	.224***	.161**	.074
Trauma exposure at 6-weeks	-.137**	-.017	.128**	.178***	.203***	.072
Trauma exposure at 6-months	-.064	-.030	.023	.136**	.128**	.208***
PCL-5						
PCL-5 at baseline	.135**	.303***	.441**	1	.424***	.383***
PCL-5 at 6-weeks	.207***	.282***	.335***	.424***	1	.412***
PCL-5 at 6-months	.105*	.211***	.300***	.383***	.412***	1
Predictors						
RIQ at baseline	.228***	.464***	1	.441***	.335***	.300***
RRS at baseline	.288***	1	.464***	.303***	.282***	.211***
CAT 'best scenario' at baseline	1	.288***	.228***	.135**	.207***	.105*

PCL-5= The PTSD Checklist for DSM-5; CAT ‘best scenario’=Concrete and Abstract Thinking Questionnaire ‘best scenario’; RRS=Rumination Response Scale-Brooding Subscale; RIQ=Response to Intrusions Questionnaire-Rumination Subscale. RIQ and RRS were only measured at baseline and 6-weeks.
* $p < .05$, ** $p < .01$, *** $p < 0.001$.

4.3.3 Prediction of PTSD Symptom Severity at 6-Week Follow-Up

Table 12 shows the results of the regression models of PCL-5 at 6-weeks and 6-months. Trauma exposure measured at 6-weeks and the PCL-5 at baseline, entered in model 1, $F(2, 414)=50.693$, $p<.001$, $R^2 =.197$, $R^2_{adj}=.193$, significantly predicted PTSD symptom severity at 6 weeks, with trauma exposure at 6 weeks, b(SE)=.422(.143), β=.132, p=.003, and the PCL-5 at baseline, b(SE)=.413(.046), β=.401, $p<.001$, significantly predicting PCL-5 at 6-week follow-up.

Adding the RRS and RIQ in model 2 significantly improved prediction, $\Delta F(2,412)=10.514$, $p<.001$, $\Delta R^2 =.039$, $\Delta R^2_{adj}=.035$, accounting for an additional 3.9% of the variability in PTSD symptom severity at 6 weeks. In this model, trauma exposure at 6-weeeks, b(SE)=.434(.141), β=.136, p=.002 and the PCL-5, b(SE)=.315(.050), β=.306, $p<.001$, continued to predict PTSD symptom severity. The RIQ, b(SE)=.222(.097), β=.120, p=.022 and the RRS, b(SE)=.367(.133), β=.136, p=.006 predicted PTSD symptom severity over and above the PCL-5 at baseline.

Adding the CAT 'best scenario' in model 3 significantly improved the prediction of PTSD at six weeks, $\Delta F(1,411)=8.635$, $p<.001$, $\Delta R^2 =.016$, $\Delta R^2_{adj}=.014$, accounting for an additional 1.6% of the variance in PTSD symptom severity at 6-weeks. In this model, trauma exposure at 6-weeks, b(SE)=.501(.142), β=.157, $p<.001$, the PCL-5 at baseline, b(SE)=.310(.050), β=.301, $p<.001$, and the RRS, b(SE)=.291(.135), β=.108, p=.031 continued to predict PTSD symptom severity, while the RIQ only predicted at trend level significance, b(SE)=.189(.097), β=.102, p=.051. The CAT 'best scenario' significantly predicted PTSD symptom severity over and above trauma exposure, the PCL-5, RRS and RIQ, b(SE)=.043(.015), β=.134, p=.003. In summary, hierarchical linear regression suggests that after controlling for PTSD

symptom severity at baseline, abstract thinking predicts PTSD symptom severity at first follow-up, explaining a small but significant amount of variance in PTSD scores.

4.3.4 Prediction of PTSD Symptom Severity at 6-Month Follow-Up

Trauma exposure at 6-month follow-up and the PCL-5 at baseline, entered in model 1, $F(2, 414)=42.856$, $p<.001$, $R^2 =.172$, $R^2_{adj} =.168$, significantly predicted PTSD symptom severity at 6 months, (trauma exposure at 6-months, b(SE)=.511(.145), β=.159, $p<.001$, PCL-5 at baseline, b(SE)=.282(.035), β=.361, p=.009.

Adding the RRS and RIQ in model 2 significantly improved the prediction, $\Delta F(2,412)=6.814$, $p<.001$, $\Delta R^2 =.027$, $\Delta R^2_{adj}=.022$, accounting for an additional 2.7% of the variance in PTSD symptom severity at 6-months. In this model, trauma exposure at 6 months, b(SE)=.544(.144), β=.169, $p<.001$, the PCL-5 at baseline, b(SE)=.216(.039), β=.277, $p<.001$ and the RIQ, b(SE)=.200(.075), β=.143, p=.008, predicted PTSD symptom severity. The RRS was not a significant predictor, b(SE)=.136(.103), β=.066, p=.187.

Adding the CAT 'best scenario' in model 3 did not improve prediction, $\Delta F(1,411)=0.394$, $p<.001$, $\Delta R^2 =.001$, $\Delta R^2_{adj}=-.001$, accounting for an additional 0.1% of the variance in PTSD symptom severity at 6-months. In this model, trauma exposure at 6 months, b(SE)=.550(.144), β=.171, $p<.001$, the PCL-5 at baseline, b(SE)=.216(.039), β=.276, $p<.001$, and the RIQ, b(SE)=.196(.075), β=.139, p=.010 continued to predict PTSD symptom severity, while the RRS, b(SE)=.123(.105), β=.060, p=.245 and the CAT 'best scenario', b(SE)=.007(.011), β=.029, p=.531, did not. In summary, hierarchical linear regression suggests that after controlling for PTSD symptom severity at baseline, abstract thinking did not predict PTSD symptom severity at 6-month follow-up, above established predictors of rumination.

Table 12

Results of multiple regressions: regression coefficients and significance for control variables and predictors of PTSD symptom severity at 6-week and 6-month follow-up

	PTSD symptom severity at 6-week follow-up		
	b (SE)	β	*p*
Block 1: Trauma exposure and PCL-5			
Trauma exposure at 6-week follow-up	.422 (.143)	.132	.003
PCL-5 at baseline	.413 (.046)	.401	<.001
Block 2: Rumination added			
Trauma exposure at 6-week follow-up	.434 (.141)	.136	.002
PCL-5 at baseline	.315 (.050)	.306	<.001
RIQ	.222 (.097)	.120	.022
RRS	.367 (.133)	.136	.006
Block 3: CAT added			
Trauma exposure at 6-week follow-up	.501 (.142)	.157	<.001
PCL-5 at baseline	.310 (.050)	.301	<.001
RIQ	.189 (.097)	.102	.051
RRS	.291 (.135)	.108	.031
CAT 'best version'	.043 (.015)	.134	.003
	PTSD symptom severity at 6-month follow-up		
	b (SE)	β	*p*
Block 1: Trauma exposure and PCL-5			
Trauma exposure at 6-month follow-up	.511 (.145)	.159	<.001
PCL-5 at baseline	.282 (.035)	.361	.009
Block 2: Rumination added			
Trauma exposure at 6-month follow-up	.544 (.144)	.169	<.001
PCL-5 at baseline	.216 (.039)	.277	<.001
RIQ	.200 (.075)	.143	.008
RRS	.136 (.103)	.066	.187
Block 3: CAT added			
Trauma exposure at 6-month follow-up	.550 (.144)	.171	<.001
PCL-5 at baseline	.216 (.039)	.276	<.001
RIQ	.196 (.075)	.139	.010
RRS	.123 (.105)	.060	.245
CAT 'best version'	.007 (.011)	.029	.531

PCL-5= The PTSD Checklist for DSM-5; RIQ=Response to Intrusions Questionnaire-Rumination Subscale; RRS=Rumination Response Scale-Brooding Subscale; CAT 'best version'=Concrete and Abstract Thinking Questionnaire 'best scenario.'

4.4 Discussion

The aim of the current study was to test whether the newly developed CAT measure of abstract thinking predicted PTSD symptom severity over and above established measures of rumination.

4.4.1 Correlations

Abstract thinking (CAT best scenario') at baseline correlated, as expected, with PTSD symptom severity at 6 weeks and 6 months. The effect size of the correlations was small. In line with previous studies (e.g. Beierl et al., 2019; Ehlers et al., 1998; Ehring, Ehlers, et al., 2008; Kleim et al., 2007; Razik et al., 2013) rumination (RRS, RIQ) and PCL-5 scores at baseline also correlated significantly with PTSD symptom severity at 6-weeks and 6-months.

Trauma exposure at baseline correlated with PTSD symptom severity at baseline and 6 weeks, but not 6-month follow-up. This finding is in line with a prospective study of paramedics by Wild and colleagues (Wild et al., 2016) who found no relationship between baseline trauma exposure and PTSD symptoms two years later. This most likely reflects the natural recovery of PTSD symptoms in the initial months after trauma. Trauma exposure at 6-weeks correlated with PTSD symptom severity at 6-weeks and trauma exposure at 6-months correlated with PTSD symptom severity at 6-months. This can be expected as the PCL-5 measures PTSD symptoms of the past month in response to trauma exposure (traumatic events).

4.4.2 Regressions

At 6 weeks, but not at 6 months abstract thinking significantly predicted PTSD symptom severity, over and above established measures of rumination (RRS and RIQ),

after controlling for trauma exposure and baseline PTSD symptom severity, with a small effect size. The findings at 6-weeks are in line with previous literature which demonstrated that abstract thinking combined with rumination explained more variance in PTSD than rumination alone (Ehring & Watkins, 2008; Michael et al., 2007). In line with the differences between risk factors and predictors discussed in chapter 1 (Kraemer et al., 1997), these findings indicate that abstract thinking could be considered a 'risk factor' for PTSD symptom severity if it was measured before participants were exposed to a traumatic event, or a predictor for PTSD symptom severity if participants were already exposed to trauma.

One likely reason why the CAT and the RRS did not add significantly to the prediction model at 6-months is that there is some common variance with the RIQ. All three measure aspects of rumination with some similar items. For example, 'I think about why the incident happened to me' in the RIQ, 'Think "Why do I have problems other people don't have?' in the RRS and 'Why me, why now?' in the CAT are all negative thoughts about the reason why something happened specifically to them. Even though the assumption of multicollinearity was not violated, correlating predictors means that the likelihood for each predictor to explain unique variance is reduced. The RIQ is trauma-related and may therefore explain unique variance.

PCL-5 scores decreased from 6 weeks to 6 months. At 6-weeks, PCL-5 scores were close to 6 while PCL-5 scores at 6-months clustered around 4, both in the sub-clinical range. The reasons for this are unclear. One possibility was that the trauma exposure between 6 weeks and 6 months was low.

4.4.3 Comparing Dropouts and Non-Dropouts

Dropouts and non-dropouts only significantly differed by age, with dropouts showing a higher average age of 25 compared to non-dropouts with an average age of 23. It is likely that 25-year-old students did not start their paramedic training directly after school but had some years of work experience. It may also be that older participants already have more caring responsibilities that occupy their time such as children, making them less available to complete questionnaires.

4.4.4 Limitations

One limitation of the current study is that trauma exposure at baseline and at 6-week follow-up asked about a traumatic events in participants' 'entire life.' The measure of trauma exposure at 6-weeks would have been more meaningful if it limited the assessment of trauma exposure to the measurement period (previous 6 weeks). The average trauma exposure decreased from baseline to 6-week follow-up even though the exact same wording was used and 6-week follow-up included the additional time of 6-weeks. This may be due to missing data or due to some participants not consistently endorsing the same events.

A second limitation is that not all participants indicated a traumatic event. At baseline, 12.2% of the sample noted no traumatic event, at 6 weeks, 16.5% noted no traumatic event and at 6 month follow-up, 34.1% indicated no traumatic event. This raises questions about the validity of PTSD symptoms as measured by the PCL-5 for participants indicating no traumatic event. Taking a closer look at the PCL-5, the measure asked participants to "answer a few questions about your *worst event*, which for this questionnaire means the event that currently bothers you the most. Briefly identify the worst event (if you feel comfortable doing so): … " The next question asked

the participant to indicate whether the event involved "actual or threatened death, serious injury, or sexual violence" and how it was experienced (directly, indirectly, learned about etc). For the purpose of completing the 20-item PCL-5 measure, participants referred to their self-identified 'worst event'. Reviewing the open ended questions showed that, besides traumatic events, participants noted events such as "divorce", "bad relationship breakup" and "failing university" as their worst events which are not traumatic events based on the DSM-5 criteria (American Psychiatric Association, 2013). Although only a small percentage of the sample indicated no traumatic event, the outcomes should be considered with care and the PCL-5 measure as limited in its accurate assessment of symptoms in response to a diagnosable traumatic event. For those individuals without a traumatic event, the PCL-5 may have been measuring symptoms related to a stressful event. An expected consequence of including some participants without traumatic events are lower symptom scores on the PCL-5.

Another limitation of the current study is therefore that participants on average had very low PTSD symptom severity scores at all time points. As noted in the methods section, the PTSD symptom measure was skewed and inspection of the residuals showed that normality was borderline due to some outliers. The skew towards low scores further restricted the range in outcome, and decreased the power to detect significant effects of abstract thinking. Despite ongoing trauma exposure, the severity of PTSD symptoms reduced during follow-up, restricting the range even further. This may explain why abstract thinking added significant predictive value at 6-weeks but not at 6-month follow-up. It may be that abstract thinking shows stronger predictive power in a sample with a wider range of PTSD symptom severity. Future research should replicate this study in a sample with a greater range of PTSD symptom severity in order to

determine if this improves the ability to detect effects of abstract thinking in the prediction of PTSD symptom severity.

The current study assessed PTSD symptom severity not PTSD diagnosis. Very few (n=2) participants met the diagnostic cut-off for full PTSD at 6-month follow-up. This is unsurprising as the study screened and excluded participants with PTSD at the start and participants experienced a limited number of traumatic events during the 6-month follow-up. The current study can therefore not make any claims about abstract thinking and rumination as predictors of a PTSD diagnosis, only in relation to subthreshold PTSD symptoms. Future research should investigate abstract thinking as a potential predictor after exposure to severe trauma or PTSD diagnosis and with longer follow-up.

Limitations of the CAT measure as described in chapter 3 also apply in this study. These include the limitation of using specific scenarios to assess abstract thinking. Their answers to these scenarios may not fully reflect their general abstract or concrete thinking style. For the prediction of PTSD, it may be more important to assess abstract thinking about the traumatic event than abstract thinking of unrelated scenarios.

4.4.5 Larger Implications

Bearing in mind that a minority of participants had not experienced trauma at baseline, 6 week or 6 month follow-up, the findings of the current study should be considered with care. This study provides preliminary ideas which are in need of further testing. In the current study, rumination about traumatic events appears more relevant to the prediction of PTSD symptom severity than a general abstract thinking style. These findings would add to the established role of rumination as predictor of PTSD (e.g.

Beierl et al., 2019; Ehlers et al., 1998; Ehring, Ehlers, et al., 2008; Kleim et al., 2007; Razik et al., 2013).

The current study raises the initial possibility of abstract thinking as a predictor of PTSD symptom severity, when abstract thinking is considered on its own (correlations) or in the short-term (6-weeks). Literature shows that abstract thinking underlying rumination is unhelpful as it focuses on questions with no obvious answer, on causes, meanings and consequences often leading to repetitive, negative, circular thinking (Ehring, Szeimies, et al., 2009; Ehring & Watkins, 2008). This may keep individuals from fully processing the traumatic or stressful event. If this is the case, abstract thinking would be unlikely to alleviate symptoms of PTSD, however, this does not necessarily make it a predictor of PTSD. It is worth further investigating abstract thinking as a predictor of PTSD symptom severity and PTSD before conclusions can be drawn. The current study cannot make any claims about the relationship between abstract thinking, rumination and PTSD diagnosis since PTSD was assessed by self-report, a minority of participants completed the questionnaire in relation to a stressful rather than a traumatic event, and overall symptom scores of PTSD were in the non-clinical range.

4.4.6 Conclusion

The current study contributes to our preliminary understanding of abstract thinking and its relationship to rumination and PTSD symptom severity. Whilst rumination at baseline was a robust predictor of PTSD symptom severity over the course of the study, abstract thinking at baseline added to the prediction only in the short-term. Rumination in response to re-experiencing symptoms, such as intrusive memories, appeared more clearly related to PTSD symptom severity than a general

abstract style of thinking. However, noting the limitations above, the results should be interpreted with caution.

5 Chapter 5: Can we Reduce Analogue Trauma Memories in Student Paramedics by Teaching Stimulus Discrimination?

5.1 Introduction

Student paramedics are regularly exposed to traumatic incidents through their work and are therefore at higher risk for posttraumatic stress disorder (PTSD) compared to the general population (Mind, 2014; Wild et al., 2016). Unwanted, intrusive memories are a hallmark symptom of PTSD (American Psychiatric Association, 2013) and the distress associated with intrusive memories as well as their 'here and now' quality predicts PTSD severity (Michael, Ehlers, Halligan, & Clark, 2005). Since student paramedics are at risk of developing PTSD, they may benefit from learning strategies to reduce intrusive memories of traumatic incidents. One such strategy for dealing with trauma-related intrusive memories is 'stimulus discrimination', a technique used in cognitive therapy for PTSD (Ehlers, 2010; Ehlers et al., 2005b), which has also been shown to reduce intrusive memories of analogue trauma (Kennedy-Williams et al., 2019). This chapter describes the comparison of stimulus discrimination to an alternative technique for reducing intrusive memories after an analogue trauma film in a sample of student paramedics.

5.1.1 Intrusive Memories: Frequency, Distress, Nowness and Duration

Intrusive memories are spontaneous, unwanted memories that come to mind when they are not deliberately recalled (Brewin et al., 2010). Such memories can take different forms, such as seeing images (visual sensations) or hearing sounds from the

traumatic event, or having bodily reactions or feelings as during the traumatic event (Ehlers et al., 2002; Ehlers & Steil, 1995). Some studies have found that the frequency of intrusive memories predicts PTSD symptoms. For example, in a study of cancer survivors intrusion frequency 13 months after diagnosis predicted PTSD symptoms at 3-months later (Salsman et al., 2009). However, not all studies have found this relationship (Michael et al., 2005; Shalev, 1992; Steil & Ehlers, 2000).

Intrusive memories after a trauma are often of the most distressing parts of the event (Holmes et al., 2005). According to a study assessing the characteristics of intrusive memories, individuals with PTSD after single events typically experience one to four distinct memories that are highly repetitive and distressing (Hackmann et al., 2004). Intrusive memories are often experienced as being in the present ('here and now') rather than as a memory of the past (American Psychiatric Association, 2013; Hackmann et al., 2004). Ehlers (2010) describes this characteristic as a sense of 'nowness.' In a study of assault survivors, greater nowness has been associated with greater PTSD symptoms (Michael et al., 2005). Multiple studies have investigated intrusion-related distress and found it to be a predictor of persistent PTSD. For example, in a study of survivors of motor vehicle accidents (MVA), intrusion-related distress showed a higher correlation with PTSD severity than intrusion frequency (Steil & Ehlers, 2000). Another study found that intrusion-related distress after MVAs predicted PTSD severity 12 months later (Mayou et al., 1993).

Only a few studies have included measures of duration in their assessment of intrusive memories (Iyadurai et al., 2019; Streb et al., 2016; Wegerer et al., 2014). These studies have noted duration as meaningful and distinct information relating to intrusive memories. They suggest that a stronger experience of intrusive memories may be due to longer intrusions. However, more research is needed to understand the role of

intrusion duration in the experience of intrusive memories. Overall, it seems that frequency, distress, nowness and, to a lesser extent, duration, are important characteristics of intrusive memories.

5.1.2 Responses to Intrusions: Rumination, Suppression and Dissociation

When experiencing intrusions, individuals often respond with unhelpful coping strategies, such as rumination, suppression or dissociation (Steil & Ehlers, 2000). Rumination in response to intrusions and abstract-ruminative thinking during or after an analogue trauma have been shown to increase re-experiencing symptoms (Ehring, Szeimies, et al., 2009; Laposa & Rector, 2012; White & Wild, 2016) whilst rumination about having intrusive memories has been shown to predict PTSD severity (Michael et al., 2005). Rumination is a risk factor for PTSD in student paramedics (Wild et al., 2016) and a predictor of PTSD (Beierl et al., 2019; Ehlers et al., 1998; Ehring, Frank, et al., 2008; Kleim et al., 2007; Michael et al., 2007).

Suppression in relation to intrusive memories involves making efforts to push them out of mind as well as efforts to avoid thoughts associated with the trauma. This has been reported as a common response to intrusive memories in emergency workers (Clohessy & Ehlers, 1999). However, suppression has been shown to have the paradoxical effect of increasing the frequency of intrusive memories (Ehlers & Steil, 1995; Shipherd & Beck, 1999, 2005; Wegner et al., 1987) by causing a so-called 'rebound-effect' (Abramowitz et al., 2001). Two studies assessed responses to intrusive memories in 159 and 138 survivors of MVAs (Steil & Ehlers, 2000). Both studies found that rumination and thought suppression in response to intrusive memories correlated with PTSD severity.

Dissociation, a psychological process associated with a reduction in awareness

of surroundings, can occur in response to intrusive memories. It can vary from mild, such as feeling spaced out in response to trauma reminders, to severe, such as dissociative flashbacks during which the individual may re-experience their trauma in the here and now. In a study of 91 female students, greater peritraumatic dissociation was shown to be associated with increased intrusion frequency after an analogue trauma film (Laposa & Rector, 2012). Along with other cognitive processes, peritraumatic dissociation has been associated with PTSD symptoms in police officers (McCaslin et al., 2008) and in survivors of MVAs (Murray, Ehlers, & Mayou, 2002). Dissociation that persists in the weeks following trauma has been shown to contribute to the maintenance of PTSD. Murray and colleagues (2002) found that persistent dissociation four weeks after MVAs predicted PTSD severity at 6-months. Similarly, in a sample of 81 physical or sexual assault survivors, ongoing dissociation at initial assessment predicted subsequent PTSD symptoms (Halligan et al., 2003) and a path analyses of 700 individuals attending an emergency department following an assault or MVA showed a strong effect of dissociation at 1 month after the trauma on PTSD symptoms at 6 months (Beierl et al., 2019).

5.1.3 Stimulus Discrimination

Intrusive memories are often triggered by sensory cues. For example, after a motor vehicle accident that involved a red lorry, the sight of a red car may trigger an intrusive memory of the lorry that caused the accident. Stimulus discrimination, a technique in cognitive therapy for PTSD (CT-PTSD; Ehlers et al., 2005b), helps people to discriminate between the trigger of the intrusive memory or its context in the present and the past trauma. Stimulus discrimination is designed to reduce the recurrence of unwanted memories. It teaches individuals to recognise the sensory triggers of intrusive

memories and then discriminate between the harmless stimulus that triggered the intrusive memory in the present context ('now') and the stimulus in the context of the trauma ('then') (Ehlers, 2010; Ehlers et al., 2004; Ehlers & Clark, 2000). Stimulus discrimination is therefore sometimes referred to as 'Then versus Now' technique. When applying stimulus discrimination to a trauma trigger, individuals are instructed to focus on how what they see, hear, feel, and smell in the moment is different from the past event. Using the previous example, individuals might focus on how the red car, sunny sky, smell of car freshener, and dry road in the current context are different from the lorry, dark night, smell of petrol, and wet road in the context of the traumatic event.

According to Ehlers and Clark's (2000) cognitive model of PTSD, the theory behind stimulus discrimination is that strong perceptual priming and strong associative learning during trauma lead to poor discrimination between the triggers in the present and the original cues present during trauma. By focusing on the sensory discrepancies, individuals can improve the discrimination (Lommen et al., 2017) and learn to distinguish the memory from the present, which reduce the sense of nowness (the sense of the trauma happening in the here and now). By focusing their attention on their current sensory impressions and on the fact that they are safe, stimulus discrimination helps individuals to re-evaluate their sense of current threat and danger, which is often maintained by the sensory nature of the trauma memory (Brewin et al., 1996; Ehlers & Clark, 2000). In other words, individuals learn that the stimuli are just reminders of the event that do not indicate current danger because they occur in a different context (Ehlers et al., 2004).

5.1.4 Preventing Intrusive Memories

Stimulus discrimination can also be taught as a potential preventative tool to developing frequent, distressing intrusive memories. A study by Kennedy-Williams, Ehlers, Chan and Wild (2019) investigated the effects of stimulus discrimination in reducing intrusive memories after an analogue trauma. Sixty-three undergraduate students were randomly allocated to stimulus discrimination training, training to suppress memories, or training in a neutral control technique (counting intrusions, where participants were instructed to assign a number to the intrusive memory and record it in a diary in the evening). Participants were trained in the relevant strategy in the week prior to exposure to analogue trauma. They were then instructed to use their strategy in the week afterwards. As predicted, those trained in stimulus discrimination reported significantly fewer intrusive memories in the seven days following exposure to analogue trauma than those trained to suppress the memories or to respond to them by counting. This study demonstrated that stimulus discrimination could be taught to healthy participants prior to exposure to analogue trauma and that it could be successfully applied to intrusive memories afterwards. Although the results are promising, the use of stimulus discrimination training in groups regularly exposed to trauma, such as student paramedics, has not yet been investigated.

Other interventions have aimed to prevent intrusive memories through visuospatial interventions such as playing the computer game ‘Tetris’ (Holmes et al., 2009, 2010; H. Kessler et al., 2019), sculpting clay (Stuart et al., 2006), or playing word games (Hagenaars et al., 2017) after an analogue trauma. Holmes and colleagues (2009) randomly allocated 40 participants to play Tetris after watching a trauma film or to receive no intervention. A 7-day intrusion diary showed that playing Tetris significantly reduced the frequency of intrusive memories and PTSD symptomatology compared to

no intervention (Holmes et al., 2009). However, this study did not assess the distress associated with intrusive memories, which previous literature has established is a more accurate predictor of PTSD than frequency (Michael et al., 2005). These visuospatial and word game interventions aim to disrupt memory consolidation by competing for cognitive resources (Holmes et al., 2009). Stimulus discrimination aims to improve the sensory discrimination between triggers in the present and sensory information from the trauma that is associated with feelings of danger (Ehlers & Clark, 2000). One problem with the practical implication of visuospatial tasks, such as Tetris and sculpting clay, to reduce intrusive memories is that they may not be readily available following exposure to traumatic events, whereas a cognitive strategy such as stimulus discrimination, once learned, may be applied more readily and could be taught prior to exposure to trauma.

5.1.5 Analogue Experimentation

The use of analogue trauma to simulate real-life events allows researchers to observe, manipulate and evaluate peri and post-traumatic responses in a controlled setting (B. G. Cook & Rumrill, 2005). Through analogue experimentation, interventions can be developed and evaluated, often before real-world testing. The most common analogue used to study psychological trauma is the trauma film paradigm.

5.1.5.1 The trauma film paradigm.

The trauma film paradigm (TFP) involves exposure to traumatic film material, often video footage of real or acted traumatic events such as road traffic accidents, natural disasters, scenes of death or physical or sexual violence. The majority of studies using the TFP have applied experimental manipulations during or shortly after a trauma film (e.g. Holmes et al., 2010; E. L. James et al., 2016) instead of manipulations before, such as teaching stimulus discrimination (Kennedy-Williams et al., 2019).

Benefits of the TFP are that causal inferences can be made with more certainty than in naturalistic settings where surrounding factors are not controlled (Holmes & Bourne, 2008; E. L. James et al., 2016). Using the TFP, the dose and nature of the trauma analogue event can be held constant. Intrusive memories following the trauma film can be attributed to the film and separated from other intrusive memories (Weidmann et al., 2009). The efficacy and mechanisms of interventions can be studied systematically (Siegesleitner et al., 2019). Offering experimental control and ability to elicit PTSD-like symptoms, the TFP is regarded as a good laboratory analogue to induce trauma-related intrusive memories (Holmes & Bourne, 2008; E. L. James et al., 2016; Siegesleitner et al., 2019).

5.1.5.2 Selection of the trauma film.

Commonly, trauma films include scenes that portray trauma characteristics as defined by the Diagnostic and Statistical Manual (DSM-5; American Psychiatric Association, 2013) which include actual or threatened death or serious physical or sexual violence. A comparison of trauma films for use in the TFP (Arnaudova & Hagenaars, 2017) found that films depicting sexual violence (from the 2003 French film *Irreversible*; Noé, 2003), physical violence or a road traffic accident, did not differ in the number of intrusions they caused. Only a clip showing regurgitated food resulted in more intrusive memoirs, likely because of the high element of disgust associated with intrusive memories and the frequent daily triggers for food. However, the scene was not considered an option for the current study since it does not fulfil the definition of a traumatic event (Criterion A, DSM-5; American Psychiatric Association, 2013). Another study (Weidmann et al., 2009) compared the effectiveness of different trauma films in provoking traumatic stress-like reactions. Results showed that the *Irreversible* film clip of sexual violence most consistently predicted higher heart rate (physiological

distress), psychological distress and more intrusive memories compared to three other film clips showing a torture scene, amateur footage of the aftermath of a tsunami and real uncut news footage (showing a mixture of events from spring 2006 including protesters being beaten, a couple being stoned to death, badly injured people being rushed into a hospital and an injured man dying in front of the camera). All participants judged the sexual violence clip as at least moderately distressing. In addition, the sexual violence clip led to a greater number of intrusive memories immediately following the film, compared to the clips of the tsunami and news, and showed a trend to more intrusions during the diary follow-up. The study did not find a gender bias in reaction to the sexual violence clip suggesting that the film evokes similar responses in men and women. According to Weidmann and colleagues, not only the content but also the story line of a film clip influences participants' reactions. Clips with a straight (continuous) story line (such as in *Irreversible)* may result in a greater degree of emotional involvement and lead to more intense reactions than unconnected film clips (such as various news segments). The authors also suggest that witnessing sexual violence, even in a film, has a greater impact on individuals than witnessing other forms of trauma. These analogue findings are in line with naturalistic findings that show that sexual assault is commonly associated with the highest risk of PTSD (R. Kessler et al., 1995). Based on these findings, the film clip depicting sexual violence from the film *Irreversible* was selected for the current study. This scene has been used in previous studies (Arnaudova & Hagenaars, 2017; Sachschal et al., 2019; Schaich et al., 2013; Siegesleitner et al., 2019; Weidmann et al., 2009).

5.1.5.3 Ethical considerations of the trauma film paradigm.

Given the content of the trauma film in the current study and the aim to induce intrusive memories, it was possible that the film would cause some psychological

distress. However, there is robust evidence showing that the TFP in general, and this trauma film in particular, do not cause any lasting harm. Trauma films are intended to induce only mild distress and some intrusions which typically subside after a few days (Holmes et al., 2004; E. L. James et al., 2016; Lau-Zhu et al., 2018). According to Holmes (Holmes & Bourne, 2008) who conducted a number of studies involving the TFP, psychological and physiological stress reactions are short lived in non-clinical populations. Immediate reactions to the film commonly last only a few minutes to hours and intrusive memories usually decline within the first couple of days (Butler et al., 1995; Zetsche et al., 2009). In previous studies showing traumatic film content, no participants reported ongoing distress (Arnaudova & Hagenaars, 2017; Brewin et al., 2010; Holmes et al., 2004; Holmes & Bourne, 2008; Kennedy-Williams et al., 2019; Sachschal et al., 2019; Stuart et al., 2006; Weidmann et al., 2009). Finally, the Handbook of Emotion Elicitation and Assessment has established a guide for researchers noting that the trauma films match the ethically allowed levels of emotion elicitation (Coan & Allen, 2007).

Ethical and wellbeing considerations were especially important in the design of the current study. Steps were taken to ensure that the film would cause as little distress as possible while still being effective in inducing intrusive memories. First, an extensive literature review was conducted comparing the different films to ensure they were validated and appropriate for the aims of the current study. The design was reviewed by the Medical Sciences Inter-Divisional Research Ethics Committee at the University of Oxford as well as the ethics committees of some of the participating universities. A user advisory group of student paramedics gave feedback on how they would be most comfortable watching such a film and their feedback informed the design of the study. Participants were informed at recruitment about the distressing nature of the film and

informed consent was given by all participants. Strict screening was conducted to exclude anyone with a personal experience of sexual violence or high PTSD or depression symptoms. The methods were carefully set up to ensure that participants could debrief with the researcher and were followed up if they showed any distress. Advice for using the TFP set forth in other studies (e.g. Lau-Zhu et al., 2018; Weidmann et al., 2009) was followed such as having a clinically qualified member of staff available for guidance and support throughout the study.

The present study aimed to evaluate whether training in stimulus discrimination or a counting control strategy prior to exposure to a trauma film would be effective in reducing intrusive memories when employed after analogue trauma. The study further aimed to evaluate whether the training would reduce maladaptive responses to intrusions in a sample of student paramedics.

5.1.6 Hypothesis

The primary hypothesis was that participants in the Stimulus Discrimination Training (SDT) group would experience fewer intrusive memories, less distressing intrusive memories, a reduced sense of nowness (sense of happening in the here and now) and a shorter duration of individual intrusive memories, compared to a Counting Intrusions Training (CIT) group. The secondary hypothesis was that participants in the SDT group would engage in significantly fewer maladaptive and a greater number of adaptive responses to intrusions, compared to the CIT group.

5.2 Method

5.2.1 Sample Size

A power analysis was conducted, using G*power (Faul et al., 2007), based on the results of Kennedy-Williams (Kennedy-Williams et al., 2019). Kennedy-Williams found that SDT led to a significantly fewer number of intrusive memories compared to suppression or a counting control group. Based on Kennedy-William's results and applying an α error probability of .05 and power of .95, the total required sample size was estimated to be N=86 participants. Allowing for 15% attrition, a total sample size of N=102 was recruited.

5.2.2 Participants

The Medical Sciences Inter-Divisional Research Ethics Committee at the University of Oxford granted approval (CUREC 2 ethics approval R57537/RE002). All participants were British student paramedics and were recruited through a short in-person presentation to paramedic programmes at 5 universities. Informed consent was given by all participants.

At recruitment, 259 student paramedics expressed interest. Of these, 113 completed the consent form and screening measures. Participants were excluded if they had a history of rape or sexual violence or were currently receiving cognitive behavioural therapy or counselling. Participants were screened for PTSD and depression using the PTSD checklist for DSM-5 (PCL-5; Blevins, Weathers, Davis, Witte, & Domino, 2015) and the Patient Health Questionnaire (PHQ-9; Kroenke & Spitzer, 2002). Participants were called for an individual risk assessment if they scored above the cut-off of 10 on the PHQ-9, 33 and above on the PCL-5, or indicated suicidal ideation (PHQ-9 item 9). Eighteen participants were called for individual risk

assessments and 11 of them were excluded from the study: 3 because they had a history of rape or sexual violence, 6 because they were currently receiving or were planning on receiving cognitive behavioural therapy or counselling, and 2 because they couldn't attend the in-person session. Seven of the 18 participants who scored above cut-off were re-included after the risk assessment and after consultation with a clinical psychologist (Dr. Jennifer Wild). The remaining 102 participants were randomly allocated to the two intervention groups on a 1:1 ratio: Stimulus Discrimination Training (SDT; n=50) or Counting Intrusions Training (CIT; n=52). Randomisation was stratified by gender and by cut-off on the PHQ-9 (10 and above) and the PCL-5 (33 and above) using computerised minimisation. After randomisation, 15 further participants dropped out because they could not attend the in-person session, leaving n=42 in the SDT group and n=45 in the CIT group. See Figure 9 for participant flow.

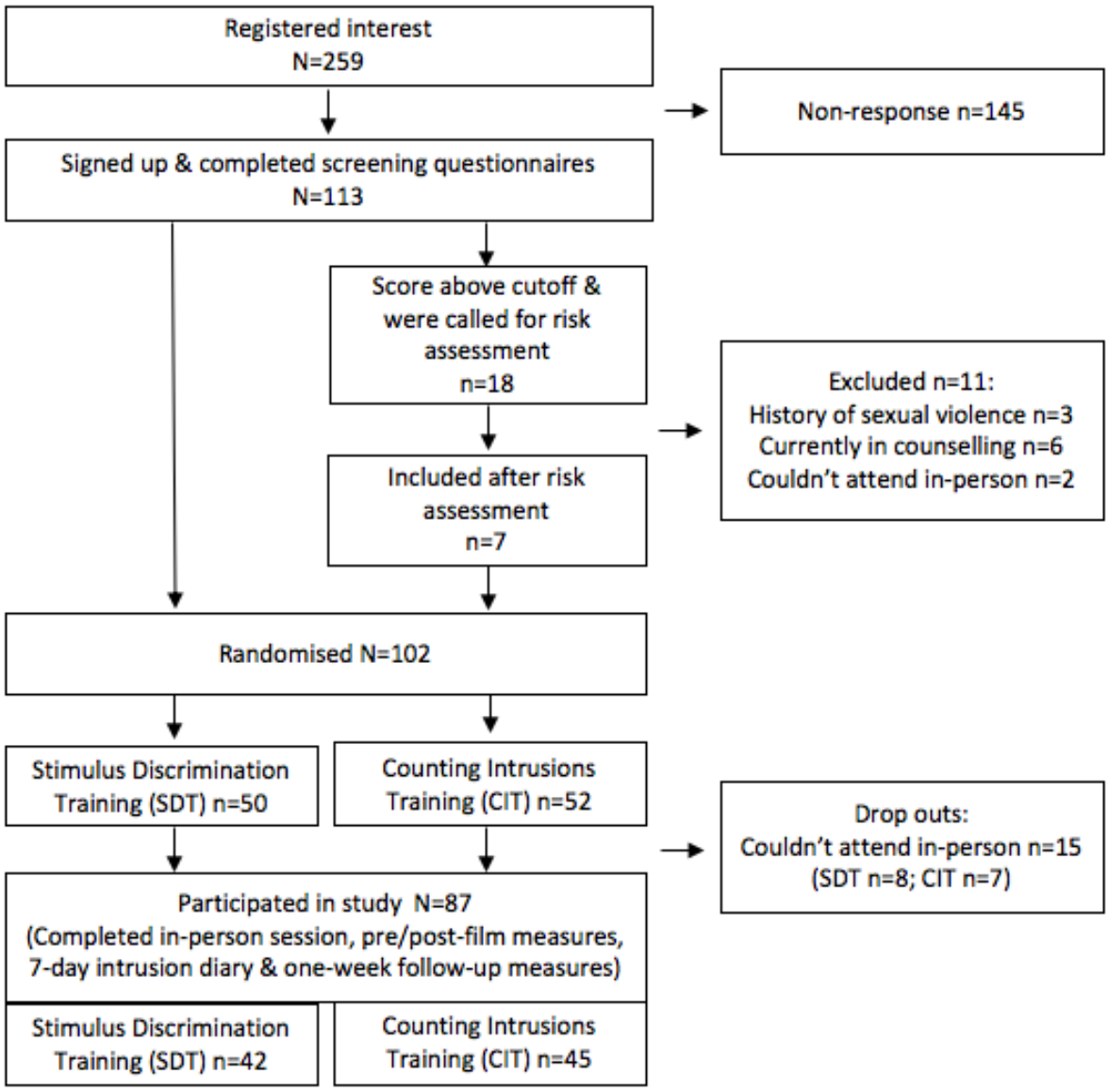


Figure 9. Trial profile showing participant flow, exclusions and dropouts.

Of the 102 participants randomised, 44 (43.14%) were male and 58 (56.86%) were female. The majority, 91 students (89.22%) were White British; 5 individuals (4.90%) White Irish; 1 (0.98%) Bangladeshi; 3 (2.94%) Pakistani, 1 (0.98%) White and Asian and 1 (0.98%) White and Black Caribbean. The mean age was 25 (SD = 7.69) with a mode of 19. Students attended one of 5 universities across England: 9 students (8.82%) attended Canterbury Christ Church University; 12 (11.76%) Oxford Brookes University; 11 (10.78%) St. George's, University of London; 63 (61.76%) University of the West of England and 7 (6.86%) University of Wolverhampton. Most participants

were attending their first (39 students, 38.23%), or second (35 students, 34.31%) year at university and slightly fewer their third year (28 students, 27.45%). (See Table 13 for demographic information by intervention group).

Table 13
Demographic characteristics of all participants randomised (N=102)

	Stimulus Discrimination Training n=50	**Counting Control Training n=52**
Age: *Mean (SD)*	25.02 (7.45)	25.44 (7.97)
Gender: No. females (%)	30 (60.00)	28 (53.85)
Ethnicity (%)		
White British	47 (94.00)	44 (84.61)
White Irish	1 (2.00)	4 (7.69)
Bangladeshi	1 (2.00)	0
Pakistani	0	3 (5.77)
White & Asian	1 (2.00)	0
White & Black Caribbean	0	1 (1.92)
University (%)		
Canterbury Christ Church	4 (8.00)	5 (9.61)
Oxford Brookes	6 (12.00)	6 (11.54)
St.George's University London	6 (12.00)	5 (9.61)
The West of England	28 (56.00)	35 (67.31)
Wolverhampton	6 (12.00)	1 (1.92)
Year of study (%)		
First	21 (42.00)	18 (34.61)
Second	15 (30.00)	20 (38.46)
Third	14 (28.00)	14 (26.92)

5.2.3 Development of the Intervention

The SDT intervention was adapted from stimulus discrimination training used in other studies (Kennedy-Williams et al., 2019; Wild et al., 2018). The CIT intervention was adapted from the counting intrusions technique used by Kennedy-Williams and colleagues (Kennedy-Williams et al., 2019). Two online modules were created and uploaded to Qualtrics. These modules and the design of the study were further

developed following a user advisory group and a pilot study to assess the acceptability of the online training.

5.2.3.1 User advisory group.

Three student paramedics participated in a user advisory group. The aim of the group was to understand how to engage student paramedics in participating in the study, how they would like to receive training in dealing with intrusive memories (i.e., online or in person or a combination of both or in a group), whether or not they would like to watch a trauma film by themselves at home or at university with the researcher outside their room, and what would encourage compliance with completing a diary in the week after the film. Participants were shown the online module and then explained the purpose of the study.

5.2.3.1.1 Generating interest in participating.

Participants were asked what would encourage engagement in this study. They stated that they would most likely participate if their lecturers supported and advertised the study. They would also choose to participate if it was emphasised that the study could help their own coping with unwanted memories ("asking for help sucks and I'd rather prevent than need help later"…"it's for our own benefit. It's not like you're teaching us a useless skill") and if it was advertised that participants would receive an Amazon voucher as reimbursement.

5.2.3.1.2 Learning the technique.

Participants were asked how they thought they would best learn the stimulus discrimination or counting technique. They noted that if they learned it in-person in a large group, they would feel uncomfortable admitting they had not understood something. If they only learned it online on their own, they would likely not bother emailing if they hadn't understood something. All agreed that online learning *and* a

one-on-one in-person practice of the technique and review of any questions would be best. They found the technique straightforward and engaging to learn through the online module but critiqued that it contained too much writing. One of their concerns was that they might not recognise an intrusive memory in themselves, despite learning the theory in the online module. It would therefore be useful to review what intrusive memories are and how to recognise them during the in-person session.

5.2.3.1.3 Watching the trauma video.

Participants were asked how they would feel about watching a trauma analogue film that included a rape scene. Participants stated that they would be open to watching such a film if they knew about it beforehand, so they could choose whether or not to participate. They further stated that they would not want to watch such a video in a group ("if it upset me I wouldn't want other people to see it"). They also would not want to watch it at home on their own ("what if I'm extremely upset and don't know how to help myself?"). Their best version entailed watching the video on their own with the researcher next door and an opportunity to debrief one-on-one with the researcher afterwards ("it would be nice to have the security of having someone to talk to afterwards").

5.2.3.1.4 Completing the intrusion diary.

Participants were shown the intrusion diary and given different options of completing it, including pen and paper, computer-based or phone-based. All participants agreed that they preferred to complete the diary online on their smartphones.

5.2.3.1.5 Conclusion.

Following the User Advisory Group, changes were made to incorporate feedback, including shortening and simplifying the written text in the online module.

5.2.3.2 Pilot study.

5.2.3.2.1 Introduction.

A short pilot was conducted to assess the acceptability of the updated online interventions.

5.2.3.2.2 Method.

Seventeen third-year undergraduate psychology students from the University of Oxford participated in a pilot. Participants were randomly allocated to the two intervention groups: n=7 to SDT and n=10 to stress management. Participants learned their respective technique through a 30-minute online module. In order to include all students in the pilot, participants were not screened for PTSD, depression or for current treatment and the trauma film was not shown. Instead, participants could choose between a light-hearted, humorous video or a video of a road traffic accident as part of the online module. All participants (N=17) chose the light-hearted video. For seven days after the film, participants completed the intrusion diary. The diary contained detailed instruction of what intrusive memories are and detailed questions on time, frequency, distress, nowness and length of intrusive memories. Participants were emailed the intrusion diary link and sent daily email reminders to complete it. No follow up measures were completed.

5.2.3.2.3 Results.

Participants stated that it was easy to guess whether they were in the intervention or the control group. Feedback on the intrusion diary was that the text was too lengthy and it took too long to complete. In addition, participants often missed their email reminders to complete the daily diary and recommended SMS reminders in the evenings instead. There were no significant differences in the frequency or distress of intrusive memories between the two groups.

5.2.3.2.4 Discussion.

The aim of the pilot was to receive feedback on the acceptability of the online modules and the intrusion diary. Based on the participant feedback, the following changes were made for the full study: The concern about the believability of the comparison intervention was taken into account and the comparison training was changed to include a much stronger rationale for the counting intrusions technique. A detailed rationale for its "effectiveness" was added to the online module of counting intrusions training (CIT). Practice exercises were added to the CIT module and provided with a rationale. The intrusion diary was shortened to only include the 5 questions described in the measures (frequency, time, distress, nowness and length of intrusive memories) and icons were added to each question to allow faster and easier completion. Finally, daily SMS reminders to complete the diary were sent instead of email reminders.

5.2.3.3 Method changes compared to prior research.

The current study applied the method used by Kennedy-Williams and colleagues (2019) with some changes: First, a different film was used. Second, the current study did not include a suppression intervention since there is extensive evidence that suppression is unhelpful in reducing intrusive memories (e.g. Kennedy-Williams et al., 2019; Wegner, 1989). Third, based on feedback from the pilot study, the current study included a detailed rationale for the counting intrusions intervention to make the technique believable and therefore more comparable to the stimulus discrimination intervention. Fourth, the majority of the training in this study was offered online rather than in person as in Kennedy-Williams et al. (2019). Details of the online module, intrusion diary and script for the in-person session were adapted based on feedback from the user advisory group and the pilot study. These changes included shortening

text, including new videos and exercises in the online module, reducing the number of measures used and measuring the length of intrusive memories. Finally, all material included relevant examples for student paramedics.

5.2.4 Measures

5.2.4.1 Screening measures.

At screening, participants completed two questionnaires to screen for PTSD and depression. The *PTSD Checklist for DSM-5* (PCL-5; Blevins, Weathers, Davis, Witte, & Domino, 2015) is a 20-item measure which assesses PTSD symptoms in the previous month. Psychometric evaluations have shown strong internal consistency (α=.94), and test-retest reliability (*r*=.82; Blevins et al., 2015). Symptoms are rated on a scale from 0=*not at all* to 4=*extremely.* A total score of 33 or above (out of a maximum score of 80) has been recommended as the preliminary clinical cut-off with higher scores indicting greater PTSD symptoms. For the present sample, Cronbach's alpha was α=.91.

The *Patient Health Questionnaire (PHQ-9)* was used to screen for depressive symptoms (Kroenke et al., 2001). The PHQ-9 is a 9-item self-report questionnaire that assesses depression symptoms over the previous two weeks. Scores range from 0=*not at all* to 3=*nearly every day*, with a score of 10 or above on the PHQ-9 indicating possible clinically significant depression with a sensitivity and specificity of 88% (Kroenke et al., 2001). Kroenke and team reported good internal reliability (α=.89) and test-retest reliability with a kappa of .84 after 48 hours. For the present sample, Cronbach's alpha was α=.80.

5.2.4.2 Pre and post film measures.

Immediately before and after watching the trauma film, participants completed measures to assess distress and affect. An adapted version of the *Subjective Units of*

Distress Scale (SUDS; Wolpe, 1958) as used by Sachschal and colleagues (2019) was used to assess current distress experienced before the film and in response to the film. Participants rated their distress from 0=*not at all distressed* to 10=*extremely distressed.*

The Positive and Negative Affect Mood Schedule (PANAS; D. Watson et al., 1988) is a 20-item measure assessing 10 specific positive and 10 negative feelings. Specifically, the PANAS included the following feelings: interested, distressed, excited, upset, strong, guilty, scared, hostile, enthusiastic, proud, irritable, alert, ashamed, inspired, nervous, determined, attentive, jittery, active and afraid. Since some literature (i.e., Arnaudova & Hagenaars, 2017; Weidmann et al., 2009) had raised the concern that the film *Irreversible* as a trauma analogue may lead to a gender difference related to possible sexual arousal, an item of 'arousal' was added to the PANAS. Participants were asked to rate how they were feeling right now from 1=*very slightly or not at all* to 5=*extremely*. The PANAS is scored by summing the scores of the 10 positive items to form a Positive Affect Scale (PA scale) and the 10 negative items to form a Negative Affect scale (NA scale). Psychometric properties for the PANAS are good. It demonstrates good internal consistency (Cronbach's α=.89 for the PA scale and Cronbach's α=.85 for the NA scale). Test-retest reliability is *r*=.54 for the PA scale and *r*=.45 for the NA scale. For the present sample, Cronbach's alpha was α=.56 for the PA scale and α=.78 for the NA scale. When deleting the first item ('interesting') from the PA scale, Cronbach's alpha increases to α=.60. However, the full PA and NA scales were used in the current study.

Immediately after watching the trauma films, participants completed measures to assess a number of potentially confounding variables related to the film that could influence results should there be group differences. As in Kennedy-Williams et al., (2019) and Sachschal et al. (2019) the following questions were asked: (1) 'How

distressing did you find the film?' (0=*not at all* to 100=*extremely*), (2) 'Please indicate how much (%) of the time you looked away whilst watching the film' (gaze aversion; 0=*I did not look away at all* to 100=*I looked away for the whole film*), (3) 'How real did you find the film?' (0 = *not at all* to 100=*very much so*), (4) 'How much did the film remind you of things in your personal life?' (personal relevance; 0=*not at all* to 100=*very much so*), (5) 'How strongly did you feel like you were actually in the film, observing on the scene what was happening?' (0=*not at all* to 100=*very much so*) and (6) 'Do you usually watch violent films?' (0=*never*, 1=*sometimes*, 2=*often*).

5.2.4.3 Intrusion diary.

A 7-day daily online intrusion dairy was used to assess the primary outcome measures of frequency, distress, nowness and length of intrusive memories. The intrusion diary included the following questions: (1) 'Have you had any intrusive memories since your last diary entry?' (yes, no), if yes: (2) 'How many intrusions have you had since your last diary entry?' (open ended), (3) 'Time of intrusion e.g. 14:35' (open ended, used to clearly separate the intrusive memories during one day), (4) 'How distressing was the memory?' (0=not at all to 4=extremely), (5) 'To what extent did it seem to be happening now instead of being something from the past?' (0=not at all to 4=very strongly), (6) 'How long did the intrusive memory stay in your mind? (in minutes and seconds).' Length was later analysed and reported in seconds. The intrusion diary was based on the intrusion diaries used in previous studies utilising the Trauma Film Paradigm (Holmes & Bourne, 2008; Kennedy-Williams et al., 2019) with the only difference that it was shorter in text and included a question on intrusion length. See Appendix 5 for the intrusion diary.

5.2.4.4 One-week follow-up measures.

At one-week follow-up, compliance to training was assessed with the following questions: (1) ‘About what percent of the intrusive memories did you record in the online intrusion diary? (*0-100%),* (2) ‘In the past week, how often have you practiced the technique you learned, when unwanted memories popped into your mind?’ (0=*not at all*, 1=*once*, 2=*2 to 4 times*, 3=*5 or more times/nearly every day*).

The *Response to Intrusion Questionnaire* (RIQ; Clohessy & Ehlers, 1999; Murray et al., 2002; Steil & Ehlers, 2000) is a 19-item self-report measure which examines responses to intrusive memories (version used in Beierl, Böllinghaus, Clark, Glucksman, & Ehlers, 2019). It is divided into three subscales: suppression (6 items), rumination (8 items) and dissociation (5 items) which are scored on a scale from 0=*never* to 3=*always*. The scales have demonstrated adequate reliability and predictive validity in a range of studies (Beierl et al., 2019; Ehring, Ehlers, et al., 2008; Kleim et al., 2007). The internal consistency of the rumination subscale was between α=.80-.86. Items were adapted to refer to ‘watching the trauma film’ instead of experiencing a traumatic event. The rumination item 19 (‘I think about why the event happened to me’) was removed since it could not be adapted to the trauma film. This is in line with previous research adapting the RIQ to a trauma film (Sachschal et al., 2019). An unpublished 4-item subscale on the use of stimulus discrimination was added as a manipulation check to see whether the SDT group used stimulus discrimination more than the CIT group. This scale has been used by Kennedy-Williams et al. (2019). Items were scored on a scale from 0=*never* to 3=*always* with a minimum score of 4 and a maximum score of 16. For the present sample, Cronbach’s alpha was α=.91 for the suppression subscale, α=.81 for the rumination subscale, α=.64 for the dissociation subscale, and α=.88 for the stimulus discrimination subscale.

5.2.5 Procedure

After completing screening measures, participants were randomised and then worked through a 30-minute online module of SDT or CIT. The online training module for SDT first explained what intrusive memories are and included video reports of student paramedics talking about their experiences of intrusive memories. Next, participants could engage in a video-led behavioural experiment on suppression and why it is not helpful in reducing unwanted memories. Participants were then taught stimulus discrimination, labelled the 'Then vs Now Technique'. They were instructed to focus on what is different 'now' in their current situation than it was back 'then' during the stressful or traumatic event.' A detailed rationale was given: ("Then vs Now is a strategy that helps us to focus on the differences between the triggers in our life today 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 […]). After learning the technique, participants had the choice of watching a light-hearted or serious video clip, followed by exercises to practice stimulus discrimination using images and audio clips that triggered memories from the chosen video clip.

The online training module for CIT first explained what intrusive memories are. Next, it taught participants to give each intrusive memory a number ("for example, if you have an unwanted memory in the morning, you would give it the number one. Your next unwanted memory that day would be given the number two and so on.") and labelled it the 'Counting Technique'. A detailed rationale was given ("[…] Intrusive memories are signs that lower level brain structures such as the amygdala bring emotional memory content into consciousness. Counting engages higher level brain structures such as the prefrontal cortex […] Counting abstracts information from the

sensory world, so that it becomes abstract information and less emotional […]). This 'faux rational' is not evidence based, although parts of it have a scientific basis (Arsalidou et al., 2018; Bremner et al., 1995; Ironside et al., 2017; Norbury & Goodwin, 2010). As in the SDT training, participants then had the choice of watching a light-hearted or a serious video clip, followed by exercises to practice the counting intrusions technique. The two online training modules were matched for time, type of activities to complete and depth of rational. Thus, the alternative training was matched for common and structural factors such as duration, format and depth of training, as recommended by Baskin, Tierney, Minami and Wampold (2003). Both techniques encouraged participants to disengage from the intrusive memories.

Based on feedback from the pilot study it was important to assess whether participants found their intervention to be believable and logical. Therefore, at the end of both online modules, three questions were asked: (1) 'How valuable did you find this training module?' (0 = *not at all valuable* to 10 = *extremely valuable*), (2) 'How logical do you consider this type of training to be?' (0 = *not at all logical* to 10 = *extremely logical*) and (3) 'How certain are you that this method will be successful in helping you deal with intrusive memories?' (0 = *not at all certain* to 10 = *extremely certain*).

After completion of the online module, participants attended a 30-minute, in-person session with the researcher, at their university. For the entire in-person session the researcher followed a detailed script (see Appendix 6). During this session, participants gave written consent and were asked to describe to the researcher what intrusive memories are and how their respective technique worked. Participants could ask questions and the researcher could correct or clarify any confusions about the technique. The researcher also showed and explained the intrusion diary to the participant and verbally reminded them of the next steps in the study.

Participants completed the short pre-film measures on a laptop. Next, participants were asked to watch the trauma film using earphones on a laptop with a 13-inch screen, positioned 60cm away. The trauma film was a 10.5 minute long clip from the French film *Irreversible* (Noé, 2003) depicting a young woman who walks home at night and is raped by a stranger. This clip has been used in multiple studies as an analogue trauma stressor (Sachschal et al., 2019; Schaich et al., 2013; Verwoerd et al., 2012; Weidmann et al., 2009). During the film, the researcher left the room and all windows were blinded so the participant had complete privacy. After watching the film, participants immediately completed the post-film measures. They were then asked how they were. If participants were distressed, the researcher gave them as much time as they needed, listened to their feedback and validated and normalised their feelings as instructed by the script. Finally, the researcher reminded them to apply their technique to any intrusive memories of the trauma film and record any intrusions in the online intrusion diary.

For 7 days following the in-person session, participants received daily SMS reminders at 8pm to complete the intrusion diary. The timing of daily reminders was based on feedback from the pilot study. One week after the in-person session, participants completed the one-week follow-up questionnaire. After completion of this, all participants were debriefed and informed about their assigned intervention by email. All participants in the CIT group received access to the stimulus discrimination training and were encouraged to use stimulus discrimination since the CIT training was said to be under continued evaluation. Participants received an Amazon voucher as reimbursement for their time. See Figure 10 for the timeline of the study.

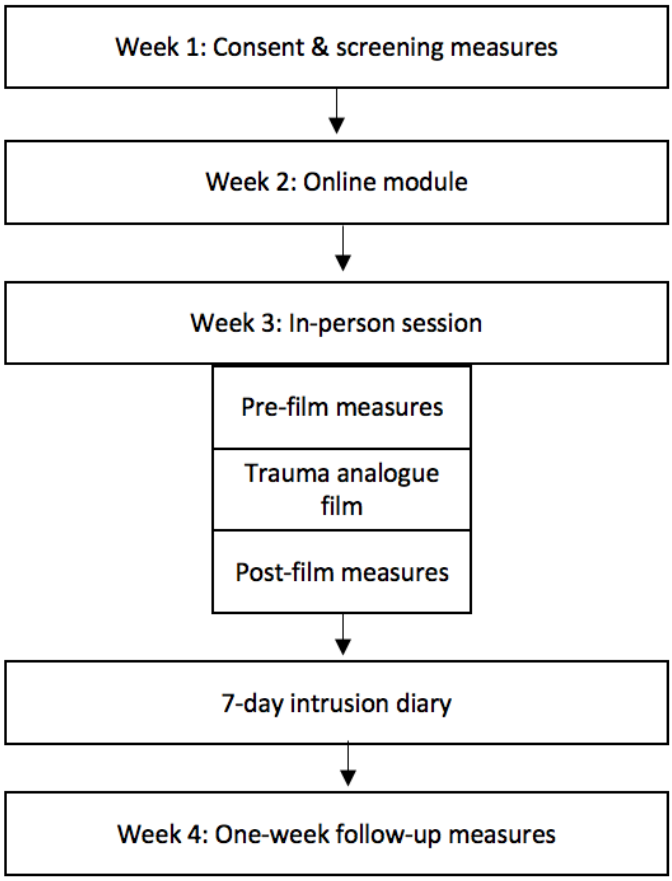


Figure 10. Timeline of the study including timepoints for online module, in-person session and outcome measures.

5.2.6 Data Analysis

Analyses were conducted using the statistics software SPSS version 22 (IBM Corp., 2017). Chi Square tests and independent t-tests were used to assess if there were any differences between dropouts and non-dropouts on screening measures or demographic factors (PCL-5, PHQ-9 age, gender, ethnicity, university, year of study or number of participants in each intervention group). Multiple imputations (MI) were performed to account for missing data of n=15 drop-outs. Predictive mean matching (pmm) from the R package mice (multivariate imputation by chained equations) v2.30 (van Buuren & Groothuis-Oudshoorn, 2011) was used to generate imputations.

A repeated measures ANOVA assessed whether there was a significant time by group interaction effect of positive or negative mood before and after watching the

trauma film. Independent t-tests were performed to test for between group differences on potential confounds (believability of the intervention modules, how personally relevant participants found the film, how real participants found the film, how distressing participants found the film, how strongly participants felt like they were actually in the film, whether participants usually watched violent movies and gaze aversion during the film).

Since female gender has been associated with a higher risk for PTSD (Olff & Langeland, 2007) and analogue trauma studies have found women to report greater frequency of intrusive memories after analogue trauma compared to men (Brewin et al., 2010; Ehlers et al., 1998), a univariate ANOVA was conducted to assess whether the intrusion frequency differed by group and gender. For all variables that showed significant or trend-level between-group differences, zero-order correlations or a point-biserial correlation (gender) were performed to test whether they correlated with the primary outcome measures and whether they would need to be considered as covariates.

One-way MANOVAs were conducted to assess whether there were any between-group differences between SDT and CIT on the primary outcome measures (frequency, distress, nowness and length of intrusive memories) and secondary outcome measures (suppression, rumination, dissociation). Univariate one-way ANOVAs were conducted to assess whether there were any between-group differences between SDT and CIT at one-week follow-up measures (manipulation check of the use of stimulus discrimination, questions about compliance).

If variables showed a non-normal distribution (showing skewness or kurtosis above 1.96), residuals of the model were visually inspected. If found to be satisfactory, no transformation was performed. If found to be non-normal, they were transformed using Log10 transformation. In the current sample, the main outcome measure of length

of intrusion as well as the manipulation check item referring to personal relevance of the film were Log10 transformed.

5.3 Results

5.3.1 Preliminary Analysis

5.3.1.1 Comparing dropouts and non-dropouts.

After randomisation, 15 participants dropped out (8 had been randomised to SDT, 7 to CIT) because they could no longer attend the in-person session. Independent sample t-tests revealed that there were no significant differences between these 15 dropouts and non-dropouts on the screening measures (PCL-5 and PHQ-9) or age. A chi-square test showed that there were no significant differences between these 15 dropouts and the non-dropouts on gender, ethnicity, university or intervention group. However, a chi-square test found that dropouts significantly differed by year of study: 9 out of 15 (60%) of participants who dropped out were in their third year of university compared to 19 out of 87 (22%) of participants who completed the study, $\chi 2(2)=9.367$, $p=.009$. The 15 participants who dropped out did not receive any training and no data were available on them except for the demographic and screening measures. The remaining 87 participants completed the entire study with n=42 in the SDT group and n=45 in the CIT group with no missing data. All 87 participants completed the in-person session, the 7-day intrusion diary and the one-week follow-up questionnaire. In order to conduct an intention-to-treat analysis, multiple imputations were performed for those 15 participants and they were included in all analyses resulting in N=102 with n=50 in SDT and n=52 in the CIT group. See Table 13 for demographic characteristics of all 102 participants randomised.

5.3.1.2 Manipulation check.

There was a significant between-group effect on the RIQ stimulus discrimination subscale, indicating that the SDT group (*M*=5.56, *SD*=3.30) engaged in significantly greater use of stimulus discrimination compared to the CIT group (*M*=3.65, *SD*=3.74), *F*(1,100)=7.016, *p*=.009, Cohen's d=.542. However, participants trained in CIT also engaged in SDT. Scores on the RIQ stimulus discrimination subscale range from 0 to 12. Should a participant apply no use of stimulus discrimination training in response to intrusive memories, their score would be 0. Results were the same pre and post multiple imputations.

5.3.2 Compliance

Of the N=86 participants who completed the training and watched the trauma analogue film, six participants looked away for more than 50% of the film (gaze aversion; n=6 SDT; n=0 CIT) and three participants (n=2 SDT; n=1 CIT) only watched between 7.16-7.5 minutes of the 10.5 minute film clip. At follow-up, there were no difference between groups in the percent of intrusive memories recorded and in the self-reported compliance to the technique. Three participants reported low compliance (n=2 SDT; n=1 CIT) stating that they only recorded 0 to 10% of their intrusive memories in the intrusion diary. All other participants stated that they recorded 80 to 100% of their intrusive memories. Four participants (n=3 SDT; n=1 CIT) had intrusive memories but reported that they didn't practice their technique at all even though they experienced intrusions.

5.3.3 Potential Covariates

5.3.3.1 Comparison of believability of interventions.

Of the 87 participants, 85 completed the online module. (The two participants who did not complete the online module reviewed the method during the in-person session).

An independent t-test of the imputed sample (N=102) was conducted to assess how valuable participants found the module ('how valuable did you find this training module?'). There was no significant between-group difference between SDT (*M*=6.74, *SD*=1.65) and the CIT (*M*=6.21, *SD*=2.25), *t*(1,100)=1.347, *p*=.181. This indicates that the degree to which participants found the technique to be valuable did not differ by group.

An independent t-test was conducted to assess how logical participants found the module ('how logical do you consider this type of training to be?). There were no significant between-group differences between the SDT (*M*=7.58, *SD*=1.72) and the CIT (*M*=7.06, *SD*=2.29), *t*(1,100)=1.294, *p*=.198. This indicates that the degree to which participants believed the technique to be logical did not differ between groups.

An independent t-test was conducted to assess how helpful participants thought the technique would be in dealing with intrusive memories ('how certain are you that this method will be successful in helping you deal with intrusive memories?'). There was a significant between-group difference between SDT (*M*=5.86, *SD*=2.01) and the CIT (*M*=4.98, *SD*=2.38), *t*(1,100)=2.007, *p*=.047. This indicates that participants in the SDT group were more certain that the technique would be successful in helping them deal with intrusive memories than participants in the CIT group.

5.3.3.2 Characteristics of participants' experience of the film.

Independent t-tests revealed no significant differences between the SDT and the CIT on measures of possible confounds related to the trauma film: how distressing the

film was, $t(1,100) = -.067$, $p = .947$, how real participants found the film, $t(1,100) = -1.235$, $p = .220$, how strongly participants felt like they were actually in the film $t(1,100) = -.591$, $p = .556$, whether participants usually watched violent movies, $t(1,100) = -1.067$, $p = .288$, and gaze aversion during the film, $t(1,100) = .668$, $p = .505$.

The item pertaining to personal relevance, 'how much did the film remind you of things in your personal life,' significantly differed between the two groups, with participants in the SDT group ($M = 20.80$, $SD = 27.54$) reporting that the trauma film of the sexual assault held more personal relevance than the CIT group ($M = 11.54$, $SD = 18.19$), $t(1,100) = 2.011$, $p = .047$, although the distribution showed high skewness and kurtosis. This significance disappeared to a trend after log-transformation, $t(1,100) = 1.585$, $p = .116$. Inspection of original scores (pre-imputation) as well as post-imputation scores showed that n=5 (4 in SDT, 1 in CIT) participants scored above 70 out of 100 on this measure with more participants in SDT experiencing the film to be highly personally relevant.

A repeated measures ANOVA was conducted to assess the changes in the PANAS by group from pre film to post film. The PANAS Positive Affect scale showed a significant main effect of time, $F(1,100) = 174.763$, $p < .001$, with participants indicating lower positive scores after the film. There was no significant main effect of group, $F(1,100) = .364$, $p = .548$, and no significant interaction effect of time by group, $F(1,100) = 2.519$, $p = .116$. The PANAS Negative Affect scale similarly showed a significant main effect of time, $F(1,100) = .340$, $p = .016$, with participants indicating greater negative scores after the film. There was no significant main effect of group, $F(1,100) = .593$, $p = .443$, and no significant time by group interaction effect, $F(1,100) = .340$, $p = .561$.

A univariate ANOVA assessed the effect of group and gender on the frequency of intrusive memories. For intrusion frequency, there was no main effect of group ($F(1,100)=1.457$, $p=.230$), no main effect of gender ($F(1,100)=2.414$, $p=.123$), and a trend-level gender by group interaction effect, $F(1,100)=3.438$, $p=.067$, suggesting a trend for women in the CIT group to have more intrusive memories than men.

5.3.4 Primary Hypotheses

5.3.4.1 Assessing potential covariates.

Multiple variables were established as potential covariates since they differed between groups either significantly or showed a trend towards significance. All of these potential covariates showed non-significant correlations with the primary outcome measures and as such, no ANCOVAS were performed. Table 14 shows the correlations between the potential covariates and the primary outcome measures.

Table 14
Correlations between potential covariates and primary outcome measures (N=102)

	Primary outcome measures of intrusive memories			
Measure	Frequency Correlation	Distress Correlation	Nowness Correlation	Length[a] Correlation
How helpful participants thought the technique would be	.052	.009	.006	-.048
How personally relevant the trauma film was[a]	.093	.108	-.140	-.015
Gender	.164	.018	-.009	-.067

a Variable was square-root transformed.
* p < .05, ** p < 0.001

Table 15a

Means and standard deviations for the primary and secondary outcome measures (N=102)

	Stimulus Discrimination Training (n=50)		Counting Control Training (n=52)	
Tests	*M*	*(SD)*	*M*	(*SD)*
Frequency of intrusive memories	3.62	3.93	3.86	3.4
Mean distress of intrusive memories	1.52	1.00	1.49	1.09
Mean nowness of intrusive memories	1.13	0.77	1.12	0.95
Mean length of intrusive memories	46.66	57.96	66.6	114.33
RIQ-stimulus discrimination subscale	5.56	3.30	3.65	3.93
RIQ-suppression subscale	7.98	5.47	6.42	5.46
RIQ-rumination subscale	3.12	3.30	2.56	3.14
RIQ-dissociation subscale	2.74	2.00	2.78	2.84

Note: Length of intrusive memories is measures in seconds; RIQ = Responses to Intrusion Questionnaire

5.3.4.2 Primary outcome measures.

Participants experienced between 0 to 9 intrusive memories a day and overall between 0 to 17 intrusive memories during the 7 days following the trauma film. A MANOVA was conducted to assess the differences in frequency, distress, nowness and length of intrusive memories between the two groups as measured by the 7-day intrusion diary. There were no significant differences between the SDT and the CIT groups, $F(1,100)=.987$, $p=.870$ (Wilks' Lambda). Specifically, there were no group difference on frequency of intrusions, $F(1,100)=1.077$, $p=.302$, distress of intrusions, $F(1,100)=.017$, $p=.897$, nowness of intrusions, $F(1,100)=.008$, $p=.928$ and length (in seconds) of intrusions, $F(1,100)=.061$, $p=.806$ (log10 transformed). Table 15a presents the means and standard deviations for the outcome measures by group, post-imputations. See Appendix 8, Table 15b for the means and standard deviations pre-imputations.

1.1.1 Secondary Hypothesis

The secondary hypothesis was that participants in the STD group would engage in fewer maladaptive responses to intrusive memories compared to the CIT group. A MANOVA was conducted to assess the differences in responses to intrusions between the two groups, as measured by the Response to Intrusion Questionnaire (RIQ). There were no significant differences between the SDT and the CIT groups, $F(1,100)=.962$, $p=.287$ (Wilks' Lambda). Specifically, there were no group difference on the subscales of suppression, $F(1,100)=2.067$, $p=.154$, rumination, $F(1,100)=.778$, $p=.380$ and dissociation, $F(1,100)=.010$, $p=.921$. See Table 15 for means and standard deviation of all RIQ subscales. Conducting the same analyses pre-imputations yielded the same results.

5.4 Discussion

5.4.1 Primary Outcomes

This study investigated whether specific training in stimulus discrimination could reduce intrusive memories after an analogue trauma film in student paramedics more than a time-matched alternative training, which focuses on distancing oneself from the intrusion by counting it. The primary hypothesis was that participants in the Stimulus Discrimination Training (SDT) group would experience fewer and less distressing intrusive memories, a reduced sense of nowness and a shorter duration of individual intrusive memories compared to the Counting Intrusions Training (CIT) group. Contrary to prediction, SDT did not differ from the CIT group on any of these outcome measures. Both groups experienced on average 3 to 4 intrusive memories in the week after the analogue film, both groups experienced low distress and nowness across intrusions and in both groups intrusions lasted around one minute. These findings

are not in line with a similar study by Kennedy-Williams and colleagues (2019) who found a significant difference in the frequency and distress of intrusive memories between the SDT group and a group counting intrusions.

Both interventions appeared to have a similar effect on intrusive memories. Both groups were instructed to disengage from the intrusive memory through their technique. Both groups may have felt equipped with a valuable and logical tool to actively deal with intrusive memories although participants in the stimulus discrimination group believed their technique to be significantly more helpful in reducing intrusive memories than did participants in the counting group. However, none of these factors of believability influenced the results. It is important to note that, although the SDT group showed significantly greater use of stimulus discrimination techniques, the CIT group also applied stimulus discrimination to intrusive memories. It is possible that participants in the SDT group shared their technique with participants in the CIT group at their university, even though they were instructed not to do so. It is possible that each intervention may have reduced intrusive memories by differing mechanisms of action. Potential explanations are explored in the next sections.

5.4.2 Understanding the Stimulus Discrimination Training

Participants in the current study applied stimulus discrimination with the SDT group making more use of stimulus discrimination than participants training in CIT. Stimulus discrimination is proposed to work by improving the sensory discrimination between triggers and their present context and the trauma, thereby focusing attention to and awareness of the presence and reducing the sense of 'nowness' of memory content and current threat (Brewin et al., 1996; Ehlers & Clark, 2000). SDT works best if there are distinct stimuli that occur during the trauma that trigger intrusions. It is possible that

the chosen film was not an ideal model for visual trauma triggers as the whole scene takes place in the same location and the colours are very muted and not very distinct, in contrast to the film used by Kennedy-Williams et al. (2019) which contained very varied film clips with many different stimuli that could become triggers.

5.4.3 Understanding the Counting Intrusions Training

5.4.3.1 Improved rational and believability.

Based on user feedback from the pilot study, which stated that the alternative module was not very convincing, the CIT was improved upon by adding a detailed, logical rationale for why the CIT would decrease intrusive memories. Whilst the rational gives a plausible explanation, it should be noted that there is no evidence that counting is associated with a decrease in amygdala responses and the current study did not assess any neurological changes.

5.4.3.2 Changed focus of attention.

Intrusions after a traumatic event are often experienced as happening in the here and now (nowness) which can induce a sense of current threat (Brewin et al., 1996; Ehlers, 2010; Ehlers & Clark, 2000; Michael et al., 2005). Participants in the CIT group were instructed to count each intrusive memory that came to mind, thereby focusing on a number every time they had an intrusive memory and repeating that number in their head throughout the day. It may be that, by counting intrusive memories, participants focused their attention away from the distressing memory and onto something neutral and non-threatening (a number) or as stated above, that giving the intrusion a number enabled them to 'let the memory go' facilitating greater focus on the task at hand or the environment around them. Some literature suggests that simply noticing and recording intrusive thoughts (Salkovskis & Campbell, 1994) or replacing intrusive thoughts with

neutral thoughts (e.g. concentrating on your childhood kitchen) is common (Moulds et al., 2008) and can lead to fewer intrusive thoughts and lower anxiety compared to suppression (Lin & Wicker, 2007; Najmi et al., 2009). It may be that the CIT training allowed participants to focus on something neutral and non-threatening, reducing the memory's sense of nowness and distress. However, this remains to be explored with further research.

5.4.3.3 Detached mindfulness.

Aspects of the counting technique in the CIT training could be seen as similar to 'detached mindfulness' as used in Metacognitive Therapy (MCT) for PTSD. MCT is a new, transdiagnostic treatment that has shown good efficacy in treating PTSD in adults and young people (Simons & Kursawe, 2019; Wells & Colbear, 2012). MCT approaches intrusive memories through 'detached mindfulness' by instructing participants to 'leave the thoughts alone' and not engage with them. This is explained using analogies like the telephone metaphor: "you can hear the phone ring but you can learn to let it ring without picking it up" (Simons & Kursawe, 2019). The aim is to weaken metacognitive beliefs about the uncontrollability of worry and rumination that often follow intrusive memories. CIT in the current study may have worked in a similar way: participants noticed intrusive memories, gave them a number to mark that they had noticed them but did not further engage with them and let the memory go again. However, it should be noted that participants were not directly taught detached mindfulness so it is unclear to which extent they may have used this technique.

5.4.4 Comparison to Other Studies

Although female gender has been associated with higher risk for PTSD in the wider literature (e.g. Olff & Langeland, 2007) the current findings, in which gender was

found to have no effect on outcome, are in line with previous research using the film *Irreversible* in a trauma analogue study (Weidmann et al., 2009) which also found that gender did not affect outcome.

Objective measures of intrusive memories in the current study, specifically frequency and length, are comparable to other studies. In line with previous research (Holmes et al., 2004; Lau-Zhu et al., 2018), participants experienced the highest number of intrusive memories during the first few days and very little or none at the end of the week. Previous studies using the same trauma film reported the same (3-4; Siegesleitner et al., 2019) or a slightly higher average number of intrusions per week (5-6; Sachschal et al., 2019; Weidmann et al., 2009). The previous study using SDT with a different trauma film also reported a similar number of intrusions per week (3; Kennedy-Williams et al., 2019). The mean length of intrusions was similar to that reported in previous literature (Speckens et al., 2007).

5.4.5 Secondary Outcomes

The secondary hypothesis was that participants in the STD group would engage in significantly fewer maladaptive responses to intrusions, compared to the CIT group. Contrary to prediction, both intervention groups showed similar levels of rumination, suppression and dissociation as measured by the Response to Intrusion Questionnaire (RIQ) subscales. Since the frequency of intrusive memories was relatively low, and participants had been instructed to respond to intrusions with stimulus discrimination or counting, this could explain why there was little use of maladaptive strategies for dealing with intrusive memories.

5.4.6 Dropouts

There were no differences between participants who dropped out and participants who continued participation in the study on factors of gender, ethnicity, university, intervention group or on PTSD and depression scores. The only differences was that significantly more participants who dropped out were in their third and last year of their university programme. The unanimous reason for dropping out was that participants felt 'too busy' and did not have time to attend the in-person session, which is in line with the increased workload during the student paramedics' third year.

5.4.7 Limitations

5.4.7.1 Lack of a no-intervention group.

There are several limitations worth considering. The study did not include a no-intervention control group. This leaves it unclear whether both interventions were successful or both unsuccessful in reducing unwanted memories. This design was chosen because the study aimed to apply the method used by Kennedy-Williams and colleagues (Kennedy-Williams et al., 2019) who similarly did not include a no-intervention control group.

5.4.7.2 Ecological validity.

Another limitation is the use of an analogue compared to a real-life trauma which means the ecological validity could be criticised. In response to this, multiple studies have found that intrusive memories after a stressful film closely resemble clinical intrusions described by patients with PTSD (Holmes et al., 2004; Laposa & Alden, 2006; Weidmann et al., 2009). Some studies have found that analogue trauma findings translate well into naturalistic settings. For example, Holmes and colleagues tested the effects of visuospatial interventions (playing Tetris) on intrusive memories in

analogue studies (Holmes et al., 2009, 2010). In a naturalistic sample of survivors of road traffic accidents these analogue findings could be replicated. Results showed that that playing 'Tetris' in the emergency room, immediately after the accident led to fewer intrusive memories compared to a time-matched control (Iyadurai et al., 2018). Although it is widely used, findings should be considered with caution and should be complemented with studies of real-life trauma (Lau-Zhu et al., 2018).

5.4.7.3 Ethical considerations.

As in previous literature, the trauma film in the current study did not lead to severe or lasting psychological distress. Four participants stopped the film clip and some expressed slight distress or discomfort. They were all followed up via text message and expressed no lasting concerns. Despite stringent screening for personal experiences of sexual violence, some participants expressed more distress than others because they related the film to a situation in their personal lives (e.g. one had attended a paramedic call of a rape survivor, one had learned about sexual violence happening to a family member). Future studies may benefit from even more rigorous screening that excludes not only personal experience of sexual violence but its personal relevance to minimise distress.

5.4.7.4 Time based recording.

Sending daily text messages (time-based recording) to remind participants to complete their intrusion diary may have triggered intrusive memories and may have led to a higher frequency of intrusive memories reported. However, alternative ways of reporting also have their limitations. Retrospective reporting may be less accurate and event-based reporting (reporting intrusions upon occurrence) relies on participants remembering to report them. The benefits of time-based recording are that it gives the researcher more control over compliance than event-based recording and is more

objective than retrospective reporting. A study (Rattel et al., 2019) comparing assessment methods after an analogue trauma film found that there were no differences in frequency and distress of intrusive memories or compliance between the different assessment methods.

5.4.7.5 Measures.

The current study could have benefited from additional measures. For example, including a measure on attention may have helped to understand whether or not SDT and CIT were associated with a change in focus of attention from the intrusive memory to non-threatening material.

Of the current measures used, some showed unsatisfactory internal consistency which may have influenced their validity. The PANAS PA scale showed low internal consistency and slightly improved Cronbach's alpha when the first item ('interested') was removed. However, in the current study, the full scale was used since removing the one item did not change outcomes and the full scale allows for comparison with other studies using the PANAS.

5.4.8 Conclusion

In conclusion, this study showed that stimulus discrimination could be taught to a group of student paramedics by use of an online module and that students who were trained in stimulus discrimination applied it more than students who were taught the alternative technique. The study failed to support the hypothesis that training in stimulus discrimination by way of an online module leads to a greater reduction in intrusive memories and maladaptive responses to intrusions compared to a counting intrusions intervention. Further research is needed to assess whether both interventions reduced intrusive memories compared to no intervention. In a group regularly exposed

to trauma, such as student paramedics, a technique to reduce intrusive memories and potentially protect against the development of PTSD, is much needed.

6 Chapter 6: Discussion

This thesis aimed to address risk for poor mental health in student paramedics. First, by investigating a psychological tool to improve general wellbeing and reduce psychological distress in this population. Second, by targeting factors relevant to the development of PTSD with a specific focus on assessing and understanding rumination, a risk factor for PTSD, characterised by abstract thinking, and modifying responses to intrusive memories, a predictor of PTSD.

The current thesis addressed these three areas in four separate studies investigating:

1. Daily planning ahead to improve general wellbeing in student paramedics (Chapter 2)
2. The assessment of abstract thinking and its role in predicting PTSD symptom severity (Chapters 3 and 4)
3. Stimulus discrimination to reduce unwanted memories and maladaptive responses to intrusions after an analogue trauma (Chapter 5)

While awareness of emergency workers as a high risk population is increasing, no previous studies have assessed these factors in a population of student paramedics. The results help to inform the development of interventions that may improve mental health and the prevention of PTSD symptoms in student paramedics. This discussion will briefly summarise the key findings of each study, and then discuss limitations and broader implications.

6.1.1 Summary of Findings and Conclusions

Chapter 2, study 1 (*Daily Planning Ahead to Improve the Mental Health of Student Paramedics: A Randomised Controlled Experiment*) showed that daily planning ahead for two weeks significantly improved wellbeing in a sample of student paramedics compared to reading about stress online and standard practice (i.e., no intervention). Planning ahead also reduced psychological distress. These gains were maintained at 3-week follow-up and students who trained in planning ahead also demonstrated improvements in mindfulness. Overall, the results suggest that planning ahead is likely to be more effective as a means for improving psychological outcomes in student paramedics than accessing psychoeducation about stress. Participation in the daily exercise reduced during the follow-up period when participants did not receive reminders, suggesting that regular reminders to practice the technique or a longer training period are needed to make planning ahead a daily habit (Lally et al., 2010). Chapter 2 extended findings by Holland (2017) who tested a similar intervention in a general student population and found that planning ahead reduced psychological distress. The findings of improved wellbeing and reduced psychological distress are in line with the broader literature on planning and time management (Häfner & Stock, 2010; Jex & Elacqua, 1999; Macan et al., 1990). The effects of planning ahead on factors of wellbeing have never been tested in a group of student paramedics, suggesting that these findings are novel. Planning ahead may be a useful tool to include in programmes to improve wellbeing in this population. However, it should be noted that whilst planning ahead led to significant improvements in psychological outcomes compared to reading about mental health and waitlist by post-intervention, by follow-up group differences only remained between planning ahead and waitlist. Inspection of the means suggested that participants who had learned to plan head sustained their gains

and participants who read about mental health improved slightly between post-intervention and follow-up, accounting for the non-significant group differences in wellbeing at this timepoint. For psychological distress, inspection of the group means suggested that participants who had planned ahead and those who had read about mental health experienced small decreases in psychological distress, leading to reductions in their group differences by follow-up.

Chapter 3, Study 2 (*Development and Validation of a Measure of Concrete and Abstract thinking (CAT) for Student Paramedics*) described the development and validation of a new measure of concrete and abstract thinking (CAT). The construct of abstract thinking underlying rumination and worry (or the umbrella concept of repetitive negative thinking) has received attention in experimental studies (see review in Watkins, 2008) and in applied clinical research (Stöber & Borkovec, 2002; Watkins, 2009; Watkins & Moberly, 2009; Watkins & Moulds, 2007). However, only a few measures, with limitations, are available to assess this construct. The novel CAT questionnaire addresses these limitations and provides the first measure of abstract thinking for student paramedics. The CAT showed good validity and reliability and a 'best version CAT' with good factorial validity was established and is recommended for future use. Convergent validity showed that abstract thinking measured by the CAT, among others, correlated with repetitive negative thinking, rumination, worry and PTSD symptoms. These relationships are consistent with previous studies (Ehring, Szeimies, et al., 2009; Stöber & Borkovec, 2002; Watkins & Moulds, 2007). However, the CAT did not correlate with an existing measure of abstract thinking, which could indicate that the CAT measures a concept other than abstract thinking or, more likely, given the

scoring issues with the Problem Elaboration Questionnaire, that the measures used different definitions and scoring of abstract thinking, making them difficult to compare.

Chapter 4, Study 3 (*Abstract Thinking and Rumination as Predictors of PTSD*) built on chapter 3 and showed that abstract thinking measured by the CAT questionnaire significantly adds to the prediction of PTSD symptom severity at 6-week follow-up, above and beyond established measures of rumination. These findings were in line with two previous studies which showed that the assessment of abstract thinking as a feature of rumination explained greater variance in PTSD symptoms than rumination alone (Ehring, Frank, et al., 2008; Michael et al., 2007). Abstract thinking also correlated with PTSD symptom severity at 6-months but did not significantly add to the prediction in a model, which included established measures of rumination. A minority of participants at each timepoint had not experienced a traumatic event and hence, their symptoms on the PCL-5 are not indicative of PTSD symptoms. This study is the first to apply the newly developed CAT questionnaire in the prediction of PTSD symptoms. The findings may add to our understanding of abstract thinking and rumination in the prediction of PTSD symptom severity and is the first to look at abstract thinking in student paramedics.

Chapter 5, study 4 (*Can we Reduce Analogue Trauma Memories in Student Paramedics by Teaching Stimulus Discrimination Pre Trauma-Film?)* compared stimulus discrimination training (SDT, adapted from CBT treatment) to alternative training called counting intrusions training (CIT). The study was the first to test stimulus discrimination training in a sample of student paramedics and showed that stimulus discrimination could be taught in this population. However, the results demonstrated that stimulus discrimination training was similar to training in counting

intrusions in terms of reducing unwanted memories linked to analogue trauma. These findings are contrary to the broader literature on stimulus discrimination (Brewin et al., 2010; Ehlers et al., 2004; Kennedy-Williams et al., 2019). Possible explanations were proposed for why the CIT may have reduced intrusive memories such as that it likely led students to disengage from unwanted memories. Also, students trained in CIT appeared to use stimulus discrimination either because CIT led students to notice differences between the present and the past trauma film (a core feature of stimulus discrimination training), or because students trained in stimulus discrimination shared their training. Further research is needed to assess both interventions to determine how they may work. Without a no-intervention training group, the findings should be treated with caution since it is unclear whether the interventions reduced intrusions over and above students' own strategies for dealing with intrusions.

6.1.2 Overall Limitations and Suggestions for Future Research

Improving wellbeing and reducing risk factors for developing PTSD amongst student paramedics were approached as separate pathways in this thesis. All studies included some measure of repetitive negative thinking (rumination or worry). Chapter 2 hypothesised that planning ahead may improve wellbeing and reduce psychological distress by reducing worry, a feature of repetitive negative thinking. However, chapter 2 failed to establish this connection. This is contrary to studies that have demonstrated a link between time management and worry (Kelly, 2003; Van Eerde, 2003). Chapter 2 did not include or measure risk factors or predictors of PTSD. Future research investigating tools to improve wellbeing could combine planning ahead with concreteness training to measure the effect on rumination.

The current thesis only included non-clinical populations and participants were carefully screened for PTSD and depression at onset and excluded if symptoms affected their functioning. Consequently, PTSD symptom severity across studies was low. For ethical reasons, the only PTSD-related intervention study in this thesis (Chapter 5) used analogue trauma. The studies that did measure PTSD measured severity rather than caseness (Chapters 3 to 5). Therefore no claims can be made about how the results may apply to clinical populations or to the prevention of a PTSD diagnosis. Even though PTSD symptoms were measured in all studies and, in chapter 4, included in the prediction, not all participants had been exposed to a traumatic event but merely to their 'worst' events, so results should be considered with care. Future research investigating similar factors could assess PTSD with structured interview schedules to ascertain diagnoses over a much longer follow-up period (i.e., greater than 6 months). A longer follow-up period increases the likelihood of regular exposure to trauma and the likelihood of developing PTSD.

Not all intervention studies adhered to the golden standard of method design. While chapter 2 used a randomised controlled design, chapter 5 included an alternative control but failed to include a no-intervention control (as the design was based on a previous study). A replication of study 5 is recommended, with the inclusion of a no-intervention control group as well as a measure of focus of attention, which may help to explain how the two interventions (stimulus discrimination and counting intrusions) led to their effects on intrusive memories. All studies in the current thesis used self-report measures which have multiple limitations. For example, answers may be influenced by how participants want to be viewed or by what they think they 'should' answer. If measures ask about past events participants may simply forget details or not be aware of them. Self-assessments could be improved on in future studies by also including

clinician or researcher administered structured interviews. Whilst social desirability may also come into play during interview assessments, probing by an interviewer and comparisons with self-report data could reduce risk of bias linked to social desirability. It would also be worth including objective measures such as monitoring stress through heartrate or cortisol levels.

6.1.3 Theoretical Implications

The findings hold theoretical implications for models of PTSD, specifically for the cognitive model of PTSD (Ehlers & Clark, 2000). The model suggests that PTSD is maintained by a sense of current threat. This current threat stems from the nature of the trauma memory, negative appraisals of the trauma or its sequelae and dysfunctional coping strategies. The model notes rumination as one of the dysfunctional coping strategies which predict and maintain PTSD. The results from chapter 4 are in line with this model, showing that rumination, and especially rumination in response to intrusive memories, predict PTSD symptom severity. Chapter 3 supports this relationship to a weaker extent, showing that abstract thinking linked to rumination significantly correlates with PTSD symptoms. The thesis thereby contributes to the existing empirical evidence that supports the role of rumination in predicting PTSD as described in the cognitive model (Beierl et al., 2019; Ehring, Frank, et al., 2008; Kleim et al., 2012; Lancaster et al., 2011).

The cognitive model of PTSD (Ehlers & Clark, 2000) guides therapy goals for treatment. One goal is to reduce the sense of current threat associated with the trauma memory, which is heightened by triggers that bring to mind unwanted memories. Stimulus discrimination aims to reduce the sense of current threat by guiding patients to identify patterns that trigger intrusive memories, such as visual patterns, colours,

shapes, sounds, smells, tastes, or touch, and then to learn to discriminate them from the corresponding stimulus encountered during the trauma, by focusing their attention on the differences between the trigger in its current safe context and the original similar stimulus in the context of the trauma (Ehlers et al., 2005a). The findings from chapter 5 suggest that disengaging from intrusive trauma memories when they occur may be effective in reducing their frequency and associated distress, which may also reduce the sense of threat associated with the analogue trauma memory. However, more research is needed to first replicate this finding and then to determine the mechanism through which techniques, such as counting intrusive memories, may work to reduce the frequency of intrusive memories and their associated distress.

6.1.4 Broader Contributions and Implications

The findings of this thesis offer advances in our understanding of methods to improve wellbeing in student paramedics as well as a better understanding of the role of abstract thinking linked to rumination and tools to reduce intrusive memories in this population. The results provide initial implications for further research on PTSD prevention and mental health programmes for student paramedics. It seems that both a general approach to improving wellbeing and a more specific approach to targeting risk factors and predictors of PTSD could be worth exploring.

Research on the role of abstract thinking in PTSD-related rumination is still in its infancy. Results from chapters 3 and 4 contribute to our knowledge basis. This thesis adds a potentially valid new measure of abstract thinking for student paramedics. Its construct validity showed a close relationship between abstract thinking and rumination and a slightly weaker but nevertheless significant relationship between abstract thinking and PTSD symptoms. However, it did not show a relationship with an existing measure

of abstract thinking and the overall CAT failed to provide sufficient factorial validity. The recommended 'Best Version CAT' has not yet been tested as a stand-alone measure in an independent sample. More research is needed before the new 'Best Version CAT' measure can be recommended for use in student paramedics. The current thesis also contributes to our understanding of abstract thinking as a potential risk factor for PTSD symptom severity. Chapter 4 showed that abstract thinking and rumination together predict more variance in PTSD symptom severity at 6-week follow-up than rumination alone. Furthermore, chapter 4 demonstrated a weak but significant relationship between abstract thinking and PTSD symptom severity at 6-month follow-up. More research is needed to better understand the role of abstract thinking in the development of PTSD symptoms over time (i.e., longer follow-up) in student paramedics. The follow-up period of 6 months is relatively short and unlikely to have offered sufficient time for DSM-5 criterion A trauma exposure.

While the current thesis focused on student paramedics, some of the findings may generalise to other at risk populations such as qualified paramedics, fire fighters and police officers who also experience poor mental health, including PTSD (Bennett et al., 2004; Carlier et al., 1997; Heinrichs et al., 2005; Mind, 2014). Planning ahead could be a simple tool to improve wellbeing easily accessed by other high-stress groups should it prove to be effective in these populations after evaluation. More research is needed on training in stimulus discrimination and counting intrusions before recommendations about their further use can be made. The CAT questionnaire may be helpful with other emergency populations in student training once its limitations have been considered and the 'Best Version CAT' has been re-validated. The benefit of working with populations during their training is that it gives an opportunity for primary

prevention before repeated exposure to traumatic events. Individuals may learn psychological coping tools as part of healthy work habits.

The long-term aim of the current research direction is to supply student paramedics and emergency workers more broadly with a psychological tool kit so they feel equipped to deal with traumatic events and their consequences. This could prevent the occurrence of more severe mental health problems such as PTSD.

6.1.5 Future Direction: A PTSD Prevention Programme for Student Paramedics

Reflecting on the learning from this thesis, lessons can be drawn that may be relevant for a future programme of research for prevention of PTSD in student paramedics. The following section will elaborate on how experiences and findings from this thesis as well as existing literature can be built upon and where future research could go.

6.1.5.1 Theoretical basis.

The current thesis bases its understanding of PTSD on the Ehlers and Clark (2000) model of persistent PTSD. The model suggests that PTSD is maintained by a sense of current threat. The nature of the trauma memory, negative appraisals of the trauma and/or its sequelae and strategies intended to control symptoms or the sense of current threat (such as rumination, suppression and avoidance), feed into the sense of current threat. This sense of current threat is further maintained by re-experiencing symptoms such as intrusive memories, as well as by arousal symptoms and strong emotions. Multiple studies have shown that the cognitive factors of persistent PTSD proposed in the model also predict PTSD (Dunmore et al., 2001; Ehlers et al., 1998; Ehring, Ehlers, et al., 2008; Halligan et al., 2003; Michael et al., 2005; Murray et al., 2002). As elaborated in chapter 1 (section 1.4.1), many PTSD prevention programmes

to date have failed, possibly because they have not addressed evidence-based risk factors and predictors. It is therefore recommended that a prevention programme focusses on established, malleable risk factors (section 1.5.2) and predictors (section 1.5.3).

6.1.5.2 Aim.

The section will first focus on the methodology of running preventative studies in the high-risk population of student paramedics. Next, it will focus on the content of such a prevention programme, combining learnings from the current thesis and the wider literature.

6.1.5.3 Method.

The current thesis has taught me a great deal about carrying out research of student paramedics. Learning points described below are relevant to future research of this population.

6.1.5.3.1 Recruitment.

The thesis demonstrated that recruitment of student paramedics was possible and relatively straightforward. The user advisory group in chapter 5 revealed that student paramedics would be more likely to participate in a study if it was supported and advertised by their university lecturers and if participants received remuneration.

6.1.5.3.2 Retention.

Student paramedics are extremely busy, combining undergraduate coursework with paramedic placements including night shifts. This may influence their participation in a research study. This could be seen in chapter 4 where the dropouts were older than the non-dropouts, and in chapter 5, where the dropouts were more frequently in their third year of their training which is the most intensive. Most dropouts in chapter 5 stated being “too busy” as reason for dropping out. It is therefore important that future

research considers this threat to retention. From the current studies it appears that three things help to increase retention in research studies involving student paramedics: reminders, online participation and remuneration.

That reminders appeared to be helpful could be seen in chapter 2. When participants received regular reminders, their adherence to the exercises was high (70-78% of the time), however when these reminders stopped, participants continued with the exercise only 46-50% of the time. Anecdotal evidence supports this with student paramedics stating that more reminders would have helped them. Daily reminders to complete the intrusion diary in chapter 5 led to no missing data of the daily diary across a sample of N=87 participants.

It is likely that online participation in research studies is easier for student paramedics than in-person participation. This is based on the success of recruitment for online-only studies (chapters 2, 3, & 4) compared to the then vs now chapter 5 study which required an in-person session. Of course the content of the study (watching a violent movie) could have also explained the difference in recruiting. Participants completed questionnaires and modules at night and from varying devices (phone, laptop, iPad, computer). Running studies online also allowed the studies to be more accessible and not restricted, for example, by the researcher's geography. Consequently student paramedics across the UK, including Scotland and northern England, participated in the current studies. The usual disadvantages of online studies (access to a computer, ability to use computers, good reading skills) did not apply to the current sample since participants were already enrolled in an undergraduate university degree programme, which required computer and reading skills.

Anecdotal feedback from the different studies showed that financial remuneration was a strong motivator for many participants to continue in the study,

especially for students who have little or no income, this appeared to be an important factor.

6.1.5.3.3 Design.

A randomised controlled design is recommended as a gold standard for research. Methodologically, a major learning point that came out of this dissertation is the importance of a non-intervention control group when running randomised controlled studies. This became evident in the results from the study on stimulus discrimination in chapter 5 where no differences were found between the intervention and control group and a non-intervention group was missing.

In order to assess the preventative value of an intervention, follow-up measures should cover a sufficient period of time. The current thesis was limited by its short follow-up periods. The regression analysis (chapter 4) showed that by 6-month follow-up, a significant proportion of the sample (N=142, 34.1%) had not experienced a traumatic event, meaning their symptom scores on the PCL-5 were not indicative of PTSD symptoms. Other prevention programmes, include longer follow-up (i.e., 12-month and 18-month follow-ups) (e.g. Greenberg et al., 2010; Skeffington et al., 2016).

In terms of measures, the PCL-5 showed good validity and reliability in previous studies (Blevins et al., 2015) and good internal consistency in all four studies of this thesis (chapters 2-5). It appears to be a useful outcome measure for a PTSD prevention study. Attention needs to be given to an accurate and reliable trauma screener, based on the limitations found in chapter 4, and time frames for the traumatic event should be clearly communicated. Further research is needed to determine which resilience measure is best suited for this populations. Chapter 3 showed that both resilience measures, The Resilience Scale (Wagnild & Young, 1993) and the Connor-

Davidson Resilience Scale (CD-RISC; Connor & Davidson, 2003) correlated similarly with abstract thinking, rumination and PTSD.

6.1.5.4 Intervention.

The recommendations below for developing an intervention to prevent PTSD are based on the risk factors and predictors described in Chapter 1 (section 1.5.2 and 1.5.3) and are consistent with the Ehlers and Clark (2000) model. In order to address these factors, prevention programmes could draw from evidence-based interventions that have been successful in PTSD treatment. For example, tools could be drawn from cognitive therapy for PTSD (CT-PTSD; Ehlers et al., 2005a; Ehlers & Clark, 2008) which is based on the Ehlers and Clark model and has been supported by empirical evidence in clinical trials (Brewin et al., 2008; Duffy et al., 2007; Ehlers et al., 2003, 2010, 2014; Gillespie et al., 2002; Kleim et al., 2013; P. Smith et al., 2007).

Future research should first systematically test the individual interventions that may modify specific risk factors or symptoms of PTSD. In a next step, the tools that have demonstrated success in modifying risk factors could be pulled together as part of a prevention intervention and evaluated in a randomised controlled trial.

The next sections will consider addressing of the following risk factors and predictors of PTSD: rumination, intrusive memories, suppression, the nature of the trauma memory, negative appraisals and avoidance. Finally, techniques to increase general wellbeing in student paramedics will be considered.

6.1.5.4.1 Rumination and abstract thinking.

In Ehlers and Clarks model, rumination is noted as one of the possible maladaptive cognitive strategies intended to control symptoms or the sense of current threat. As elaborated in chapter 1 (section 1.6. and 1.8), rumination has been established as an important risk factor and predictor of PTSD (Clohessy & Ehlers, 1999; Ehlers et

al., 1998; Ehring, Ehlers, et al., 2008; Kleim et al., 2007; Murray et al., 2002; Razik et al., 2013; Wild et al., 2016). It therefore appears important to address ruminative thinking in a PTSD prevention programme. The current thesis did not test an intervention to decrease rumination. Instead, it assessed abstract thinking which characterises rumination. One prospective study of assault survivors found that abstract thinking was one of the characteristics of rumination that explained more variance in PTSD predication than the presence of rumination alone. The current thesis (chapter 3) developed a measure of abstract thinking which showed good validity and reliability despite some limitations. Further, chapter 4 showed that abstract thinking appears to add some predictive value to established measures of rumination, however findings should be considered with care due to short follow-up during which a significant proportion of the sample did not experience a traumatic event or PTSD symptoms. Overall, the findings appear to support the predictive value of rumination and, in particular, rumination in response to intrusive memories, for PTSD. More research is needed before concrete thinking to address abstract thinking/rumination can be recommended for inclusion in a PTSD prevention programme. In depression research, on the other hand, a study by Cook and colleagues (2019) reduced the risk of depression by 34% through internet-based rumination-focused CBT (which included concreteness training). Even if the technique remains uncertain, it will be important to address rumination in a future PTSD prevention programme. It is possible that for PTSD, it is the content and the cognitive themes of rumination that cause symptoms to persist perhaps more so than the abstract nature of ruminative thoughts. More research is needed to investigate how rumination contributes to and maintains PTSD.

6.1.5.4.2 Intrusive memories.

Intrusive memories are a common symptom of PTSD and maintain a sense of current threat (Ehlers & Clark, 2000). Multiple studies have shown that maladaptive responses to intrusive memories, such as negative interpretations of intrusions, predict PTSD (Ehlers et al., 1998; Freeman et al., 2013; Kleim et al., 2012). The qualities of intrusive memories, such as a strong sense of 'nowness' (the memory happening in the here and now) or distress associated with the intrusive memory also predict PTSD (Mayou et al., 1993; Steil & Ehlers, 2000). Ehlers and Clark recommend stimulus discrimination, a cognitive therapy for PTSD (CT-PTSD; Ehlers et al., 2005a; Ehlers & Clark, 2008) technique to help individuals discriminate between the trigger in the present and the past trauma, thereby reducing the threat associated with unwanted memories. Kennedy-Williams and colleagues (Kennedy-Williams et al., 2019) found that this technique could be taught to individuals prior to their exposure to analogue trauma and that it led to fewer unwanted memories afterwards in comparison to individuals who were taught to suppress or to count their memories. However, the current thesis failed to support these findings. More research is needed before stimulus discrimination can be recommended for inclusion in a PTSD prevention programme. However, responses to intrusive memories remain an important risk factor that should be addressed in such a programme.

6.1.5.4.3 Suppression.

The Ehlers and Clark model describes suppression as one of the dysfunctional coping skills intended to control symptoms or the sense of current threat. Multiple studies have found that attempts to suppress intrusive memories are associated with subsequent PTSD severity (Clohessy & Ehlers, 1999; Duffy et al., 2013; Ehring, Ehlers, et al., 2008). An analogue study by Kennedy-Williams (Kennedy-Williams et al., 2019),

mentioned above, found that suppression led to a greater frequency of intrusive memories compared to stimulus discrimination and a control intervention. Education about the unhelpful nature of suppression may be an important component of a future PTSD prevention programme and it is recommended that experiential exercises related to the harmful effects of suppression are included in such a programme over psychoeducation, which alone, has not been shown to reduce the symptoms or incidence of PTSD (Sharpley et al., 2008).

6.1.5.4.4 Updating the trauma memory.

The nature of the trauma memory plays a role in the development and maintenance of PTSD (Murray et al., 2002). A disjointed trauma memory (disjointed from other autobiographical memories) has been shown to predict PTSD (Kleim & Ehlers, 2008). Ruminating instead of updating unwanted memories has been shown to significantly predict PTSD (Pile et al., 2015; Wild et al., 2016). The Ehlers and Clark (2000) model of PTSD identifies the trauma memory and linked negative appraisals as a target for treatment with the aim to update the memory. 'Updating' involves gathering more information and adding it to the memory which helps elaborate and contextualise the memory, thereby integrating it within the autobiographical memory base. For example, this could include information that the victim of the trauma is no longer suffering or that the individual is safe now and survived. Updating has further shown to reduce intrusive memories (Pile et al., 2015). Teaching participants preventatively a technique to update traumatic memories, may have potential to prevent PTSD.

6.1.5.4.5 Negative appraisals.

Pre-trauma negative appraisals are a risk factor for PTSD. In a study of fire-fighters, general negative self-appraisals, such as 'I am inadequate,' present before trauma were shown to predict as much as 20% of variance in PTSD severity (Bryant &

Guthrie, 2007). Negative appraisals could be characteristic of depression which increases vulnerability to developing PTSD. However, the study controlled for depression symptoms which did not significantly predict PTSD. Negative appraisals of trauma or its sequelae, have further been shown to contribute to the prediction of PTSD (Beierl et al., 2019; Bryant & Guthrie, 2005; Duffy et al., 2013; Dunmore et al., 2001; Ehring, Ehlers, et al., 2008; Freeman et al., 2013; Halligan et al., 2003; Lancaster et al., 2011; O'Donnell et al., 2007). In the Ehlers and Clark model, negative appraisals of the trauma and/or its sequalae is one of the central maintaining factors. It might therefore be useful to include techniques to help individuals challenge negative appraisals about themselves prior to exposure to trauma.

6.1.5.4.6 Avoidance.

Dysfunctional behaviours, such as avoidance and safety-seeking, aimed to control symptoms after trauma have significantly predicted subsequent PTSD symptom severity (Dunmore et al., 2001; Ehring, Ehlers, et al., 2008; Nash et al., 2015; Razik et al., 2013). The Ehlers and Clark model describes techniques intended to control symptoms or the sense of current threat as one of the maintaining factors of PTSD. It may be helpful to teach participants the paradoxical effects of safety-seeking, such as the effect that checking behaviours have on anxiety, and this could be included in a prevention programme. However, pre-trauma prospective studies have not found that such behaviours have predicted post-trauma PTSD. The existing literature base supports a relationship between such behaviours in after trauma and subsequent PTSD severity. There would be rationale for possible inclusion of experiential techniques, such as behavioural experiments that guide participants to experiment with increasing and decreasing their checking to see the effect on anxiety, in post-incident prevention programmes.

6.1.5.4.7 Planning ahead to increase wellbeing

The current thesis addressed risk for poor mental health in student paramedics, with PTSD as a central focus. It thereby took a two-pronged approach: addressing risk factors of PTSD and increasing general wellbeing in this population. As part of the PTSD treatment based on the Ehlers and Clark model, 'reclaiming life' activities are included in treatment where individuals are encouraged to engage in enjoyable activities or social contacts which they may have given up. Similarly, simple interventions to increase wellbeing may be beneficial in improving the mental health of student paramedics. Daily planning ahead as taught in chapter 2 guided participants to include an enjoyable activity in their daily plan. Results showed that planning ahead increased wellbeing and reduced psychological distress and whilst the findings are preliminary, they are promising. More research is needed to investigate how best to support participants to continue to plan ahead so that long-term benefits may be realised.

6.1.5.5 PTSD prevention programme conclusion.

The above is not an exhaustive list of risk factors that could be addressed, but an initial suggestion for areas that could be addressed in a potential PTSD prevention programme based on Ehlers and Clark's model. Further research will need to investigate the optimal components and content of a potential PTSD prevention programme, the timing of such a programme and also the ideal audience. It is unclear whether or not such a programme should be administered to all student paramedics (i.e, a universal programme) or only to those who hold established risk factors (i.e., a targeted programme) and whether to administer such a programme pre-or post-trauma. These questions need to be answered with empirical evidence in order to develop a cost-effective programme with maximum benefits for student paramedics.

Reflecting on the current thesis provides learning about how one could carry out research to develop a PTSD prevention programme for student paramedics. Specifically, the thesis teaches valuable lessons on working with this population, lessons related to recruitment, study design, retention, intervention content and questionnaire design. The findings from the current thesis are preliminary and should be considered with care due to several limitations, which have been presented and discussed. No recommendations for inclusion of specific PTSD prevention or wellbeing techniques should be based on this thesis. Instead, findings from this thesis may add to the evidence base that may help to create a PTSD prevention programme in the future.

6.1.6 Conclusions

In summary, the current thesis addressed risk for poor mental health in student paramedics by evaluating a tool to improve wellbeing, and more specifically by targeting two predictors of PTSD. Daily planning ahead may be a helpful technique to improve overall wellbeing and, to a lesser degree, to reduce psychological distress in student paramedics. This thesis contributed to the initial assessment and understanding of abstract thinking in the context of PTSD symptom severity in student paramedics, although more research is needed to consolidate and clarify findings. Finally, the thesis aimed to modify intrusive memories linked to analogue trauma although these specific findings were inconclusive. It is hoped that this thesis will contribute to our understanding of factors that may influence the wellbeing and mental health of student paramedics and add to research that may, in the future, be used to develop prevention programmes for this population and emergency workers more broadly.

7 References

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8 Appendices

8.1.1 Appendix 1: Planning Ahead Exercise Instruction Sheet

The Planning Ahead Exercise

- Each night before you go to bed, plan what you will do tomorrow
- Write it down to have a physical record
- Be sure to include at least one thing you'll enjoy as well as what you have to do
- From the second day onwards, briefly review the day that has just passed before planning
- for tomorrow.
- Be kind to yourself in the review: credit, not criticism

We know your time is limited, so please do not spend more than 10 minutes on the task each night.

Here are some tips that may help you plan your next day:

Tip 1: Block off time you have no control over
When you look at your next day, start with the time chunks that are out of your control and write them down first, such as "class", "out on placement" or "lunch," to get an overview of how much time you have left. Then plan everything else you need to do around them.

Tip 2: Say when and where
The more specific you are about when and where you are going to do things the next day, the more likely it is that you will stick to your plan. For example, instead of saying "email supervisor" say "email supervisor tomorrow at 9am."

Tip 3: Break down big tasks.
Few things feel as paralyzing as huge tasks like "study for finals" or "clean up my room." Therefore, break big projects into smaller, manageable pieces such as "read chapter 16" or "clear out top shelf."

Tip 4: Use "time boxing" for large projects
For large tasks that may stretch over a few days and are not as easily split into smaller parts, use "time boxing." Cut out a specific part of time to do just one thing e.g. "45 minutes work on my dissertation." This makes the task less scary and not too overwhelming in your day plan because it has an end point.

Tip 5: Be realistic
The day plan is just for yourself and no one will judge it. So, try to be as realistic as possible. You don't have to fit everything into one day.
Tip 6: Don't forget your enjoyable activity
Don't forget to include one enjoyable activity each day. Even if it is a busy day, you can take just 10 minutes to do something fun and have something to look forward to, such as reading a magazine, taking a short walk, watching a funny video or meeting a friend for coffee.

8.1.2 Appendix 2: Table 3b Means and Standard Deviations Pre-imputations

Table 3b

Means and standard deviations of outcome measures at pre-intervention, post-intervention, and 3-week follow-up by intervention group (N=76)

	Planning Ahead (n=27)			Reading (n=23)			Waitlist (n=26)		
	Pre	Post	Follow-up	Pre	Post	Follow-up	Pre	Post	Follow-up
Measure	Mean *(SD)*	Mean *(SD)*	Mean *(SD)*	Mean *(SD)*	Mean *(SD)*	Mean *(SD)*	Mean *(SD)*	Mean *(SD)*	Mean *(SD)*
WEMWBS	46.70 *(8.71)*	51.56 *(9.93)*	51.00 *(9.45)*	48.65 *(7.85)*	49.09 *(8.56)*	50.13 *(10.92)*	50.00 *(5.75)*	47.08 *(6.81)*	47.15 *(9.23)*
GHQ	25.37 *(5.32)*	21.33 *(5.16)*	21.59 *(5.64)*	24.87 *(5.61)*	23.57 *(4.32)*	24.04 *(3.80)*	23.23 *(4.90)*	24.58 *(3.47)*	24.46 *(5.67)*
MAAS	52.30 *(11.61)*	56.19 *(12.76)*	59.19 *(12.99)*	54.17 *(12.48)*	54.22 *(13.10)*	56.30 *(13.21)*	58.73 (*12.70)*	58.77 *(12.77)*	56.38 (*13.73)*
PSWQ	45.33 *(9.36)*	44.63 *(10.07)*	43.70 *(8.97)*	45.61 *(7.99)*	46.87 *(7.63)*	43.65 *(10.12)*	44.08 *(7.38)*	45.65 *(7.76)*	45.38 *(7.96)*

Note. Missing data were replaced with imputed values using pmm.

8.1.3 Appendix 3: Concrete Abstract Thinking Questionnaire (CAT)

CAT Version 1
For the following scenarios, please **imagine they were happening to you.** Please tick the likely thoughts you would have:

Scenario 1:
You see a friend on the street and say hi but they pretend they don't see you, even though you know they did.

	Scoring:
1. Why did they ignore me?	(abstract)
2. What will I do next time I see them?	(concrete)
3. Why does this always happen to me?	(abstract)
4. What if they are annoyed with me?	(abstract)
5. What's the best way to bring this up, if at all?	(concrete)
6. Did they not see me?	(concrete)
7. What does this mean about me?	(abstract)
8. How can I check they are ok?	(concrete)

Scenario 2:
You have an important essay to hand in tomorrow. You haven't started it yet.

1. Why did I leave it so late?	(abstract)
2. Why do I always do this?	(abstract)
3. How much can I realistically get done before the deadline?	(concrete)
4. What's the first step I can take now to get started?	(concrete)
5. Why are other people more organised than me?	(abstract)
6. What if I don't finish it on time?	(abstract)
7. How can I make sure this doesn't happen again?	(concrete)
8. What if I fail this module?	(abstract)
9. How do I best use the time I have left?	(concrete)
10. How can I learn from the people who are more organised?	(concrete)

Scenario 3:
You have recently learned to cannulate. Now you have to do it while your supervisor is watching.

1. How do I manage my nerves? (concrete)
2. What if I mess up? (abstract)
3. What are the steps they taught us? (concrete)
4. Why is it so hard for me to cannulate? (abstract)
5. What if I miss the vein? (abstract)
6. What's the best way to start if I can't find a vein? (concrete)
7. Why is it so easy for others? (abstract)
8. How can I get help if this doesn't go well? (concrete)

Scenario 4:
You are the first to arrive on the scene of an accident. A young man is lying on the ground. You try to resuscitate him.

1. What if I can't help him? (abstract)
2. What's the first thing I need to do? (concrete)
3. What if I forget the procedure? (abstract)
4. What if my supervisor thinks I'm doing a bad job? (abstract)
5. How can I help him? (concrete)
6. What have I learned that I can apply in this situation? (concrete)
7. What if I'm never competent with this procedure? (abstract)
8. How can I get help if this doesn't go well? (concrete)

CAT Version 2

Scenario 1: You have an assignment due tomorrow and your friend is celebrating their birthday tonight.

1. Why are they celebrating tonight and not on the weekend? (abstract)
2. How best can I plan my time this evening? (concrete)
3. What if I do less well because I go out tonight instead of working? (abstract)
4. What is the first step I can take to finish my assignment? (concrete)
5. What steps do I need to take to finish my assignment and be able to go out? (concrete)
6. What if I can't finish my assignment on time? (abstract)
7. What if I don't go out tonight and I carry on working? (abstract)
8. What could I do with my friend instead of going out tonight? (concrete)

Scenario 2: You receive an email from your supervisor saying that they want to meet with you.

1. Why do they want to see me? (abstract)
2. How shall I reply to their email? (concrete)
3. What have I done that we might need to chat about? (concrete)
4. What if I've done something wrong? (abstract)
5. How best shall I prepare for the meeting? (concrete)
6. Why didn't they mention in the email what it was about? (abstract)
7. What were the reasons we've met in the past? (concrete)
8. What if they're concerned about my work? (abstract)

Scenario 3: You see a patient and recognize symptoms that you learned about in class but can't remember what you have to do next.

1. Who can I ask for help? (concrete)
2. What if I mess up completely? (abstract)
3. What do know about these symptoms? (concrete)
4. Why do I struggle to remember the important stuff? (abstract)
5. What if I never learn it properly? (abstract)
6. What can I do to make the patient feel comfortable? (concrete)
7. Does this mean I'm not cut out to be a paramedic? (abstract)
8. What have I learned that I can apply in this situation? (concrete)

Scenario 4: You are helping a patient and a family member is standing next to you saying that you are not working fast enough.

1. Why are they saying this to me? (abstract)
2. What are the steps I learned for this situation? (concrete)
3. What if I'm really not fast enough? (abstract)
4. What if it all goes wrong? (abstract)
5. What does the patient need right now? (concrete)
6. Who can I ask for help if I really can't do it? (concrete)
7. What if my supervisor hears this? (abstract)
8. What can I politely say to the family member? (concrete)

CAT Version 3

Scenario 1: You received a bad mark for an essay.

1. What if I fail this course? (abstract)
2. How can I use the overall feedback to improve? (concrete)
3. What is wrong with me? (abstract)
4. Why can't I do anything right? (abstract)
5. What resources could help me? (concrete)
6. Who can I ask for help? (concrete)
7. What if my tutors think I'm not good enough? (abstract)
8. How can I better prepare next time? (concrete)

Scenario 2: Your computer crashed with your essay on it and you don't have a back-up.

1. Why me, why now? (abstract)
2. Why didn't I prepare for this? (abstract)
3. What steps can I take to recover it? (concrete)
4. Who or where can I go for help? (concrete)
5. What if I fail this essay? (abstract)
6. If I can't recover my essay, what can I do now to make progress? (concrete)
7. Why didn't I backup? (abstract)
8. What do I still have or remember about my essay? (concrete)

Scenario 3: You're not sure what is wrong with a patient. You convey them to hospital and don't hear what the problem was.

1. What's the best way to check that what I did was clinically correct? (concrete)
2. What if it's the wrong decision? (abstract)
3. How can I prepare myself for not knowing what happens to patients? (concrete)
4. What if they deteriorate? (abstract)
5. What if they'd have been better off at home? (abstract)
6. What would my mentor do in this situation? (concrete)
7. I finished my job, what is my next task? (concrete)
8. What if I'm not cut out for this job? (abstract)

Scenario 4: You attend a cardiac arrest of a young male and you are asked to speak to his children.

1. What if they get really upset? (abstract)
2. What do the children need right now? (concrete)
3. What if I make them feel worse? (abstract)
4. What if I have to tell the children we couldn't help their dad? (abstract)
5. What is the first thing I can do to help? (concrete)
6. What can I do to reassure these children? (concrete)
7. What will happen to the children if their father suffers? (abstract)
8. What can I use in my environment to help comfort the children? (concrete)

CAT Version 4

Scenario 1: You and a more experienced colleague disagree about a clinical decision they've made.

1. Why are they so adamant about their course of action? (abstract)
2. Who can I talk to about this? (concrete)
3. Why wouldn't they take on board my thoughts? (abstract)
4. What can I say to my colleague to resolve the situation? (concrete)
5. How have I successfully resolved similar situations in the past? (concrete)
6. What if they make things difficult for me in the future? (abstract)
7. What if my clinical thinking was wrong here? (abstract)
8. How can I do things differently next time? (concrete)

Scenario 2: You discover that your account balance is much lower than you expected.

1. Why has this happened again? (abstract)
2. How can I make sure this doesn't happen again? (concrete)
3. How can I best plan my budget with what I have left? (concrete)
4. What if I don't have enough money to cover my expenses this month? (abstract)
5. How can I better monitor my spending? (concrete)
6. Why am I so rubbish at budgeting? (abstract)
7. Why does this only seem to happen to me? (abstract)
8. Who can I ask for help? (concrete)

Scenario 3: A patient's condition rapidly declines when you're not expecting it.

1. What does the patient need right now? (concrete)
2. What if I've done something that has made them worse? abstract)
3. What do I know about these symptoms? (concrete)
4. Why is this patient getting worse? (abstract)
5. What if the worst happens and they die? (abstract)
6. What are the steps I learned for a situation such as this? (concrete)
7. What if I missed something? (abstract)
8. What is the first thing I can do? (concrete)

Scenario 4: You're called to an elderly patient with chest pain. It's clear they need to go to hospital and you are keen to take them. But they refuse to go so you must discharge them at their home.

1. Why are some patients so stubborn? (abstract)
2. Who can I talk to about this situation? (concrete)
3. What if they go into cardiac arrest? (abstract)
4. Why wasn't I able to convince them of the seriousness of the situation? (abstract)
5. What can I do to make the patient as safe as possible at home? (concrete)
6. What procedures have I learned that I need to follow in this sort of situation? (concrete)
7. What if something bad happens and their family investigate? (abstract)
8. How can I best prepare myself to deal with not knowing what will happen to them? (concrete)

8.1.4 Appendix 4: 'Best Version CAT'

University scenarios:

Version 3 Scenario 1: You received a bad mark for an essay.

1. What if I fail this course? (abstract)
2. How can I use the overall feedback to improve? (concrete)
3. What is wrong with me? (abstract)
4. Why can't I do anything right? (abstract)
5. What resources could help me? (concrete)
6. Who can I ask for help? (concrete)
7. What if my tutors think I'm not good enough? (abstract)
8. How can I better prepare next time? (concrete)

Version 3 Scenario 2: Your computer crashed with your essay on it and you don't have a back-up.

1. Why me, why now? (abstract)
2. Why didn't I prepare for this? (abstract)
3. What steps can I take to recover it? (concrete)
4. Who or where can I go for help? (concrete)
5. What if I fail this essay? (abstract)
6. If I can't recover my essay, what can I do now to make progress? (concrete)
7. Why didn't I backup? (abstract)
8. What do I still have or remember about my essay? (concrete)

Paramedic Scenarios:

Version 1 Scenario 4: You are the first to arrive on the scene of an accident. A young man is lying on the ground. You try to resuscitate him.

1. What if I can't help him? (abstract)
2. What's the first thing I need to do? (concrete)
3. What if I forget the procedure? (abstract)
4. What if my supervisor thinks I'm doing a bad job? (abstract)
5. How can I help him? (concrete)
6. What have I learned that I can apply in this situation? (concrete)
7. What if I'm never competent with this procedure? (abstract)
8. How can I get help if this doesn't go well? (concrete)

Version 2 Scenario 3: You see a patient and recognize symptoms that you learned about in class but can't remember what you have to do next.

1. Who can I ask for help? (concrete)
2. What if I mess up completely? (abstract)
3. What do know about these symptoms? (concrete)
4. Why do I struggle to remember the important stuff? (abstract)
5. What if I never learn it properly? (abstract)
6. What can I do to make the patient feel comfortable? (concrete)
7. Does this mean I'm not cut out to be a paramedic? (abstract)
8. What have I learned that I can apply in this situation? (concrete)

8.1.5 Appendix 5: Trauma Screener

(6-month example)

Please indicate whether you have experienced any of the following stressful experiences by checking the boxes below. Please consider THE LAST 6 MONTHS (since you've signed up to the resilience study) as you go through the list of events.

Yes/No

1. Serious traffic accident (e.g., car, bike, train, or boating accident)
2. Serious other accident, fire, or explosion (e.g. accident at work, fire at home)
3. Natural disaster (e.g. tornado, hurricane, flood, or major earthquake
4. Non-sexual assaults (e.g., being mugged, physically attacked, shot, stabbed, or held at gunpoint)
5. Sexual assault (e.g., rape or attempted rape)
6. Cot death
7. Witnessing or coming across a suicide
8. Childhood sexual abuse
9. Childhood physical abuse
10. Childhood neglect or childhood emotional abuse
11. Threatened or harassed by someone without a weapon
12. Threatened or harassed by someone with a weapon
13. Accidently causing or failing to prevent the death of another person
14. Serious risk of contamination by another person
15. Terrorist attack (e.g., a bombing)
16. Imprisonment (e.g., prisoner of war, hostage)
17. Life-threatening illness
18. Witnessing others die / being seriously hurt
19. Sudden, traumatic death of significant other
20. Life-threatening illness of significant other
21. Suffered a great shock because one of the events on the list happened to someone close to you
22. Other traumatic event, please specify _____

8.1.6 Appendix 6: Intrusive Memory Diary

Intrusive Memory Diary

Your ID number: _____

Today's date (dd/mm/yyyy) _____

Have you had any intrusive memories **since your last diary entry?** (yes/no)

If yes:
How many intrusions have you had **since your last diary entry?**
(please enter exact numbers only e.g. 3) _____

Time of intrusion e.g. 14:35 _____

How long did the intrusive memory stay in your mind? (in minutes and seconds)
_____ (minutes)
_____ (seconds)

How distressing was the memory?
1 = Not at all
2 = A little bit
3 = Moderately
4 = Quite a bit
5 = Extremely

To what extent did it seem to be happening **now** instead of being something from the past?
1 = Not at all
2 = A little bit
3 = Moderately
4 = Quite a bit
5 = Very strongly

8.1.7 Appendix 7: Scripts for In-Person Session

In-person session for the Stimulus Discrimination Group (30min)

Intro
Hi X, thanks again for agreeing to take part in our study on dealing with unwanted memories.

First, I'd like to ask you to sign the consent form again. It's the same one you signed online, we'd just like to have a paper copy.

As you may have read online, this study includes a training session today where we'll go over the Then vs Now technique and we'll ask you to watch a distressing film so you can practice the technique with that film today and in the coming week.

Diary
Any time you have an intrusive memory of the film in the next week, please practice Then vs Now for that intrusion, focusing on what is going on NOW and how this is different to THEN, the film. We will also ask you to complete an intrusion diary for the next 7 days: Once a day, we'll ask you to note all the intrusive memories you've had since you last filled in the diary (show printout of the intrusion diary to walk them through it).
I'll send you a daily SMS and email reminder at 7pm every evening.
Do you have any questions about the diary?

After a week, we'll ask you to complete one more short set of questionnaires and then I'll send you your Amazon voucher.

Do you have any questions about the study before we begin?

Then vs Now
First let's take a moment to discuss the technique you learned online for dealing with unwanted memories.
In your own words, what is an intrusive memory? (Clarify if participant doesn't know)
In your own words, how does the technique work? (Clarify if participant doesn't know)

Let's practice together: (show participant two pictures, one of an accident, one of a normal street). *Imagine you went out on placement to this accident* (picture 1). *The next day you're driving down this street* (picture 2) *and a memory the accident pops to mind. What kind of things can you point out that are different Now than they were Then?* (Help if participant doesn't know)

As a reminder, when you experience and intrusive memory of the film you watch today:
1. Remind yourself that the person in the video is no longer suffering. Focus on the fact that these memoires are linked to films and events that happened in the PAST.

2. Then focus on what is happening NOW, starting with the things you can SEE. For example; Where are you? What can you see, here, now? How are these DIFFERENT to the things that happened in the video?

3. The next step is to focus on what you can HEAR, NOW. What can you hear in this room? How is this DIFFERENT to the things the person could hear in the video clip?

4. The final step is to MOVE and DO. I'd like you to stand up with me, and move around the room. Focus on the fact that you have the freedom to move anywhere, and do anything. Focus on how this is DIFFERENT to the people in the film. (Stand and move)

It is important to realise that the memories of the films do not indicate current danger or suffering. They are MEMORIES. Where you are now and what is happening in your life NOW today is different to what happened to the people in the films THEN.

Trauma analogue film

Next, we'll show you a distressing film clip. I'll ask you to complete a short questionnaire before and after the film. There are no right or wrong answers. Try not to think too hard about each question. Your first response is usually the most accurate.

I'd like you to give the film your full attention. Try not to pause the film or look away. I'll step out of the room during the film but I'll be right outside the whole time. Just come to the door and let me know when you've finished.

(Participant completes pre-questionnaire, watches rape film clip, and completes post-questionnaire)

Ending

How did you find the clip?
[I agree it is distressing. Are you okay to continue?]
It's normal to feel distressed after watching something like this. I just want you to know that in our experience, these feelings go away quite quickly. If you still feel distressed or find it too much to handle, you can give me a call or send me message any time over the next week and we can talk through a few strategies to help you feel better.

For the next 7 days, note when intrusive memories of this film come to mind. Remember they can be images, sounds or feelings similar to the ones you experienced during the film.

Please don't speak to your classmates about the film or your technique since they might be in a different group than you. You can always email me if you have any questions.

Thanks again for coming today! I'll send the first diary reminder tomorrow.

In-person session for Counting Intrusions Group (30min)

Hi X, thanks again for agreeing to take part in our study on dealing with unwanted memories.

First, I'd like to ask you to sign the consent form again. It's the same one you signed online, we'd just like to have a paper copy.

As you may have read online, this study includes a training session today where we'll go over the Counting technique and we'll ask you to watch a distressing film so you can practice the technique with that film today and over the coming week.

Diary
Any time you have an intrusive memory of the film in the next week, please practice the Counting technique for that intrusion. We will also ask you to complete an intrusion diary for the next 7 days: Once a day, we'll ask you to note all the intrusive memories you've had since you last filled in the diary (show printout of the intrusion diary to walk them through it).
I'll send you a daily SMS and email reminder at 7pm every evening.
Do you have any questions about the diary?

After a week, we'll ask you to complete one more short set of questionnaires and then I'll send you your Amazon voucher.

Do you have any questions about the study before we begin?

Counting
First we'll take a moment to discuss the technique you learned online for dealing with unwanted memories.
In your own words, what is an intrusive memory? (Clarify if participant doesn't know)
In your own words, how does the technique work? (Clarify if participant doesn't know)

Let's practice together: (show participant two pictures, one of an accident, one of a normal street). *Imagine you went out on placement to this accident* (picture 1). *The next day you're driving down this street* (picture 2) *and a memory of the past event pops to mind. Tell me what kind of things pop to mind and then give each memory a number.* (Help if participant doesn't know)

As a reminder, when you experience an intrusive memory of the film you watch today:

Give it a number and

Then record it later in the evening

For example, if you have an unwanted memory in the morning, you would give it the number one. Your next unwanted memory that day would be given the number two and so on. In the evening, you would note the memories in the intrusive memory diary you will be given as part of this study.

Trauma analogue film

Next, we'll show you a distressing film clip. I'll ask you to complete a short questionnaire before and after the film. There are no right or wrong answers. Try not to think too hard about each question. Your first response is usually the most accurate.

I'd like you to give the film your full attention. Try not to pause the film or look away. I'll step out of the room during the film but I'll be right outside the whole time. Just come to the door and let me know when you've finished.

(Participant completes pre-questionnaire, watches rape film clip, and completes post-questionnaire)

Ending

How did you find the clip?
[I agree it is distressing. Are you okay to continue?]
It's normal to feel distressed after watching something like this. I just want you to know that in our experience, these feelings go away quite quickly. If you still feel distressed or find it too much to handle, you can give me a call or send me message and we can talk through your feelings together.

For the next 7 days, note when intrusive memories of this film come to mind. Remember they can be images, sounds or feelings similar to the ones you experienced during the film.

Please don't speak to your classmates about the film or your technique since they might be in a different group than you. You can always email me if you have any questions.

Thanks again for coming today! I'll send the first diary reminder tomorrow.

8.1.8 Appendix 8: Table 15b Means and Standard Deviations Pre-imputations

Table 15a
Means and standard deviations for the primary and secondary outcome measures (N=87)

	Stimulus Discrimination Training (n=42)		Counting Control Training (n=45)	
Tests	*M*	*(SD)*	*M*	(*SD)*
Frequency of intrusive memories	4.12	4.08	2.87	3.44
Mean distress of intrusive memories	1.67	0.98	1.47	1.15
Mean nowness of intrusive memories	1.22	0.77	1.11	1.01
Mean length of intrusive memories	50.54	61.66	64.92	16.75
RIQ-stimulus discrimination subscale	5.64	3.41	3.73	3.93
RIQ-suppression subscale	7.64	5.43	6.56	5.33
RIQ-rumination subscale	3.33	3.48	2.58	3.28
RIQ-dissociation subscale	2.88	2.05	2.78	2.96

Note: Length of intrusive memories is measures in seconds; RIQ = Responses to Intrusion Questionnaire