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Contribution of cognitive factors to the prediction of post-traumatic stress disorder, phobia and depression after motor vehicle accidents

Thomas Ehring[a,1], Anke Ehlers[a,*], Edward Glucksman[b]

[a]*King's College London, Institute of Psychiatry, Department of Psychology, De Crespigny Park, London SE5 8AF, UK*
[b]*King's College Hospital, Accident and Emergency Department, Denmark Hill, London SE5 9RS, UK*

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Abstract

Past research into the psychological consequences of traumatic events has largely focused on post-traumatic stress disorder (PTSD), although other anxiety disorders and depression are also common in the aftermath of trauma. Little is known about differential predictors of these conditions. The present study investigated the extent to which theoretically derived cognitive variables predict PTSD, phobias and depression after motor vehicle accidents. The cognitive predictors were compared to a set of established, mainly non-cognitive predictors. In addition, we tested how disorder-specific the cognitive predictors are. Participants ($n = 101$) were interviewed within a year after having been injured in a motor vehicle accident. Diagnoses of PTSD, travel phobias and depression, symptom severities and predictor variables were assessed with self-report questionnaires and structured interviews. In multiple regression analyses, the sets of cognitive variables derived from disorder-specific models explained significantly greater proportions of the variance of the symptom severities than the established predictors (PTSD 76% vs. 45%, depression 72% vs. 46% and phobia 66% vs. 40%), and than cognitive variables derived from the models of the other disorders. In addition, the majority of individual cognitive variables showed the expected pattern of differences between diagnostic groups. The results support the hypothesis that disorder-specific sets of cognitive factors contribute to the development and maintenance of PTSD, phobias and depression following traumatic events.

Keywords: Post-traumatic stress disorder; Depression; Specific phobia; Motor vehicle accidents; Cognition; Predictors

Introduction

Predictors of psychological consequences of trauma

Traumatic events such as injury in a motor vehicle accident (MVA) can lead to a range of psychological problems. Past research has largely focused on post-traumatic stress disorder (PTSD) (see Blanchard &

*Corresponding author. Tel.: +44 20 7848 5033; fax: +44 20 7848 0763.
E-mail addresses: thomas.ehring@uni-bielefeld.de (T. Ehring), a.ehlers@iop.kcl.ac.uk (A. Ehlers).
[1]Present address: Department of Psychology, University of Bielefeld, Postfach 100131, D-33501 Bielefeld, Germany.

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Hickling, 2004), but other anxiety disorders, depression and substance use disorders are also common consequences of trauma (e.g. Blanchard et al., 2004; Mayou, Bryant, & Ehlers, 2001; O'Donnell, Creamer, Pattison, & Atkin, 2004). The question of what factors predict which of these psychological problems trauma survivors will develop has rarely been addressed in previous research, and findings have been inconsistent (Mayou et al., 2001; McFarlane, Atchison, & Yehuda, 1997; O'Donnell, Creamer, & Pattison, 2004; Shalev et al., 1998).

Cognitive theories of emotional disorders postulate *content specificity*, i.e. specific sets of cognitions are thought to be involved in the development and maintenance of each disorder (e.g., Beck, 1976; Clark, 1999). In recent years, several cognitive models of PTSD (for a review see Brewin & Holmes, 2003), other anxiety disorders (e.g., Beck, Emery, & Greenberg, 1985; Clark, 1999) and depression (e.g., Beck, 1990; Teasdale, 1988) have been developed. This raises the question of whether cognitive variables specified in these models are useful in predicting differential psychological outcomes after traumatic events.

Most studies of predictors of psychological problems after accidents have focused on pre-accident risk factors, characteristics of the trauma, the emotional response during the trauma, or post-accident stressors (e.g., Blanchard et al., 1995, 1996; ; Schnyder, Moergeli, Klaghofer, & Buddeberg, 2001). In a recent meta-analysis, seven variables were identified as the best-established predictors[2] of PTSD following trauma: prior trauma, prior psychological adjustment, family history of psychopathology, perceived life threat during the trauma, post-trauma social support, peritraumatic emotional responses and peritraumatic dissociation (Ozer, Best, Lipsey, & Weiss, 2003). The meta-analysis included data from very diverse populations of trauma survivors. Studies looking specifically at PTSD following MVA have found similar patterns of results (see Blanchard & Hickling, 2004).

The present study aimed to extend past research into the psychological consequences of MVA by (a) simultaneously focusing on three different disorders with onset after accidents, namely PTSD, travel phobias and depression, as well as (b) investigating the role of cognitive factors derived from theoretical models and comparing their predictive power to that of the established PTSD predictors identified in Ozer et al.'s (2003) meta-analysis. In addition, we tested how disorder-specific these cognitive factors are.

Cognitive-behavioral models of PTSD, phobias, and depression

PTSD

Cognitive factors play a central role in a number of recent theoretical models of PTSD (for reviews see Brewin & Holmes, 2003; Dalgleish, 2004). The present study is built on Ehlers and Clark's model (2000). These authors suggest that PTSD develops if people process the trauma in a way that induces a sense of current threat. The sense of current threat has two sources, negative appraisals of the trauma and/or its consequences and certain characteristics of the trauma memory (poor elaboration and integration, strong priming and associative learning). The characteristics of the trauma memory are thought to lead to easy cue-driven retrieval of aspects of the trauma memory (intrusive memories) that lack the awareness of remembering and thus have a "here and now" quality. The memory characteristics are thought to result from the quality of cognitive processing during the event, in particular, data-driven processing (i.e. predominant processing of the sensory impressions and insufficient processing of the meaning of the situation) and a lack self-referential processing (i.e. linking the event to knowledge of the self), both of which overlap with the concept of dissociation (Halligan, Michael, Clark, & Ehlers, 2003). Finally, a range of cognitive and behavioral strategies (e.g. avoidance of trauma reminders, safety behaviors, rumination, thought suppression and ongoing dissociation) that individuals use to control the threat and symptoms are thought to maintain PTSD. The cognitive factors specified in Ehlers and Clark's model predicted the development and maintenance of PTSD in a series of studies of survivors of MVA (Ehlers, Mayou, & Bryant, 1998, 2003; Mayou et al., 2001; Murray, Ehlers, & Mayou, 2002) and other types of traumatic events (e.g. Clohessy & Ehlers, 1999; Dunmore, Clark, & Ehlers, 2001; Halligan et al., 2003; Laposa & Alden, 2003). In addition, Ehlers et al. (1998) and Halligan et al. (2003) showed that factors derived from the Ehlers and Clark (2000) model significantly improved the

[2]In line with Ozer et al. (2003) the present paper uses the term *predictor* in a statistical sense, i.e., how much variance in outcome is accounted for by the predictor variable.

prediction of PTSD symptom severity over and above risk factors identified in earlier research. However, no study to date has tested whether the cognitive variables on their own are better predictors of PTSD than established non-cognitive predictors.

Travel phobia

From a cognitive-behavioral perspective, distorted beliefs concerning threat and danger lie at the core of *specific phobias* (e.g. Beck et al., 1985; Salkovskis, 1996). In the case of travel phobia, these have been found to include negative beliefs regarding the dangerousness of travel as well as the anticipated effects of anxiety/panic symptoms experienced in travel situations and concerns about potentially embarrassing situations (Ehlers, Hofmann, Herda, & Roth, 1994; Taylor, Deane, & Podd, 2000). Cognitive models furthermore suggest that threat beliefs are maintained by avoidance and safety behaviors that individuals carry out to prevent or minimize the feared outcome (Clark, 1999; Salkovskis, 1991). Following conditioning accounts, high fear during the accident, leading to strong conditioned fear responses, can be expected to predict phobias (Taylor & Koch, 1995). To our knowledge, no published study to date has investigated whether these cognitive-behavioral factors predict the development and maintenance of travel phobias following MVA.

Depression

Cognitive conceptualizations suggest that *major depression* is caused by the interaction of cognitive vulnerability factors and matching stressors (see Ingram, Miranda, & Segal, 1998, for a review). Individuals vulnerable to depression are thought to be characterized by certain cognitive patterns that are activated in response to a decline in mood and/or when the individual encounters stressful situations. These patterns include a tendency to develop negative and self-devaluative thoughts (Ingram et al., 1998), the activation of depressogenic schematic models resulting in a feeling tone of sad mood that reflects self-devaluative thinking (Teasdale & Barnard, 1993) and a focus on one's symptoms of depression and their possible causes and consequences (*depressive rumination*, Nolen-Hoeksema, 1991). Nolen-Hoeksema and Morrow (1991) found that depressive rumination significantly predicted levels of depression following a natural disaster. However, we are not aware of any other study that has investigated the role of the cognitive factors described in the development of depression following trauma.

Aims and hypotheses

The first aim of this study was to compare the explanatory power of cognitive variables derived from models of PTSD, phobias and depression to that of a set of established PTSD predictors identified in the recent meta-analysis by Ozer et al. (2003), using multiple regression analyses. The second aim was to test how disorder-specific the cognitive variables are. Specificity was expected on two different levels: firstly, it was expected that the different *sets of variables* are specific in that symptom severity of one disorder is better accounted for by the set of its specific theory-derived predictor variables than by the sets of predictor variables derived from theories of the other disorders. Secondly, the individual *variables* specified in the cognitive-behavioral models were expected to distinguish between different diagnostic groups.

Method

Participants

Participants ($n = 101$) had attended King's College Hospital's Accident and Emergency (A&E) Department, London, 3–12 months prior to participation because they had been injured in a motor vehicle accident. Inclusion criteria were: injury in a MVA as a driver, passenger, motorcyclist, or cyclist; accident occurred 3–12 months ago; injuries exceeded triage category 'blue' (very mild injuries); age between 18 and 65; address in greater London. Exclusion criteria were: left before receiving medical treatment; attended the A&E Department more than 3 days after the accident; current psychosis or suicidality. Demographics as well as characteristics of the accidents are shown in Table 1.

Table 1
Demographics and accident characteristics

Variable		*N* or *M*	% or SD
Gender	Male	57	56.4%
	Female	44	43.6%
Age (years)		34.95	10.60
Ethnic background	Caucasian	77	76.3%
	Black	18	17.8%
	Other	6	5.9%
Marital status	Single	60	59.4%
	Married	30	29.7%
	Divorced/separated	11	10.9%
Education (years)		14.83	4.70
Employment status	Working	69	68.3%
	Student	13	12.9%
	Not working	19	18.8%
Days since accident		196	57.5
Type of road user	Driver	23	22.8%
	Passenger	22	21.8%
	Motorcyclist	29	28.7%
	Bicyclist	27	26.7%
Injury severity (Triage category)	Green	57	56.4%
	Yellow	26	25.7%
	Orange	1	1.0%
	Red	4	4.0%
	Missing	13	12.9%

Measures

Outcome measures: PTSD, phobia, depression

The presence of PTSD, travel phobia and major depressive disorder was assessed with the Structured Clinical Interview for the DSM-IV (SCID) (First, Spitzer, Gibbon, & Williams, 1996). For a diagnosis of travel phobia, participants had to meet DSM-IV criteria for a specific phobia with the phobic situation being one or more travel situations (i.e. driving a car, being a passenger in a car or on a bus, riding or motorbike or a bicycle). However, the criterion G (not better accounted for by PTSD) was not used for the present analyses. DSM-IV is inconsistent in that it allows comorbid diagnoses of PTSD and depression, but not of PTSD and travel phobia after accidents. Determining whether or not participants met criteria for travel phobia, regardless of whether or not they also had PTSD, made it possible to: (1) relate the degree of phobic symptoms to the predictor variables, and (2) to examine the overlap between symptoms of PTSD and travel phobia in our sample, especially the percentage of participants with PTSD who also meet full criteria for travel phobia when the hierarchy rule is not applied. Interrater-reliability for the SCID interviews were high (PTSD: $\kappa = .82$; specific phobia: $\kappa = .85$; major depression: $\kappa = 1$, $N = 56$ randomly chosen interviews from this and a related study, 2 raters). The SCID manual states that κ's above .70 indicate good reliability (First et al., 1996).

In addition, the severity of symptoms for each of the psychological outcomes was assessed with standardized self-report measures: The Post-traumatic Diagnostic Scale (PDS) (Foa, Cashman, Jaycox, & Perry, 1997; $\alpha = .93$) for PTSD, the Beck Depression Inventory (BDI) (Beck, Ward, Mendelson, Mock, & Erbaugh, 1961; $\alpha = .89$) for depression, and the Travel Phobia Questionnaire (TPQ) for travel phobia. The latter scale was developed for the purposes of the study, as no validated self-report measures of travel phobia symptom severity were available. The TPQ closely follows DSM-IV criteria for specific phobia. The main part

Table 2
Sets of predictor variables used

Established predictors from meta-analysis	Cognitive predictors of PTSD	Cognitive predictors of phobia	Cognitive predictors of depression
Number of past traumas	Cognitive processing during MVA	Fear during MVA	*Vulnerability factors*
Past emotional problems	Memory disorganisation	Concerns about future MVA	Self-devaluation
Perceived life threat	Negative appraisals of trauma and sequelae	Beliefs about other drivers	Depressive rumination
Negative emotions during MVA	Safety behaviors (total scale)	Negative beliefs about travel	*Stressor variables*
Dissociation during MVA	Rumination about trauma and consequences	Safety behaviors (travel)	Social support
Social support	Thought suppression		Ongoing physical problems
Years of education[a]	Ongoing dissociation		Stressful life events

[a]This variable was included on the basis of Brewin et al.'s (2000) meta-analysis.

of the questionnaire consists of 12 items enquiring about fear experienced in travel situations (e.g. *I am very afraid of driving/travelling as a passenger/riding a bike*), items related to the DSM-IV criteria of insight (*I am more afraid of driving/travelling as a passenger/riding a bike than I should be*) and interference (*My fear of driving/travelling as a passenger/riding a bike interferes with my life (*e.g. *work, relationships, free time activities)*, and the degree of avoidance related to travel. The scale showed a high internal consistency ($\alpha = .94$) as well as a good re-test reliability over an interval of 2 weeks ($n_1 = 32$, $r = .76$; $n_2 = 104$, $r = .85$). Participants with a SCID diagnosis of travel phobia showed significantly higher scores on the TPQ than participants without the disorder (M (SD) = 42.83 (9.66) vs. M (SD) = 25.37 (9.96); $t(98) = 8.18$, $p < .001$), supporting the validity of the measure.[3]

Established predictors from Ozer et al.'s (2003) meta-analysis

Table 2 gives an overview of the predictor variables. Six *predictors* identified in Ozer et al.'s (2003) meta-analysis were assessed with self-report questionnaires and semi-structured interviews. For practical reasons, one of the predictors identified in the meta-analysis, namely family history of psychopathology, could not be assessed in this project. This variable showed the lowest effect size in Ozer et al.'s (2003) meta-analysis and has generally not been found to predict PTSD following MVA (Blanchard & Hickling, 2004). In addition, we added 'years of education' as an additional predictor variable as it can be considered a proxy for intelligence, which has been identified as a consistent predictor of PTSD in earlier research (Brewin, Andrews, & Valentine, 2000).

Number of past traumas. In the *Trauma History Interview,* participants were asked whether they had experienced a range of traumatic events prior to the accident. The interview was based on similar trauma checklists (Blake et al., 1995; Foa et al., 1997). The interview determined the number of traumatic experiences fulfilling the DSM-IV stressor criteria.

Past emotional problems were assessed with the SCID (past major depression, past PTSD, past travel phobia) as well as a self-report questionnaire enquiring about any past treatment for emotional problems or substance abuse.

Perceived life threat during the accident was assessed by asking participants to rate, on a scale from 0 (*not at all*) to 4 (*very strongly*), how much they thought they were going to die during the accident.

Negative emotions during the MVA were assessed with the Peritraumatic Emotions Questionnaire (Halligan et al., 2003; $\alpha = .88$) that asks participants to rate the extent to which they experienced each of 15 different negative emotions during the accident and until help arrived. This questionnaire has been shown to have good internal consistency and to predict PTSD symptoms after assault (Halligan et al., 2003).

Dissociation during the MVA was assessed with State Dissociation Questionnaire (SDQ) (Murray et al., 2002, $\alpha = .88$), a 9-item scale assessing different aspects of dissociation such as derealization, depersonaliza-

[3]The questionnaire as well as more detailed information regarding its validation can be obtained from the first author.

tion, detachment, altered time sense, emotional numbing, and reduction of awareness in surroundings. The SDQ showed good reliability and validity in traumatized and nontraumatized samples (Halligan, Clark, & Ehlers, 2002; Halligan et al., 2003; Murray et al., 2002). It correlates strongly with the Peritraumatic Dissociation Scale (Marmar, Weiss, & Metzler, 1997; $r = .79$ in Rosario, Ehlers, Williams, & Glucksman, submitted).

Social support after the MVA was assessed with a modified version of the Crisis Support Scale (CSS) (Joseph, 1999; 7 items; $\alpha = .82$), a widely used measure of social support in PTSD research. One item enquiring about personal contact with other trauma survivors was omitted from the scale as it did not appear relevant for MVA survivors. Instead, two items about informational support (*Did people give you advice and helpful information?*) and companionship support (*Did people invite you to participate in social or leisure activities*) were added to the scale.

Years of education. Participants reported how many years they had spent in full-time education.

Cognitive predictors of PTSD

Seven variables derived from Ehlers and Clark's (2000) cognitive model of PTSD were assessed.

Cognitive processing during MVA was assessed with the Processing Questionnaire (Halligan et al., 2003). The questionnaire measures three aspects of cognitive processing during the accident, namely data-driven processing (8 items, e.g. *My mind was fully occupied with what I felt, saw, heard and smelled*) and lack of self-referential processing (8 items, e.g. *I felt as if the accident was happening/had happened to someone else*), and dissociation (9 items, see SDQ). The measure was developed in a series of studies (Halligan et al., 2002, 2003; Murray et al., 2002; Rosario et al., submitted), and showed good reliability and validity in predicting intrusive memories and PTSD. The sum score of all 25 items was used in this study ($\alpha = .93$).

Memory disorganization was assessed with the Trauma Memory Questionnaire (TMQ) (Halligan et al., 2003), which asks participants to describe the quality of their trauma memories. The disorganization subscale consists of 5 items assessing deficits in intentional recall (e.g. *I cannot get what happened during the accident straight in my mind*). The measure has demonstrated good reliability and validity in earlier studies (Halligan et al., 2002, 2003) and the internal consistency in this study was $\alpha = .87$.

Negative appraisals of the trauma and its sequelae were assessed with the 'Negative Thoughts about the Self' subscale of the Post-traumatic Cognitions Inventory (PTCI) (Foa, Ehlers, Clark, Tolin, & Orsillo, 1999; 21 items; $\alpha = .91$). The scale has been shown to have good reliability, convergent validity and to discriminate between traumatized people with and without PTSD (Foa et al., 1999). It includes items that measure negative interpretations of the initial PTSD symptoms (Ehlers et al., 1998; Ehlers & Steil, 1995; Dunmore et al., 2001).

Safety behaviors (i.e., excessive precautions) were assessed with the Safety Behaviors Questionnaire. This questionnaire is based on an earlier scale by Dunmore, Clark, and Ehlers (1999) and Dunmore et al. (2001) that showed good internal consistencies and correlated with PTSD severity. The scale assesses excessive precautions related to travel (14 items, e.g. *I keep checking the position of other traffic*; $\alpha = .87$) as well as generalized safety behaviors (10 items, e.g. *I check carefully whether doors/windows are locked*; $\alpha = .84$). The total score is the sum of all 24 items.

Rumination about the trauma and its consequences and *thought suppression* were assessed with the Responses to Intrusions Questionnaire (RIQ). This self-report questionnaire assesses different aspects of trauma survivors' responses to intrusive memories, rumination about the trauma and/or its consequences (8 items; e.g. *I think about why the event happened to me;* $\alpha = .80$), and thought suppression (6 items; e.g. *I try to push them out of my mind*; $\alpha = .89$). It was developed in a series of studies (Clohessy & Ehlers, 1999; Ehlers et al., 1998; Halligan et al., 2002; Murray et al., 2002; Steil & Ehlers, 2000), and has shown good reliability and predictive validity.

Ongoing dissociation at the time of assessment was assessed with the 'current dissociation' subscale of the SDQ (Murray et al., 2002) described earlier. Participants were asked to rate the items regarding how they had felt during the preceding week ($\alpha = .90$).

Cognitive predictors of travel phobia

Five potential predictors of *travel phobia* following MVA were assessed.

Fear during the accident was assessed with 5 items of the Peritraumatic Emotions Questionnaire (Halligan et al., 2003) described above (*terrified, alarmed, frozen, fearful, shocked*; $\alpha = .85$).

Negative beliefs related to travel. Concerns about future accidents (6 items, e.g. *I will be injured in an accident*; $\alpha = .87$) and negative beliefs about travel (13 items, e.g. *Now I have had one accident, I am more likely to have another one; If I am anxious in traffic, this shows that I must be in danger*; $\alpha = .72$) were assessed with the Travel Phobia Beliefs Questionnaire (TPBQ) developed for this study. Negative beliefs about other drivers were assessed with an adapted version of the subscale 'other drivers' of the Motor Vehicle Accident Scale (Fedoroff, Taylor, Asmundson, & Koch, 2000; 9 items; $\alpha = .89$).

Safety behaviors were assessed using the 'travel' subscale of the Safety Behaviors Questionnaire described above.

Cognitive predictors of depression

Five variables representing a cognitive vulnerability–stress model of depression were assessed.

Self-devaluation. The Depressed States Checklist (Teasdale & Cox, 2001) is based on the Interactive Cognitive Subsystems Theory (Teasdale & Barnard, 1993). Participants are asked to describe how they felt when their mood started to deteriorate during the preceding month by rating 28 adjectives on a scale from 0 (*Not at all*) to 4 (*Extremely*). Half of the adjectives imply self-devaluation (e.g. *unacceptable, rejected, unwanted, worthless*). The sum of responses to all self-devaluative descriptors (14 items, $\alpha = .95$) was used in this study.

Depressive rumination was assessed with the 10-item short version of the Response Style Questionnaire (RSQ) (Nolen-Hoeksema & Morrow, 1991; $\alpha = .92$), a well-validated measure of depressive rumination.

Social support was measured using the Crisis Support Scale described above.

Severity of ongoing physical problems related to the accident was rated by the participant on a scale from 0 (*not at all severe*) to 10 (*very severe*).

Stressful life events. The Stressful Life Events Interview was developed for this project on the basis of similar scales (see Wethington, Brown, & Kessler, 1997) to assess stressful life events experienced by the participants within the past year in the domains of family, friends, social life, work, health, legal problems, finances, accommodation and other events. The sum of stressful life events reported by the participants with a distress rating of at least 50 on a scale ranging from 0 (*not at all distressing*) to 100 (*very distressing*) was used for the analyses.

Additional measures

Demographics and characteristics of the accident were assessed using a self-report questionnaire. The triage categories established at the A&E Department served as an objective indicator of injury severity.

Design and procedure

After agreeing to participate in the study, participants received a pack of questionnaires, which they were asked to complete on the day before the assessment session. The session consisted of the completion of the remaining questionnaires, the SCID assessment and some additional tasks unrelated to the analyses presented here. All assessments were conducted by the first author. Participants were paid £30 as a reimbursement for their time.

Data analyses

Associations between the continuous predictor variables and symptom severity measures were calculated with Spearman's rank correlation coefficients (*Spearman's* ρ), as many variables were skewed. Rank biserial correlation coefficients were computed for dichotomous predictor variables (Willson, 1976).

Analyses of variance (ANOVA) tested differences between the diagnostic groups on continuous predictor variables, followed by Tukey tests for pairwise comparisons if the group factor was significant. Most predictor variables were positively skewed and therefore transformed to normal via log- or square root-transformation prior to analysis. If variables were still skewed after transformation or if variables were rank-ordered, the

non-parametric Kruskal–Wallis one-way analysis of variance was conducted. For significant main effects in the Kruskal–Wallis test, pairwise comparisons were computed using the Mann–Whitney test. For categorical predictor variables, χ^2 tests were conducted.

Linear multiple regression analyses were conducted to test how well each set of predictor variables predicted PTSD, depression and phobia symptom severity. The PDS and the BDI were positively skewed and therefore square root-transformed for these analyses. In order to rule out multicollinearity, variance inflation factors (VIFs) were computed for each regression analysis. VIFs <3 were found for all analyses. Following suggestions by Steiger (1980), differences between the variance explained by the models (squared multiple correlation coefficients, R^2) were tested with the t-test for non-independent correlation coefficients by Williams (1959).

All analyses were conducted using SPSS 11.0. An alpha level of .05 was used for all statistical tests.

Results

Distribution of disorders

According to the SCID, 22 participants (21.8%) met criteria for PTSD following the accident. In addition, two participants (2%) met criteria for PTSD related to a different event, but did not meet full PTSD criteria in relation to the accident[4]. Thirty one participants (30.7%) met criteria for travel phobia with onset after the accident and 11 participants (10.9%) met criteria for a current major depressive episode. In all cases, the episode either started after the accident or got considerably worse as a consequence of it. As shown in Fig. 1, there was a high comorbidity between the three disorders, and 37 (36.6%) participants met criteria for one or more disorders. Sixty two participants (61.4%) did not meet criteria for any of the disorders.

Participants showed on average moderate levels of PTSD symptom severity (PDS: $M = 12.28$, SD $= 11.16$), moderate levels of travel phobia symptom severity (TPQ: $M = 18.39$, SD $= 1.25$) and mild symptoms of depression (BDI: $M = 9.59$, SD $= 8.31$). The PDS was highly correlated with both the TPQ, $\rho = .67$, $p = .001$; and the BDI, $\rho = .75$, $p = .001$. The correlation between the TPQ and the BDI was $\rho = .48$, $p = .001$. For comparison, the correlation between the corresponding SCID diagnoses were: PTSD and phobia: $\varphi = .53$; PTSD and major depression $\varphi = .55$; and phobia and major depression: $\varphi = .42$.

Relationship between accident characteristics and symptom severities

The triage category as a measure of injury severity was not significantly correlated with any of the symptom severity scales (ρ's $<.07$, p's $>.53$). Different types of road users (i.e. drivers, motorcyclists, bicyclists or passengers) did not differ regarding their symptom severities (F's <1.70, p's $>.18$). Time elapsed since the accident was significantly negatively correlated with PTSD symptom severity ($\rho = -.21$, $p<.05$), but not with symptom levels of phobia ($\rho = -.03$, $p = .75$) or depression ($\rho = -.09$, $p = .36$).

Comparison of established and theory-derived cognitive predictors

All theory-derived cognitive variables correlated moderately to highly with the respective psychological outcome variable (see Appendix A). With the exception of past emotional problems, the established predictors showed small to moderate correlations with the psychological outcomes. The number of past traumas was only related to depressive symptoms. The results of the multiple regression analyses are summarized in Table 3 (for detailed results see Appendix B). The established predictors predicted 45%, 46% and 40% of the PTSD, depression and phobia severity variance, respectively. Each of the disorders was, as expected, better predicted by the cognitive variables derived from its specific theoretical model (bold in Table 3) than by the established predictors, PTSD: 76% vs. 45%, $t(95) = 4.96$, $p<.001$; phobia: 66% vs. 40%, $t(95) = 3.73$, $p<.001$; depression: 72% vs. 46%, $t(95) = 4.13$, $p<.001$.

[4]These participants are included in the PTSD group for the present analyses. Excluding them did not change the results.

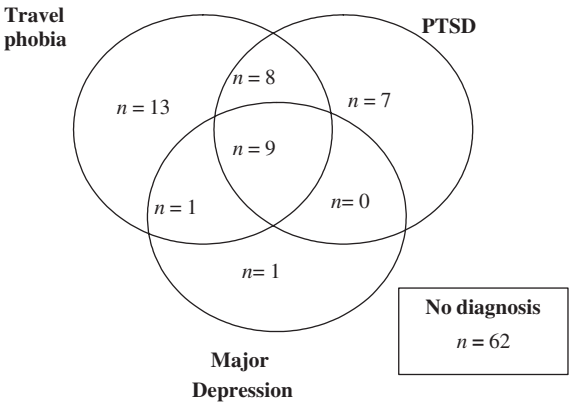

Fig. 1. Distribution of psychological disorders in 101 MVA survivors.

Table 3
Summary of multiple regression analyses: Variance (in %) predicted by different sets of predictors

Outcomes: predictors	PTSD severity (PDS)	Phobia severity (TPQ)	Depression severity (BDI)
Established Predictors	45	40	46
Cognitive-behavioral predictors			
PTSD Model	**76**	57	65
Phobia Model	61	**66**	38
Depression Model	63	32	**72**

All regression models were highly significant. Bold numbers show the relationships predicted by the cognitive-behavioral models of PTSD, phobia, and depression.

Tests of specificity

Specificity of models

If the cognitive-behavioral models are specific, then each of the three psychological outcomes should be explained better by its respective model than by the models for the other two disorders. The multiple regression analyses (Table 3) showed that each outcome was best predicted by the set of variables from its respective theoretical model. In most cases, the differences were statistically significant: The PTSD model ($R^2 = .76$) explained significantly more variance of PTSD symptom severity than the phobia model ($R^2 = .61$; $t(95) = 3.13$, $p = .001$) and the depression model ($R^2 = .63$; $t(95) = 2.56$, $p < .05$). Similarly, the phobia model ($R^2 = .66$), accounted for significantly more variance of phobia severity than the depression model ($R^2 = .32$; $t(95) = 4.89$; $p < .001$); and there was a trend for a difference with the variance explained by the PTSD model ($R^2 = .57$; $t(95) = 1.71$, $p = .09$). Finally, the depression model ($R^2 = .72$) explained more variance of depression severity than the phobia model ($R^2 = .38$; $t(95) = 4.97$, $p < .001$), but not the PTSD model ($R^2 = .65$; $t(95) = 1.32$, $p = .19$).

Specificity of theory-derived variables

As shown in Fig. 1, participants could be divided into four diagnostic groups: participants without any disorder ($n = 62$), participants with travel phobia only ($n = 13$), participants with PTSD but no depression, most of whom also met criteria for a travel phobia ($n = 15$); and participants with major depression, most of whom also met criteria for PTSD and/or travel phobia ($n = 11$). Table 4 summarizes the results of the ANOVAs comparing the four diagnostic groups on the predictor variables. For variables derived from the PTSD model, we expected (a) that participants with PTSD and those with depression (most of whom also met criteria for PTSD) would show significantly higher scores than participants without a disorder and that

Table 4
Differences between diagnostic groups in theory-derived cognitive-behavioral variables

Predictor variable		No diagnosis	Travel phobia only	PTSD/ no depression	Depression	Statistic
PTSD Model						
Cogn. processing during MVA	*M* (SD)	17.36[a] (13.83)	27.38[ab] (13.77)	42.87[b] (22.78)	45.22[b] (18.59)	$F(3, 94) = 16.62$, $p < .001$
Memory disorganisation	*M* (SD)	3.20 (4.20)	2.69 (2.56)	7.60 (6.28)	5.44 (6.46)	$\chi^2(3, 100) = 5.54$, $p = .08$
	Mean rank	45.43	45.96	64.90	56.56	
Neg. appraisals of trauma/sequelae	*M* (SD)	1.53[a] (.57)	1.96[ab] (.63)	2.61[b] (1.00)	2.64[b] (1.08)	$F(3, 94) = 14.39$, $p < .001$
Safety behaviors (Total scale)	*M* (SD)	10.30[a] (10.78)	22.95[b] (15.39)	33.73[c] (19.90)	56.58[d] (14.86)	$F(3, 91) = 10.91$, $p < .01$
Rumination about trauma/consequences	*M* (SD)	4.58[a] (3.35)	7.00[b] (2.83)	9.36[bc] (3.32)	13.56[c] (4.93)	$F(3, 93) = 19.16$, $p < .01$
Thought suppression	*M* (SD)	4.45[a] (4.10)	5.38[ab] (3.58)	8.21[bc] (3.15)	10.56[c] (2.17)	$F(3, 93) = 9.28$, $p < .01$
Ongoing dissociation	*M* (SD)	1.16 (2.38)	1.20 (1.75)	6.43 (5.69)	4.67 (7.16)	$\chi^2(3) = 14.58$, $p < .01$
	Mean rank	44.35[a]	45.73[a]	74.14[b]	52.11[ab]	
Phobia model						
Fear during MVA	*M* (SD)	8.66[a] (5.09)	12.85[b] (5.19)	14.07[b] (3.96)	15.78[b] (4.32)	$F(3, 94) = 10.00$, $p < .001$
Concerns about future MVA	*M* (SD)	4.89[a] (3.68)	9.69[b] (4.19)	8.53[b] (3.62)	11.41[b] (2.60)	$F(3, 94) = 14.08$, $p < .01$
Beliefs about other drivers	*M* (SD)	15.68[a] (5.68)	19.28[ab] (5.15)	20.33[b] (7.36)	24.00[b] (4.95)	$F(3, 94) = 7.26$, $p < .01$
Negative beliefs about travel	*M* (SD)	7.62[a] (2.89)	9.44[a] (2.40)	9.60[a] (2.75)	13.15[b] (3.28)	$F(3, 93) = 10.99$, $p < .01$
Safety behaviors (Travel)	*M* (SD)	7.20[a] (8.07)	15.75[b] (10.78)	20.72[b] (10.24)	36.08[c] (6.66)	$F(3, 92) = 27.84$, $p < .01$
Depression model						
Self-devaluation	*M* (SD)	6.20 (8.59)	11.15 (9.49)	16.20 (11.98)	22.67 (13.38)	$\chi^2(3, 100) = 19.65$, $p < .01$
	Mean rank	40.30[a]	56.15[ab]	65.67[ab]	75.33[b]	
Depressive rumination	*M* (SD)	18.41[a] (5.86)	22.92[ab] (6.58)	27.10[b] (6.58)	28.42[b] (7.32)	$F(3, 93) = 12.97$, $p < .01$
Social support	*M* (SD)	38.63[a] (7.10)	34.92[ab] (6.86)	34.13[ab] (8.17)	30.67[b] (11.25)	$F(3, 95) = 3.96$, $p < .05$
Ongoing physical problems	*M* (SD)	2.19[a] (2.22)	3.92[ab] (2.69)	4.00[ab] (2.93)	5.33[b] (3.94)	$F(3, 95) = 4.90$, $p < .01$
Stressful life events	*M* (SD)	3.11[a] (1.78)	5.54[b] (2.47)	5.73[b] (2.82)	6.89[b] (2.03)	$F(3, 95) = 14.00$, $p < .001$

Note: Means not sharing a superscript letter are significantly different from each other (Tukey tests conducted following significant main effects in ANOVAs.).

(b) participants with travel phobia would either not be significantly different from participants without disorder and/or score lower than the PTSD group. This pattern of results was found for five out of seven variables derived from the PTSD model (cognitive processing, negative appraisals of the trauma and its sequelae, safety behaviors — total scale, thought suppression and ongoing dissociation). For memory disorganization, there was a trend in the expected direction.

For variables derived from the phobia model, we expected that all participants with disorders — most of whom met criteria for travel phobia — would score higher than participants without a disorder, but would not significantly differ from each other. This pattern of results was found for three out of five variables derived from the phobia model (fear during MVA, concerns about future MVA and travel safety behaviors).

For variables derived from the depression model, we expected that (a) participants with depression would show significantly higher scores than participants without disorders and that (b) those with travel phobia only or PTSD without depression would not differ from the 'no disorder' group and/or show lower scores than those with depression. This pattern of results was found for three out of five variables derived from the depression model (self-devaluation, social support, ongoing physical problems).

Discussion

In line with previous studies, the present study showed that traumatic events such as motor vehicle accidents may not only lead to post-traumatic stress disorder, but also to travel phobia and depression (Mayou et al., 2001; McFarlane, 1997, O'Donnell, Creamer, Pattison, & Atkin, 2004; Shalev et al., 1998). There was substantial comorbidity among the psychological outcomes. Pure depression, in the absence of PTSD or phobia, was very rare. The latter finding is consistent with epidemiological data by Breslau, Davis, Peterson, and Schultz (2000). Nearly all participants with depression also had either PTSD (82%) or travel phobia (91%), in line with the argument that depression is often a complication of having a disabling anxiety disorder (e.g., Blanchard, Buckley, Hickling, & Taylor, 1998). Similarly, nearly all participants with PTSD showed significant travel phobia (when the DSM-IV hierarchy rule was ignored), corresponding to the significant avoidance of trauma reminders common in PTSD.

The study tested how well theory-derived cognitive variables predict PTSD, travel phobias or depression after a motor vehicle accident. A small set of variables derived from specific cognitive-behavioral models of these disorders was compared to established PTSD predictors identified in a recent meta-analysis by Ozer et al. (2003). Most of the established predictors replicated well in the present study, and together explained 40–46% of the variance of PTSD, phobia and depressive symptom severity. The size of the correlations was in line with the effect sizes obtained in the meta-analysis. The results show that these variables are not only associated with PTSD, but with emotional problems following trauma in general.

In line with cognitive-behavioral models, the theory-derived cognitive variables correlated significantly with the severity of the respective disorder. They explained 66% (phobia), 72% (depression) and 76% (PTSD) of the symptom severity. This represents significant increases in the accuracy of the prediction by 26% (phobia, depression) and 31% (PTSD) additional variance explained compared to the established predictors. These findings are in line with the hypothesis that cognitive factors are involved in the development and maintenance of post-traumatic emotional problems.

Very few studies to date have investigated how specific predictors of emotional problems following trauma are for the different disorders, and the results have been inconsistent (Mayou et al., 2001; McFarlane et al., 1997; O'Donnell, Creamer, & Pattison, 2004; Shalev et al., 1998). Our finding that the set of established predictors from the meta-analysis did not differentially predict the psychological outcomes under investigation is in line with these previous negative findings.

The present study provided preliminary support for a specificity of theory-derived cognitive predictors. We first considered the comparative explanatory power of the different sets of theory-derived variables for each of the three psychological outcomes. The results indicated specificity in that the variables derived from Ehlers and Clark's (2000) cognitive model of PTSD statistically predicted PTSD severity better than phobia and depression models. Second, variables derived from a phobia model predicted phobia severity better than those derived from a depression model, and vice versa. The PTSD model, which shares some of the symptoms to be explained and some hypothesized mechanisms with both phobia (e.g., fear when exposed to feared stimuli;

safety behaviors) and depression (e.g., loss of interest in significant activities; rumination), also explained a substantial degree of the variance of phobic and depressive symptoms, but tended to explain less variance of travel phobia than the phobia model. The finding that the PTSD and depression model did not differ in the prediction of depression is probably explained by the fact that the depression was triggered by a traumatic event and that 82% of the participants with depression also had PTSD.

Second, we tested specificity for the cognitive variables individually. It was expected that the theory-derived variables would show particular patterns of group differences. This hypothesis was supported for most of the cognitive variables studied. An exception was rumination, a factor in both the PTSD model and the depression model, which was also elevated in participants with phobia. This result may indicate that this style of repetitive thinking is a general vulnerability factor for emotional disorders after trauma.

The relationship between different trauma-related emotional disorders has been the subject of considerable debate in the past (e.g., Blanchard et al., 1998; Breslau, Chase, & Anthony, 2002; Neria & Bromet, 2000; O'Donnell, Creamer, & Pattison, 2004; Shalev et al., 1998). The overall pattern of results obtained in this study suggests that PTSD, travel phobias and depression are distinct, but correlated responses to trauma that can be predicted by a number of non-specific predictors as well as additional variables that are specific for the different disorders.

The study had several limitations. First, the study was cross-sectional and established the predictive power of the study variables only in a *statistical* sense, not in terms of a temporal relationship. This is in line with the meta-analysis by Ozer et al. (2003). Additional studies using a prospective longitudinal design are necessary to test whether these variables also show a better *temporal* prediction of subsequent symptom severities. Preliminary results of a recent prospective study conducted by the authors support this conclusion (Ehring, Ehlers, & Glucksman, in preparation).

Second, the sample was self-selected. Although the test of hypotheses derived from theoretical models does not strictly require representative samples, future studies should aim to replicate the results in consecutive or random samples of MVA survivors (e.g., Ehlers et al., 1998; O'Donnell, Creamer, Bryant, Schnyder, & Shalev, 2003). Nevertheless, the proportions of participants that were diagnosed as having PTSD, travel phobia and depression in the present self-selected sample were very similar to those observed in a previous large-scale study of nearly 1000 consecutive attendees to a local A&E department following a road traffic accident so that it is unlikely that people with psychological problems after the accident were over- or underrepresented in the study sample (Mayou et al., 2001).

Third, only six of the seven variables identified in Ozer et al.'s (2003) meta-analysis were included in the present study. However, it appears unlikely that this omission reduced the predictive power of the established predictors, as family psychopathology was found to show the lowest effect sizes in the meta-analysis and has generally not been found to predict PTSD following MVA (Blanchard & Hickling, 2004). We mainly restricted the set of established predictors to the ones identified in the meta-analysis by Ozer and colleagues (2003). Another meta-analysis by Brewin et al. (2000) identified additional predictors of PTSD, e.g. low intelligence, which could only approximated by the variable 'years spent in full-time education' in the present study as intelligence was not assessed directly. Future research should test whether theoretically derived cognitive factors are still superior when these additional variables are also included, and use a standard measure of intelligence.

Fourth, we conducted a large number of ANOVAs to explore the specificity of individual cognitive variables, which might have led to an inflation of the experiment-wise error rate. Therefore, the results of these ANOVAs should only be regarded as preliminary.

Fifth, the symptom measures of PTSD, phobia and depression used in the regression analyses were highly correlated. This raises the question of whether these scales measured distinct indicators of different constructs. Although the literature suggests that the measures used in the study are valid and measure different constructs (e.g., Foa et al., 1997, 1999), the present data do not permit to rule out the possibility that discriminant validity was compromised. Most likely, however, the high correlations were due to high comorbidity in the sample as the SCID diagnoses were also highly correlated. Despite similarly high correlations between single symptom measures, previous research has suggested that PTSD and depression are best conceptualized as distinct responses to trauma (Blanchard et al., 1998). It is also important to note that the high inter-correlations of the symptom outcome measures worked against the study hypothesis in that it decreased the chances to find

specificity. Thus, the fact that we found evidence for specificity despite high comorbidity is in line with a distinction of the symptom dimensions. Furthermore, the results of the ANOVAs, which were based on the SCID diagnoses, also found some evidence for specificity, which provides some cross-validation for the regression findings.

Nevertheless, future studies should aim to increase the distinctiveness of the outcome measures. One possible solution could be to specifically recruit a sample of trauma survivors with a lower degree of comorbidity between the disorders of interest, which would most likely result in a lower correlation between the symptom severity measures. However, this would have the disadvantage of compromising the generalizability of findings. In addition, future studies should aim to develop and use symptom measures that show a lower degree of overlap. One possible approach could be to try to identify and predict symptom clusters across disorders instead of symptom measures modelled after DSM-IV criteria of the disorders. Validated scales are not yet available and thus could not be included in the present study. Furthermore, the use of multiple measures for each of the different outcomes could help to increase the reliability of assessment (see Green, Goldman, & Salovey, 1993).

Sixth, some of the established predictors and cognitive variables not only differed regarding their content, but also regarding their proximity to the assessment of symptom measures. This raises a range of issues. As proximal predictors may be more likely to show higher associations with outcome than more distal variables, the differences in predictive power between the established predictors and cognitive variables may be partly due to differences in proximity. Some authors have argued that predictor research should mainly focus on risk factors that have already been present before the trauma happened, as variables that are assessed after the event may be causes or consequences of the traumatic event and post-traumatic stress symptoms (Harvey & Yehuda, 1999; McNally, 2003). However, most of the cognitive variables specified in the Ehlers and Clark (2000) model cannot be assessed as temporally antecedent predictors because they concern the processing of the traumatic event and its aftermath. This model is particularly concerned with factors that maintain PTSD. In our view, there are two problems with an exclusive focus on pre-trauma predictors. First, these variables may help explain the onset of PTSD, but have limited use in explaining maintenance of symptoms. PTSD shows substantial recovery rates in the first year after trauma, illustrating that individual differences in maintaining factors are important in predicting chronic PTSD. Previous studies have shown that such maintaining factors explain more variance of subsequent PTSD symptom severity than initial symptom severity (Dunmore et al., 2001; Ehlers et al., 1998; Halligan et al., 2003) and thus cannot be mere consequences of symptom severity. Furthermore, causality for peri- and post-traumatic cognitive variables can be established by additional studies such as experimental manipulation of the variable of interest (e.g., Halligan et al., 2002). Another disadvantage of an exclusive focus on pre-accident risk factors is that most of these variables cannot be changed and thus have only limited implications for treatment. Whereas this does not necessarily apply to all temporally antecedent risk factors, it does apply to most antecedent predictors of PTSD studied to date. For example, of the seven predictors identified by Ozer et al. (2003), only one, namely social support can potentially be modified by treatment delivered post-trauma.

The fact that most of the cognitive variables investigated in the present study concern peri- and post-traumatic cognitions also raises the question of whether there was any criterion contamination, i.e., the use of predictors that are part of the definition of the outcome variable. We do not think that this problem applied to the present study, as there was no overlap between predictors and outcome measures. For example, although avoidance is thought to maintain both PTSD and phobia, we did not include an avoidance measure in the set of predictors as avoidance is also a diagnostic criterion. Nevertheless, some of the predictors may have been affected by symptom levels. For example, depressive rumination is defined as thinking about symptoms that are part of the DSM-IV criteria for depression. Thus, we cannot rule out that rumination was in part a response to greater depression levels. It remains conceivable that such reciprocal relationships between some of the cognitive variables and symptoms of the disorders may have artificially increased the predictive power of the theoretically derived sets of predictors. Therefore, a prospective longitudinal design should be used in future studies, which allows one to test the prediction of later psychopathology while controlling for initial symptom levels. Preliminary results of a recent prospective study showed that the predictors reported in the present paper predict subsequent psychopathology over and above initial symptom levels (Ehring et al., in preparation).

Despite these limitations, some preliminary conclusions can be drawn from the findings. The results are in line with earlier evidence showing that PTSD, travel phobias and depression are distinct, but correlated responses to trauma that can be predicted by some nonspecific factors as well as disorder-specific variables (Blanchard et al., 1998; Shalev et al., 1998). In line with earlier studies (e.g. Dunmore et al., 2001; Ehlers et al., 1998; Halligan et al., 2003), the results supported the hypothesis that cognitive factors are involved in the development and maintenance of post-traumatic psychopathology. Therefore, cognitive variables as well as other maintaining factors should receive more attention in future predictor research. Most importantly, this study suggests that the investigation of the differential prediction of different post–traumatic emotional disorders is promising and thereby supports the argument made by several researchers that trauma-related disorders other than PTSD should receive more attention in future trauma research (e.g., Blaszczynski et al., 1998; Mayou et al., 2001; O'Donnell et al., 2003).

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Appendix A. Correlations between predictor variables and symptom severities

See Table A1.

Table A1

	PDS	TPQ	BDI
Established predictors			
Number of past traumas	.13	.04	.27**
Past emotional problems	.21	.18	.21
Perceived life threat	.27**	.23*	.26**
Negative emotions during MVA	.59***	.60***	.55***
Dissociation during MVA	.52***	.51***	.40***
Social support	−.38***	−.25*	−.45***
Years of education	−.23*	−.20	−.30**
PTSD model			
Cognitive processing during MVA	.61***	.60***	.54***
Memory disorganisation	.34**	.23*	.17
Negative appraisals of trauma and sequelae	.67***	.47***	.73***
Safety behaviors (total scale)	.70***	.71***	.53***
Thought suppression	.62***	.50***	.52***
Rumination about trauma and consequences	.70***	.54***	.70***
Ongoing dissociation	.42***	.32**	.44***
Travel phobia model			
Fear during MVA	.47***	.52***	.44***
Concerns about future MVA	.69***	.74***	.51***
Beliefs about other drivers	.41***	.35**	.40***
Negative beliefs about travel	.55***	.52***	.40***
Safety behaviors (travel)	.67***	.66***	.53***
Depression model			
Self-devaluation	.61***	.36***	.62***
Depressive rumination	.64***	.45***	.74***
Ongoing physical problems	.39***	.27**	.40***
Stressful life events	.57***	.42***	.56***
Social support	−.38***	−.25**	−.45***

*$p<.05$, **$p<.01$, ***$p<.001$.

Appendix B. Multiple regression analyses

See Table A2.

Table A2

Variables	*B*	*SE B*	*β*	*t*	*p*	R^2
Dependent variable: PDS model: established predictors						.45
Number of past traumas	.04	.04	.08	.90	.37	
Past emotional problems	.20	.27	.06	.73	.47	
Perceived life threat	−.06	.10	−.06	−.63	.53	
Negative emotions during MVA	.05	.01	.38	3.40	<.01	
Dissociation during MVA	.05	.02	.23	2.12	< .05	
Social support	−.04	.02	−.19	−2.03	< .05	
Years of education	−.03	.03	−.09	−1.09	.28	
Dependent variable: TPQ model: established predictors						.40
Number of past traumas	−.11	.35	−.03	−.31	.76	
Past emotional problems	.95	2.21	.04	.43	.67	
Perceived life threat	−1.05	.81	−.13	−1.29	.20	
Negative emotions during MVA	.44	.12	.43	3.70	<.001	
Dissociation during MVA	.40	.18	.26	2.26	< .05	
Social support	−.18	.16	−.11	−1.14	.26	
Years of education	−.21	.23	−.08	−.91	.37	
Dependent variable: BDI model: established predictors						.46
Number of past traumas	.12	.04	.26	3.14	< .01	
Past emotional problems	.17	.23	.06	.72	.47	
Perceived life threat	−.10	.08	−.11	−1.15	.25	
Negative emotions during MVA	.05	.01	.47	4.21	< .001	
Dissociation during MVA	.00	.02	.02	.19	.85	
Social support	−.04	.02	−.22	−2.35	< .05	
Years of education	−.05	.02	−.18	−2.20	< .05	
Dependent variable: PDS model: PTSD model						.76
Cognitive processing during MVA	.01	.01	.06	.91	.36	
Memory disorganisation	.04	.02	.13	2.28	< .05	
Negative appraisals of trauma/sequelae	.70	.15	.33	4.77	< .001	
Safety behaviors (total scale)	.03	.01	.38	5.67	< .001	
Rumination about trauma and consequences	.06	.03	.16	2.15	< .05	
Thought suppression	.05	.03	.14	2.16	< .05	
Ongoing dissociation	.00	.02	.01	.11	.92	
Dependent variable: TPQ model: PTSD model						.57
Cognitive processing during MVA	.17	.06	.25	2.80	< .01	
Memory disorganisation	.01	.20	.00	.04	.97	
Negative appraisals of trauma/sequelae	2.42	1.51	.15	1.61	.11	
Safety behaviors (total scale)	.29	.06	.46	5.19	< .001	
Rumination about trauma and consequences	.11	.28	.04	.40	.69	
Thought suppression	.31	.25	.10	1.20	.23	
Ongoing dissociation	−.16	.23	−.06	−.68	.50	
Dependent variable: BDI model: PTSD model						.65
Cognitive processing during MVA	.00	.01	.04	.47	.64	
Memory disorganisation	−.01	.02	−.03	−.48	.64	
Negative appraisals of trauma/sequelae	.76	.15	.42	5.00	< .001	
Safety behaviors (total scale)	.01	.01	.19	2.34	< .05	
Rumination about trauma and consequences	.09	.03	.31	3.33	< .01	
Thought suppression	.01	.03	.03	.42	.67	
Ongoing dissociation	.01	.02	.04	.55	.58	
Dependent variable: TPQ model: travel phobia model						.66
Fear during MVA	.38	.17	.17	2.30	< .05	

Table A2 (*continued*)

Variables	*B*	*SE B*	*β*	*t*	*p*	R^2
Concerns about future MVA	1.27	.22	.46	5.84	< .001	
Negative beliefs about other drivers	.00	.13	.00	−.03	.98	
Negative beliefs about travel	.39	.29	.10	1.32	.19	
Safety behaviors (travel)	.30	.08	.30	3.76	< .001	
Dependent variable: PDS model: phobia model						.61
Fear during MVA	.02	.02	.08	1.01	.32	
Concerns about future MVA	.13	.03	.36	4.31	< .001	
Negative beliefs about other drivers	.02	.02	.10	1.29	.20	
Negative beliefs about travel	.05	.04	.10	1.18	.24	
Safety behaviors (travel)	.05	.01	.36	4.22	< .001	
Dependent variable: BDI model: phobia model						.38
Fear during MVA	.04	.03	.14	1.43	.16	
Concerns about future MVA	.06	.03	.19	1.81	.07	
Negative beliefs about other drivers	.03	.02	.15	1.64	.11	
Negative beliefs about travel	.04	.04	.10	.97	.34	
Safety behaviors (travel)	.03	.01	.24	2.24	< .05	
Dependent variable: BDI model: depression model						.72
Self-devaluation	.02	.01	.21	2.49	< .05	
Depressive rumination	.08	.02	.41	4.82	< .001	
Social support	−.04	.01	−.24	−4.08	< .001	
Ongoing physical problems	.14	.03	.27	4.51	< .001	
Stressful life events	.07	.04	.13	1.99	.05	
Dependent variable: PDS model: depression model						.63
Self-devaluation	.04	.01	.32	3.36	< .01	
Depressive rumination	.05	.02	.25	2.47	< .05	
Social support	−.03	.01	−.14	−2.11	< .05	
Ongoing physical problems	.18	.04	.31	2.14	< .05	
Stressful life events	.11	.05	.17	2.14	< .05	
Dependent variable: TPQ model: depression model						.32
Self-devaluation	.05	.14	.05	.35	.73	
Depressive rumination	.48	.23	.29	2.13	< .05	
Social support	−.08	.14	−.05	−.58	.57	
Ongoing physical problems	.94	.43	.21	2.19	< .05	
Stressful life events	.98	.52	.20	1.87	.07	

References

Beck, A. T. (1976). *Cognitive therapy and the emotional disorders*. New York: International Universities Press.

Beck, A. T. (1990). *Depression: Clinical, experimental and theoretical aspects*. New York: Harper and Row.

Beck, A. T., Emery, G., & Greenberg, R. L. (1985). *Anxiety disorders and phobias: A cognitive perspective*. New York: Basic Books.

Beck, A. T., Ward, C. H., Mendelson, M., Mock, J., & Erbaugh, J. (1961). An inventory for measuring depression. *Archives of General Psychiatry*, *4*, 561–571.

Blake, D. D., Weathers, F. W., Nagy, L. M., Kaloupek, D. G., Gusman, F. D., Charney, D. S., et al. (1995). The development of a clinician-administered PTSD scale. *Journal of Traumatic Stress*, *8*, 75–90.

Blanchard, E. B., Buckley, T. C., Hickling, E. J., & Taylor, A. E. (1998). Posttraumatic stress disorder and comorbid major depression: Is the correlation an illusion? *Journal of Anxiety Disorders*, *12*, 21–37.

Blanchard, E. B., & Hickling, E. J. (2004). *After the crash: Psychological assessment and treatment of survivors of motor vehicle accidents* (2nd ed.). Washington, DC: American Psychological Association.

Blanchard, E. B., Hickling, E. J., Freidenberg, B. M., Malta, L. S., Kuhn, E., & Sykes, M. A. (2004). Two studies of psychiatric morbidity among motor vehicle accident survivors 1 year after the crash. *Behaviour Research and Therapy*, *42*, 569–583.

Blanchard, E. B., Hickling, E. J., Mitnick, N., Taylor, A. E., Loos, W. R., & Buckley, T. C. (1995). The impact of severity of physical injury and perception of life threat in the development of post-traumatic stress disorder in motor vehicle accident victims. *Behaviour Research and Therapy*, *33*, 529–534.

Blanchard, E. B., Hickling, E. J., Taylor, A. E., Loos, W. R., Forneris, C. A., & Jaccard, J. (1996). Who develops PTSD from motor vehicle accidents? *Behaviour Research and Therapy*, *34*, 1–10.

Blaszczynski, A., Gordon, K., Silove, D., Sloane, D., Hillman, K., & Panasetis, P. (1998). Psychiatric morbidity following motor vehicle accidents: A review of methodological issues. *Comprehensive Psychiatry*, *39*, 111–121.

Breslau, N., Chase, G. A., & Anthony, J. C. (2002). "A second look at comorbidity in victims of trauma: The posttraumatic stress disorder — major depression connection.": Reply. *Psychological Medicine*, *32*, 1480–1483.

Breslau, N., Davis, G. C., Peterson, E. L., & Schultz, L. R. (2000). A second look at comorbidity in victims of trauma: The posttraumatic stress disorder — major depression connection. *Biological Psychiatry*, *48*, 902–909.

Brewin, C. R., Andrews, B., & Valentine, J. D. (2000). Meta-analysis of risk factors for posttraumatic stress disorder in trauma-exposed adults. *Journal of Consulting and Clinical Psychology*, *68*, 748–766.

Brewin, C. R., & Holmes, E. A. (2003). Psychological theories of posttraumatic stress disorder. *Clinical Psychology Review*, *23*, 339–376.

Clark, D. M. (1999). Anxiety disorders: Why they persist and how to treat them. *Behaviour Research and Therapy*, *37*, S5–S27.

Clohessy, S., & Ehlers, A. (1999). PTSD symptoms, response to intrusive memories and coping in ambulance service workers. *British Journal of Clinical Psychology*, *38*, 251–265.

Dalgleish, T. (2004). Cognitive approaches to posttraumatic stress disorder: The evolution of multirepresentational theorizing. *Psychological Bulletin*, *130*, 228–260.

Dunmore, E., Clark, D. M., & Ehlers, A. (1999). Cognitive factors involved in the onset and maintenance of posttraumatic stress disorder (PTSD) after physical or sexual assault. *Behaviour Research and Therapy*, *37*, 809–829.

Dunmore, E., Clark, D. M., & Ehlers, A. (2001). A prospective investigation of the role of cognitive factors in persistent Posttraumatic Stress Disorder (PTSD) after physical or sexual assault. *Behaviour Research and Therapy*, *39*, 1063–1084.

Ehlers, A., & Clark, D. M. (2000). A cognitive model of posttraumatic stress disorder. *Behaviour Research and Therapy*, *38*, 319–345.

Ehlers, A., Hofmann, S. G., Herda, C. A., & Roth, W. T. (1994). Clinical characteristics of driving phobia. *Journal of Anxiety Disorders*, *8*, 323–339.

Ehlers, A., Mayou, R. A., & Bryant, B. (1998). Psychological predictors of chronic posttraumatic stress disorder after motor vehicle accidents. *Journal of Abnormal Psychology*, *107*, 508–519.

Ehlers, A., Mayou, R. A., & Bryant, B. M. (2003). Cognitive predictors of posttraumatic stress disorder in children: Results of a prospective longitudinal study. *Behaviour Research and Therapy*, *41*, 1–10.

Ehlers, A., & Steil, R. (1995). Maintenance of intrusive memories in posttraumatic stress disorder: A cognitive approach. *Behavioural and Cognitive Psychotherapy*, *23*, 217–249.

Ehring, T., Ehlers, A., Glucksman, E. (in preparation). A prospective longitudinal study of posttraumatic stress disorder, phobia, and depression after road traffic accidents.

Fedoroff, I. C., Taylor, S., Asmundson, G. J. G., & Koch, W. J. (2000). Cognitive factors in traumatic stress reactions: Predicting PTSD symptoms from anxiety sensitivity and beliefs about harmful events. *Behavioural and Cognitive Psychotherapy*, *28*, 5–15.

First, M. B., Spitzer, R. L., Gibbon, M., & Williams, J. B. W. (1996). *Structured clinical interview for DSM-IV axis I disorders*. Washington, DC: American Psychiatric Press.

Foa, E. B., Cashman, L., Jaycox, L., & Perry, K. (1997). The validation of a self-report measure of posttraumatic stress disorder: The Posttraumatic Diagnostic Scale. *Psychological Assessment*, *9*, 445–451.

Foa, E. B., Ehlers, A., Clark, D. M., Tolin, D. F., & Orsillo, S. M. (1999). The Posttraumatic Cognitions Inventory (PTCI): Development and validation. *Psychological Assessment*, *11*, 303–314.

Green, D. P., Goldman, S. L., & Salovey, P. (1993). Measurement error masks bipolarity in affect ratings. *Journal of Personality and Social Psychology*, *64*, 1029–1041.

Halligan, S. L., Clark, D. M., & Ehlers, A. (2002). Cognitive processing, memory, and the development of PTSD symptoms: Two experimental analogue studies. *Journal of Behavior Therapy and Experimental Psychiatry*, *33*, 73–89.

Halligan, S. L., Michael, T., Clark, D. M., & Ehlers, A. (2003). Posttraumatic stress disorder following assault: The role of cognitive processing, trauma memory, and appraisals. *Journal of Consulting and Clinical Psychology*, *71*, 419–431.

Harvey, P. D., & Yehuda, R. (1999). Strategies to study risk for the development of PTSD. In R. Yehuda (Ed.), *Risk factors for posttraumatic stress disorder* (pp. 1–22). Washington, DC: American Psychiatric Press.

Ingram, R. E., Miranda, J., & Segal, Z. V. (1998). *Cognitive vulnerability to depression*. New York: Guilford.

Joseph, S. (1999). Social support and mental health following trauma. In W. Yule (Ed.), *Post-traumatic stress disorder: Concepts and therapy* (pp. 71–91). Chichester: Wiley.

Laposa, J. M., & Alden, L. E. (2003). Posttraumatic stress disorder in the emergency room: exploration of a cognitive model. *Behaviour Research and Therapy*, *41*, 49–65.

Marmar, C. R., Weiss, D. S., & Metzler, T. J. (1997). The peritraumatic dissociative experiences questionnaire. In T. M. Keane, & J. P. Wilson (Eds.), *Assessing psychological trauma and PTSD* (pp. 412–428). New York, NY: Guilford Press.

Mayou, R. A., Bryant, B. M., & Ehlers, A. (2001). Prediction of psychological outcomes one year after a motor vehicle accident. *American Journal of Psychiatry*, *158*, 1231–1238.

McFarlane, A. C. (1997). The prevalence and longitudinal course of PTSD. *Annals of the New York Academy of Sciences*, *821*, 10–23.

McFarlane, A. C., Atchison, M., & Yehuda, R. (1997). The acute stress response following motor vehicle accidents and its relation to PTSD. *Annals of the New York Academy of Sciences*, *821*, 437–441.

McNally, R. J. (2003). *Remembering trauma*. Cambridge: Harvard University Press.

Murray, J., Ehlers, A., & Mayou, R. A. (2002). Dissociation and posttraumatic stress disorder: Two prospective studies of motor vehicle accident survivors. *British Journal of Psychiatry*, *180*, 363–368.

Neria, Y., & Bromet, E. J. (2000). Comorbidity of PTSD and depression: Linked or separate incidence. *Biological Psychiatry*, *48*, 878–880.

Nolen-Hoeksema, S. (1991). Responses to depression and their effects on the duration of depressive episodes. *Journal of Abnormal Psychology*, *100*, 569–582.

Nolen-Hoeksema, S., & Morrow, J. (1991). A prospective study of depression and posttraumatic stress symptoms after a natural disaster: The 1989 Loma Prieta earthquake. *Journal of Personality and Social Psychology*, *61*, 115–121.

O'Donnell, M. L., Creamer, M., Bryant, R. A., Schnyder, U., & Shalev, A. (2003). Posttraumatic disorders following injury: An empirical and methodological review. *Clinical Psychology Review*, *23*, 587–603.

O'Donnell, M. L., Creamer, M., & Pattison, P. (2004). Posttraumatic stress disorder and depression following trauma: Understanding comorbidity. *American Journal of Psychiatry*, *161*, 1390–1396.

O'Donnell, M. L., Creamer, M., Pattison, P., & Atkin, C. (2004). Psychiatric morbidity following injury. *American Journal of Psychiatry*, *161*, 507–514.

Ozer, E. J., Best, S. R., Lipsey, T. L., & Weiss, D. S. (2003). Predictors of posttraumatic stress disorder and symptoms in adults: A meta-analysis. *Psychological Bulletin*, *129*, 52–73.

Rosario, M., Ehlers, A., Williams, R.M., & Glucksman, E. (submitted). Cognitive processing during motor vehicle accidents predicts posttraumatic stress disorder in motor vehicle accident survivors.

Salkovskis, P. M. (1991). The importance of behaviour in the maintenance of anxiety and panic: A cognitive account. *Behavioural Psychotherapy*, *19*, 6–19.

Salkovskis, P. M. (1996). The cognitive approach to anxiety: Threat beliefs, safety-seeking behavior, and the special case of health anxiety and obsession. In P. M. Salkovskis (Ed.), *Frontiers of cognitive therapy* (pp. 48–74). New York: Guilford.

Schnyder, U., Moergeli, H., Klaghofer, R., & Buddeberg, C. (2001). Incidence and prediction of posttraumatic stress disorder symptoms in severely injured accident victims. *American Journal of Psychiatry*, *158*, 594–599.

Shalev, A. Y., Freedman, S., Peri, T., Brandes, D., Sahar, T., Orr, S. P., et al. (1998). Prospective study of posttraumatic stress disorder and depression following trauma. *American Journal of Psychiatry*, *155*, 630–637.

Steiger, J. H. (1980). Tests for comparing elements of a correlation matrix. *Psychological Bulletin*, *87*, 245–251.

Steil, R., & Ehlers, A. (2000). Dysfunctional meaning of posttraumatic intrusions in chronic PTSD. *Behaviour Research and Therapy*, *38*, 537–558.

Taylor, J. E., Deane, F. P., & Podd, J. V. (2000). Determining the focus of driving fears. *Journal of Anxiety Disorders*, *14*, 453–470.

Taylor, S., & Koch, W. J. (1995). Anxiety disorders due to motor vehicle accidents: Nature and treatment. *Clinical Psychology Review*, *15*, 721–738.

Teasdale, J. D. (1988). Cognitive vulnerability to persistent depression. *Cognition and Emotion*, *2*, 247–274.

Teasdale, J. D., & Barnard, P. J. (1993). *Affect, cognition, and change: Re-modelling depressive thought*. Hove: Lawrence Erlbaum.

Teasdale, J. D., & Cox, S. G. (2001). Dysphoria: Self-devaluative and affective components in recovered depressed patients and never depressed controls. *Psychological Medicine*, *31*, 1311–1316.

Wethington, E., Brown, G. W., & Kessler, R. C. (1997). Interview measurement of stressful life events. In S. Cohen, R. C. Kessler, & L. U. Gordon (Eds.), *Measuring stress: A guide for health and social scientists* (pp. 59–79). New York: Oxford University Press.

Williams, E. J. (1959). The comparison of regression variables. *Journal of the Royal Statistical Society (Series B)*, *21*, 396–399.

Willson, V. L. (1976). Critical values of the rank-biserial correlation coefficient. *Educational and Psychological Measurement*, *36*, 297–300.