



Pretrauma risk factors for posttraumatic stress disorder: A systematic review of the literature



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HIGHLIGHTS

- PTSD research has overwhelmingly relied on retrospective accounts of trauma.
- Prospective, longitudinal studies allow for examination of pretrauma vulnerability.
- Pretrauma characteristics historically thought to be symptoms may predict PTSD.
- Coping and cognitive abilities, personality, health, and environment affect risk.
- Pretrauma predictor categories used to conceptualize variable risk for PTSD.

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ABSTRACT

As it has become clear that most individuals exposed to trauma do not develop PTSD, it has become increasingly important to examine pretrauma risk factors. However, PTSD research has overwhelmingly relied on retrospective accounts of trauma, which is beleaguered by problems of recall bias. To further our understanding of PTSD's etiology, a systematic review of 54 prospective, longitudinal studies of PTSD published between 1991 and 2013 were examined. Inclusion criteria required that all individuals were assessed both before and after an index trauma. Results revealed six categories of pretrauma predictor variables: 1) cognitive abilities; 2) coping and response styles; 3) personality factors; 4) psychopathology; 5) psychophysiological factors; and 6) social ecological factors. The results indicated that many variables, previously considered outcomes of trauma, are pretrauma risk factors. The review considered these findings in the context of the extant retrospective PTSD literature in order to identify points of overlap and discrepancy. Pretrauma predictor categories were also used to conceptualize variable risk for PTSD. Limitations and directions for future research are discussed.

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Posttraumatic stress disorder (PTSD) has been generating controversy since its inception in the *Diagnostic and Statistical Manual-III* in 1980. Where virtually all other psychiatric disorders were largely agnostic to etiology, PTSD required a specific type of event to precede the development of a clinical syndrome. So important was this precipitating event that when PTSD was initially conceptualized it was thought of as a “monocausal” mental disorder that required a recognizable stressor “that would evoke significant symptoms of distress in almost everyone” and that was “generally outside the range of usual human experience” (DSM-III; American Psychiatric Association, 1980). Quickly, however, it became apparent that—although trauma was a common occurrence—PTSD was not (Breslau, Davis, Andreski, & Peterson, 1991; Breslau et al., 1998; Kessler, Sonnega, Bromet, Hughes, & Nelson, 1995; North, Suris, Davis, & Smith, 2009; Resnick, Kilpatrick, Dansky, Saunders, & Best, 1993). Studies like these, which suggest PTSD is the exception rather than the rule, have illuminated hypotheses that pretrauma risk factors, in conjunction with a Criterion A event, are important for the development of PTSD.

Epidemiologic studies, which showed that PTSD was not an inevitable consequence of trauma, also provided evidence that pretrauma risk was associated with PTSD (e.g., Breslau et al., 1991; Kessler et al., 1995). However, most risk factor studies have relied on cross-sectional designs and, therefore, retrospective reports of pretrauma risk factors in individuals who have or have not developed the disorder (e.g., de Jong et al., 2011; Kun, Han, Chen, & Yao, 2009; Schalinski, Elbert, & Schauer, 2011). A smaller number of studies—which we will refer to as retrospective longitudinal—recruited individuals who had recently been exposed to a trauma and followed them over time (e.g., Bryant, Harvey, Guthrie, & Moulds, 2000; Marshall, Miles, & Stewart, 2010; Meiser-Stedman, Dalgleish, Glucksman, Yule, & Smith, 2009; Richter & Berger, 2006).

The most notable methodological limitation in both designs relates to the issue of recall bias and its effect on retrospective accounts of pretrauma functioning (Koenen, Moffitt, Poulton, Martin, & Caspi, 2007; Southwick, Morgan, Nicolaou, & Charney, 1997). In what is considered to be one of the seminal articles on the fallibility of traumatic memory, Southwick et al. (1997) asked Gulf War veterans to report on their combat experiences one month and two years post-deployment. The authors reasoned that if traumatic memories of combat were inconsistent over time, then the notion that traumatic events are indelibly encoded as traumatic memories becomes less plausible. Their findings demonstrated many inconsistencies between the two time points, indicating that traumatic memory is not fixed, but rather malleable over time. Moreover, their data suggested that as PTSD symptoms increase, so too does the pernicious nature of memory. Their study is but one in a litany of studies that has indicated that the fallibility of traumatic memory as well as the influence that PTSD symptoms has on memory (King et al., 2000; Koenen et al., 2007; Roemer, Litz, Orsillo, Ehlich, & Friedman, 1998; Roemer et al., 1998; Schwarz, Kowalski, & McNally, 1993; Southwick et al., 1997; Wessely et al., 2003). These investigations into recall bias have been vital in highlighting the obstacles that retrospective accounts of pretrauma functioning has posed to any

retrospective studies seeking to elucidate pretrauma risk factors. The antidote to retrospective studies is prospective, longitudinal studies that assess individuals both prior to and following traumatic exposure.

To date, however, there exists no comprehensive review of prospective studies on risk factors for PTSD. A meta-analysis by Ozer, Best, Lipsy, and Weiss (2003), which is the most recent review of PTSD risk factor, included two prospective studies. Ozer et al. (2003) acknowledged this methodological weakness, writing: “Because of the almost exclusively retrospective assessment methodology of the PTSD literature, the large majority of predictors studied in the meta-analysis were not assessed prior to the development of PTSD symptoms (although this would have been far preferable)...” (Ozer et al., 2003, p. 55).

Prospective studies of posttraumatic stress are critical for several reasons. First, unlike cross-sectional, retrospective studies, the benefit of longitudinal, prospective studies is that they can attempt to examine the independent contribution of trauma to symptoms without being confounded by prior symptoms and functioning. Second, by improving our understanding of the causes and course of PTSD, it is then possible to develop more appropriate prevention and treatment models of PTSD. Third, the examination of prospective predictors of PTSD may assist in the identification of individuals who are at greatest risk for developing PTSD. Ultimately, this may aid in the development of targeted interventions.

Thus, the current paper aims to fill this gap in our knowledge by systematically reviewing prospective, longitudinal studies of PTSD with the goal of identifying risk factors that affect vulnerability or resilience to the disorder. To the best of our knowledge, this is the first review to assess the state of the prospective literature on pretrauma functioning and PTSD symptomatology.

1. Method

1.1. Inclusion criteria and procedure

A systematic review was based on the following sources: PsycINFO, PILOTS, and PubMed. The search terms included forms of the following terms alone and in combination: birth cohort, longitudinal, retrospective, military, posttraumatic stress disorder, prospective, pre-combat, pretrauma, pre-trauma, PTSD, recall, recall bias, premorbid, risk factors and trauma. Thesauruses of the three databases were searched to ensure that appropriate search terms were used. To maximize search effectiveness, Boolean searching along with truncation of terms was used. For example, search terms included “PTSD and (pretrauma* or trauma*),” which then returned studies with any combination of PTSD, pretrauma, pretraumatic, traumas, traumatic, traumatized, etc.

This study was limited to peer-reviewed journal articles, published in English that examined participants before an index traumatic exposure in order to assess how pretrauma variables contributed to posttrauma functioning. Specifically, the inclusion criteria required that participants were 1) enrolled in the study prior to index trauma exposure(s), 2) assessed both prior and subsequent to an index traumatic event and 3) assessed for PTSD symptoms following the index trauma.

Prior to the trauma, participants were assessed on a variety of variables that were empirically linked to PTSD in earlier research (e.g., cognitive abilities, personality traits); however, there were no inclusion criteria requirements pertaining to these pretrauma variables so as to conduct the most comprehensive review possible. After the index trauma, participants were assessed for PTSD symptoms, and pre and posttrauma measures were then compared. Given the extremely small body of prospective PTSD studies relative to retrospective ones, the authors made it a point to include all studies that prospectively assessed individuals before a traumatic event and included measurement of PTSD following the index event. The comprehensive review of the literature was conducted by a team of researchers and a librarian. Each article was reviewed by a minimum of three of the authors to ensure that each article clearly met inclusion criteria. While the research team conducted the literature search, the librarian assisted the research team in the specification of search terms.

Because earlier work has already clearly delineated the paucity of prospective, longitudinal risk factor studies (Ozer et al., 2003), the parameters of this review were broad so as to provide as much information as possible on relevant factors in prospective PTSD research. Thus, in addition to collecting information on the issue of central focus (i.e., pretrauma vulnerabilities for PTSD), germane information regarding demographics, study design (e.g., birth cohort vs. other longitudinal designs) and sample selection was also included. Of particular note, although several studies were labeled prospective, longitudinal studies of PTSD, they were not true pretrauma assessments. Instead, they were longitudinal assessments of PTSD that began soon after a trauma occurred (e.g., assessing participants in an emergency room immediately following a traumatic event), and, therefore, were not included in the present review.

2. Results

Utilizing the inclusion criteria above, the review yielded a total of 54 articles that were prospective, longitudinal studies of posttraumatic stress. There were no publication date constraints for inclusion in the review; however, no studies published prior to 1991 met the inclusion criteria. All of the studies were prospective in that participants were enrolled prior to index trauma exposure and longitudinal in that they followed participants through trauma exposure and assessed subsequent PTSD symptomatology posttrauma.

2.1. Study design and demographic information

2.1.1. Sample size

The sample sizes ranged widely from $n = 27$ to 22,630 (Mean $n = 955.17$; Median = 190).¹ Thirty-seven studies (69.8%) had sample sizes less than 500 and an additional 16 (30.2%) had samples between 500 and 22,630.¹ (See Table 1 for more demographic information.)

2.1.2. Age and gender

Out of 54 studies, only 35 provided information on participants' mean age. Of these, the mean age ranged from 10.9 to 49 years. Nine studies focused on children. The studies of children involved natural disasters, terrorism, child abuse and exposure to multiple traumatic events. The remaining 45 articles had adult samples. Forty-eight of the 54 (88.9%) articles provided gender information. Of the 48 articles that reported gender, 73.9% of the sample ($n = 33,628$) were men.

2.1.3. Assessment of PTSD

Fourteen of the studies assessed full DSM-III or DSM-IV criteria for PTSD whereas 36 used subclinical criteria. Studies that used subclinical

PTSD utilized symptom counts as opposed to the full DSM criteria. Four articles used both full and subclinical criteria PTSD in their analyses (LeardMann, Smith, Smith, Wells, & Ryan, 2009; Lee, Vaillant, Torrey, & Elder, 1995; Schnurr, Friedman, & Rosenberg, 1993; Soet, Brack, & Dilorio, 2003). PTSD was most commonly assessed with the PTSD Checklist (PCL) ($n = 13$; 24.1%). Other common measures included the Structured Clinical Interview for Axis I DSM-IV Disorders (SCID) ($n = 7$; 13.0%), the Self-Rating Inventory for PTSD (SRIP) ($n = 5$; 9.3%), the Diagnostic Interview Schedule (DIS) ($n = 4$; 7.4%), and the Posttraumatic Diagnostic Scale (PDS) ($n = 3$; 5.6%). (For a list of all measures, see Table 2).

2.1.4. Sample selection and study design

The majority of articles selected samples from high-risk populations such as firefighters, police officers, and veterans ($n = 31$; 57.4%). Eighteen (33.3%) were initially designed to study other related phenomena, but an unexpected trauma occurred in the interim (e.g., terrorist attack), and the researchers had pretrauma data and were then able to collect relevant posttrauma data. Forty-nine (90.7%) of the articles selected samples based on exposure to a specific type of traumatic event such as a natural disaster or terrorist attack whereas the remaining five studies (9.3%) were birth cohort designs and, subsequently, were not designed around an index trauma as were the other 49 studies. In the birth cohort studies, traumatic events ranged from witnessing violence to assaultive violence to serious injury (Betts, Williams, Najman, Bor, & Alati, 2012; Breslau, Lucia, & Alvarado, 2006; Copeland, Keeler, Angold, & Costello, 2007; Koenen et al., 2007, 2008).

2.1.5. Primary trauma type

In terms of types of trauma examined, the most common category was war or military related trauma exposure ($n = 21$), followed by trauma encountered by first responders, i.e., police and firefighters ($n = 11$), natural disasters ($n = 7$), terrorism ($n = 5$), loss or injury, e.g., pregnancy loss ($n = 2$), school shooting ($n = 1$), child abuse ($n = 1$), and other, e.g., field trip to visit WWII concentration camps ($n = 6$). (See Table 2 for more information.)

2.2. Predictors of trauma

The central purpose of this review was to identify what variables were pretrauma predictors of PTSD. Of the 54 articles reviewed, there were six categories of premorbid predictors of PTSD. These six categories, reviewed below, include: 1) cognitive abilities; 2) coping and response styles; 3) personality factors; 4) psychopathology; 5) psychophysiological factors; and 6) social ecological factors (e.g., family of origin, social support, poverty).

2.2.1. Cognitive abilities

In broad terms, ten studies examined cognitive abilities. Studies varied in how they examined cognitive function. For example, four articles examined intelligence quotient (IQ) measures (Betts et al., 2012; Breslau et al., 2006; Koenen et al., 2007; Macklin et al., 1998) while six examined other forms of neurocognitive function, including retrieval of autobiographical memories (Bryant, Sutherland, & Guthrie, 2007), negative appraisals about self (Bryant & Guthrie, 2007), cognitive abilities as related to military trainability (Kremen et al., 2007), verbal ability (Orr et al., 2012), extinction learning (Lommen, Engelhard, Sijbrandij, van den Hout, & Hermans, 2013), and processing speed and memory (Parslow & Jorm, 2007). All ten of the studies found that lower cognitive ability increased vulnerability for PTSD symptoms.

2.2.2. Coping and response styles

Eight studies examined various coping and response styles before traumatic exposure. Results revealed that a general negative cognitive bias when coping with difficult circumstances (Constans et al., 2012)

¹ Sample size of Asarnow et al. (1999) unclear.

Table 1
Sample characteristics.

Authors (year)	Mean age (SD)	Trauma exposed sample size (total sample ^a)	Assessment schedule	Premorbid diagnoses ^b
Apfel et al. (2011)	27.3 (4.9)	190 (243) police officers	W1: Prior to active duty; W2: 12 mos. after start of duty	Depression: 7.9%; LT PTSD: 1.6%; Panic disorder: 0.5%
Asarnow et al. (1999)	13.66 (2.6)	NR	W1: Prior to earthquake; W2: 1 year later	Anxiety disorder: 41%; Depression: 60%; Disruptive behavior disorder: 57%
Beevers et al. (2011)	23.3 (5.7)	139 Army soldiers	W1: Prior to Iraq deployment; W2: during deployment	Substance use disorder: 7.2%; Anxiety disorder: 6.5%; Mood disorder: 4.3%; Adjustment disorder: 1.4%; PTSD: 0%
Betts et al. (2012)	Birth cohort (21 years old)	1010 (2547) cohort members	Birth cohort study (mother and child assessed at various ages; PTSD assessed at age 21)	PTSD: 0%
Boney-McCoy and Finkelhor (1996)	NR	1,433 children	W1: Phone interviews; W2: Administered average 15 mos. after initial interview	LT depression: 17.6%
Bramsen et al. (2000)	24 (2.1)	572 military peacekeepers	W1: 1993–1995; W2: 1996	NR
Breslau et al. (2006)	NR (birth cohort)	541 (832) cohort members	Birth cohort study (assessed at 6 years old and reassessed at 17 years old)	NR
Bryant and Guthrie (2007)	W/ PTSD 33(7.13) & W/out PTSD 30.02(4.40)	52 firefighters	W1: Prior to active duty; W2: 4 years after start of duty	Current Axis I Dx: 0%
Bryant et al. (2007)	29.6 (5.0)	46 firefighters	W1: Prior to active duty; W2: 1 mo.; W3: 6 mos.; W4: 3 after start of duty	Current Axis I Dx: 0%
Constans et al. (2012)	NR	503 veterans	W1: 1 year period prior to Hurricane Katrina; W2: 2.5 years after disaster	Substance abuse disorder: 0%
Copeland et al. (2007)	NR (birth cohort)	1420 (1796) cohort members	Birth cohort study (children aged 9, 11, and 13 were followed annually through 16 years)	NR
Engelhard et al. (2003)	31 (4.2)	118 pregnant women	W1–5: every 2 mos. until 1 mo. after due date of birth	NR
Farach et al. (2008)	18.9(0.8)	44 young adults	W1: 1 day before 9/11; W2: 4 mos.; W3: 12 mos. after 9/11	NR
Gil (2005)	22.7 (3.1)	81 undergraduates	W1: 2 weeks before terrorist attack; W2: 1 week; W3: 1 mo.; W4: 6 mos. after attacks	PTSD: 6%; Performance anxiety: 4%; Depression: 1%
Gil and Caspi (2006)	23.4 (4.7)	180 undergraduates	W1: 2 weeks before terrorist attack; W2: 1 week after attack; W3: 1 mo.; W4: 6 mos. after attacks	Mood disorder: 0.5%; PTSD: 1.6%; Social phobia: 2.7%;
Guthrie and Bryant (2005)	29.0 (4.9)	35 (71) firefighters	W1: Prior to active duty; W2: 2–28 after start of duty	NR
Guthrie and Bryant (2006)	30.1 (5.1)	67 firefighters	W1: Prior to active duty; W2: 24 mos. after start of duty	Specific phobia & general anxiety: 3% ^c
Heinrichs et al. (2005)	25.6 (3.5)	43 firefighters	W1: Prior to active duty; W2: 6 mos.; W3: 9 mos.; W4: 12 mos.; W5: 24 mos. after start of duty	None had premorbid diagnosis
Hodgins et al. (2001)	25.93 (4.41)	223 police	W1: Prior to active duty; W2: 12 mos. after start of duty	NR
Inslicht et al. (2010)	27 (4.6)	278 police	W1: Prior to active duty; W2: 12 mos. after start of duty	Alcohol abuse: 11.5%; Depression: 9.4%; PTSD: 1.1%
Knezevic et al. (2005)	22.4	70 undergraduates	W1: 1–2 years before spring 1999 attacks; W2: June 1999; W3: 1 year after attacks	NR
Koenen et al. (2007)	NR (birth cohort)	239 cohort members	Birth cohort study (PTSD was prospectively examined between age 26 and 32)	NR
Koenen et al. (2008)	birth cohort (26 years old) ^d	27 ^e	Birth cohort study (complete cohort of children born 1972–73 and assessed at various ages; PTSD assessed between ages 26 and 32)	Hx of one or more mental disorders: 96%
Kremen et al. (2007)	41.9 (2.6)	2386 veterans	W1: Pre-enlistment at age 19.7; W2: at age 41.9	PTSD: 9.6%
La Greca et al. (1998)	NR (Grades 4–6)	74 children	W1: 15 mos. pre-disaster; W2: 3 mos.; W3: 7 mos. post-disaster	NR
LeardMann et al. (2009)	NR	5410 (22,208) veterans	W1: Prior to deployment; W2: Post deployment; W3: in 2004–6	PTSD: 0%
Lee et al. (1995)	NR ^f	107 veterans	W1: 1938; W2: 1946	NR
Lengua et al. (2005)	10.93 (1.01)	142 children	W1: Prior to 9/11; W2: 29 days after 9/11; W3: 6 mos. after 9/11	NR
Lengua et al. (2006)	10.94 (1.01)	143 children	W1: Prior to 9/11; W2: 29 days after 9/11	Clinical Externalizing problems: 4%; Depression: 4%
Littleton et al. (2012)	19.5 (1.4)	215 college women	W1: 2 mos. prior to shooting; W2: 2 mos. post-shooting; W3: 1 year post-shooting	NR
Lommen et al. (2013)	23.8 (4.9)	247 Dutch Royal Army soldiers	W1: Prior to deployment; W2: 2 mos. after a 4 mos. deployment	NR
MacDonald et al. (2012)	25.7 (5.9)			NR

(continued on next page)

Table 1 (continued)

Authors (year)	Mean age (SD)	Trauma exposed sample size (total sample ^a)	Assessment schedule	Premorbid diagnoses ^b
Macklin et al. (1998)	49.0(2.4) PTSD	774 active duty & National Guard soldiers	W1: Prior to Iraq deployment; W2: post-deployment	PTSD: 65%
McNally et al. (2011)	50.0(2.9) Non-PTSD NR	90 Vietnam veterans (31 Non-PTSD; 59 PTSD) 122 medical personnel	W1: Prior to deployment; W2: post-Vietnam W1: Prior to deployment W2: 1 mo. after a 5 mos. Iraq deployment	NR
Merffert et al. (2008)	27.2 (4.7)	180 police	W1: Prior to active duty; W2: 12 mos. after start of duty	Alcohol dependence: 15.6%; Depression: 10.6%; PTSD: 0.6%
Nolen-Hoekseman and Morrow (1991)	NR (undergrads)	137 undergraduates	W1: 14 days prior to earthquake; W2: 10 days post-earthquake; W3: 7 weeks after earthquake	NR
Orr et al. (2012)	27.0 (6.5)	99 (212) firefighters and police trainees	W1: during training academy; W2: average of 12.3 mos. after reported traumatic event	CT alcohol dependence: 2%; LT alcohol dependence: 10%; CT substance abuse: < 1%; LT substance abuse: 3%; CT major depression: < 1%; LT major depression: 3%; CT ADHD: 2%; CT Phobia: < 1%; LT Panic disorder: < 1%; PTSD: 0%
Parslow et al. (2006)	26.7 (1.5)	1,652 (2085) young adults	W1: before bushfire; W2: 3–4 years later	NR
Parslow and Jorm (2007)	26.7 (1.5)	1,599 (2085) young adults	W1: before bushfire; W2: 4 years later	NR
Pole et al. (2009)	NR	138 police	W1: Prior to active duty; W2: 1 year after start of duty	NR
Polusny et al. (2011)	29.9 (8.8)	424 National Guard soldiers	W1: Prior to deployment; W2: 2–3 mos. post-deployment	PTSD: 0%
Rademaker et al. (2011)	31.10 (8.98)	410 military personnel	W1: Prior to deployment; W2: 6 mos. post-deployment	NR
Rona et al. (2006)	33.0 (7.7)	1885 military personnel	W1: pre-deployment (2002); W2: post-deployment (unspecified)	NR
Sandweiss et al. (2011)	NR	22,630 military personnel	W1: Prior to deployment; W2: post-deployment	Psychological disorder(s): 3.3%
Schnurr et al. (1993)	NR	93 (131) young adults	W1: Freshman year of college; W2: post-Vietnam deployment	NR
Silverman et al. (1999)	16.5 (0.8)	87 adolescents	W1: Prior to concentration camp visit; W2: 1 mo.; W3: 6 mos.; W3: 12 mos. after visit	Previous psychiatric services: 14%
Soet et al. (2003)	29.20 (4.99)	103 pregnant women	W1: during pregnancy; W2: 4 weeks after giving birth	NR
van Zuiden, Geuze, et al. (2011)	29.42 (9.06)	455 military personnel	W1: Prior to deployment; W2: 6 mos. after deployment	PTSD: 0%
van Zuiden, Kavelaars, et al. (2011)	29.02 (9.17)	470 veterans	W1: Pre-deployment; W2: 6 mos. post-deployment	PTSD: 0%
van Zuiden, Geuze, et al. (2012)	NR	448 military personnel	W1: Prior to deployment; W2: 6 mos. after 4 mos. deployment	NR
van Zuiden, Heijnen, et al. (2012)	NR	526 military personnel	W1: 1–2 mos. prior to deployment; W2: 1 mo.; W3: 6 mos. after return from deployment	NR
Vasterling et al. (2010)	25.7 (5.9)	774 active duty & National Guard soldiers	W1: Prior to Iraq deployment; W2: post-deployment	NR
Weems et al. (2007)	11.35 (3.6)	52 children	W1: 17 mos. before Hurricane Katrina; W2: 6–7 mos. later	NR
Wright et al. (2012)	NR	522 soldiers	W1: 2 mos. before deployment; W2: 2 mos. after return from 12 mos. deployment	NR

Note. LT = Lifetime; Dx = Diagnosis; Hx = History;

^a Total sample reported if different from number of trauma exposed.

^b There was great variability between articles in the way premorbid diagnoses were reported. Often diagnoses were unable to be linked to DSM-IV diagnoses (e.g., “previous psychiatric services”). Subsequently, most premorbid diagnoses could not be aggregated across studies into major categories (e.g., Depression). Thus, to ensure accuracy, the wording in this Table is kept consistent with authors' original classification.

^c Two participants met criteria for specific phobia and 1 participant met criteria for generalized anxiety disorder.

^d This study was part of a longitudinal birth-cohort study, participants were only assessed for new cases of PTSD beginning from age 26; total people 238.

^e Only 27 of the participants (age 26–32) from the birth cohort study were found to meet criteria for new cases of PTSD.

^f Participants began study at an average age of 22 and were reevaluated 50 years later (so exact average age of when they were reevaluated is unknown).

as well as ruminative (Nolen-Hoekseman & Morrow, 1991), emotion-focused (Gil, 2005), avoidance (Gil & Caspi, 2006; Lengua, Long, & Meltzoff, 2006), global (Soet et al., 2003), low repressor coping (McNally et al., 2011), and cognitive coping (Asarnow et al., 1999) were predisposing risk factors for PTSD symptoms.

2.2.3. Personality factors

Personality factors were examined in 14 studies. The most commonly studied personality factors were negative affect and/or appraisals (n = 3; Bramsen, Dirkzwager, & van der Ploeg, 2000; Rademaker, van Zuiden, Vermetten, & Geuze, 2011; Weems et al., 2007), neuroticism

(n = 3; Engelhard, van en Hout, & Kindt, 2003; Knezevic, Opacic, Savic, & Priebe, 2005; Parslow, Jorm, & Christensen, 2006) and hostility (n = 2; Heinrichs et al., 2005; van Zuiden, Kavelaars, et al., 2011). Of the remaining personality factors, each was examined only once; these personality factors included: trait anxiety (n = 2; McNally et al., 2011; Weems et al., 2007), self-efficacy (n = 1; Heinrichs et al., 2005), self-esteem (n = 1; Lengua, Long, Smith, & Meltzoff, 2005), trait anger (n = 1; Merffert et al., 2008), harm avoidance (n = 1; Gil & Caspi, 2006), and trait dissociation (n = 1; Hodgins, Creamer, & Bell, 2001). A study by Schnurr et al. (1993) investigated various personality factors via the Minnesota Multiphasic Personality Inventory

(MMPI) and found that hypochondriasis, psychopathic deviate, masculinity-femininity and paranoia scales predicted PTSD symptoms.

All three studies that examined negative affect found a significant relationship with PTSD. Likewise, both studies that examined hostility found that it was a significant predictor of PTSD symptoms. In terms of neuroticism, two of the three studies that examined neuroticism found that it was a predictor of PTSD symptoms (Knezevic et al., 2005; Parslow et al., 2006). For the remaining personality factors, significant effects were found between PTSD symptoms and high hostility, trait anger, trait anxiety, harm avoidance, and trait dissociation. Of all the personality factors examined, the only factor that did not demonstrate a significant relationship with PTSD was self-esteem (Lengua et al., 2005).

2.2.4. Psychopathology

Twenty-three studies treated pretrauma psychopathology and/or functioning as a risk factor in their analyses (Asarnow et al., 1999; Boney-McCoy & Finkelhor, 1996; Breslau et al., 2006; Constans et al., 2012; Copeland et al., 2007; Farach, Mennin, Smith, & Mandelbaum, 2008; Heinrichs et al., 2005; Koenen et al., 2007, 2008; La Greca, Silverman, & Wasserstein, 1998; LeardMann et al., 2009; Lee et al., 1995; Lengua et al., 2005, 2006; MacDonald, Proctor, Heeren, & Vasterling, 2012; Nolen-Hoeksema & Morrow, 1991; Orr et al., 2012; Parslow et al., 2006; Rona et al., 2006; Sandweiss et al., 2011; Silverman et al., 1999; Soet et al., 2003; Vasterling et al., 2010). Four birth cohort studies used psychological functioning as predictors (Breslau et al., 2006; Copeland et al., 2007; Koenen et al., 2007, 2008). Only ten studies that treated psychopathology as a pretrauma predictor of PTSD following the index trauma also collected retrospective accounts of psychiatric history prior to the study's commencement (Asarnow et al., 1999; Boney-McCoy & Finkelhor, 1996; Constans et al., 2012; Heinrichs et al., 2005; Koenen et al., 2008; LeardMann et al., 2009; Lengua et al., 2006; Orr et al., 2012; Sandweiss et al., 2011; Silverman et al., 1999; See Table 1). Of the 23 studies that used psychopathology as a predictor, 19 studies found a significant effect on PTSD. The four exceptions were Farach et al. (2008), Heinrichs et al. (2005), Lee et al. (1995), and Rona et al. (2006).

Out of the 54 total studies examined in this review, the majority of studies ($n = 29$; 53.7%) did not provide any information about *pre-study* pretrauma psychopathology. In other words, 29 studies provided no information about the psychiatric history of participants *before* the studies began. It is important to note that this information is distinct from the variable indicating how many studies used pretrauma psychopathology as a predictor of trauma. Using psychopathology as a predictor of PTSD in relation to an index trauma is different than considering if participants had psychopathology prior to the commencement of the study. This information was included because while all studies in this review elucidate much about how pretrauma factors inform PTSD, it is an important caveat for consideration that individuals may have been traumatized prior to the start of these pretrauma risk factor studies. Twenty-five studies explicitly considered this possibility and included data about participant psychopathology prior to the commencement of the study.

Of these 25 studies, there was a lack of consistency in how this pretrauma variable was reported. Only one study stated that 100% of the sample did not have any form of pretrauma psychopathology (Heinrichs et al., 2005). Sixteen studies explicitly commented on the prior PTSD status of their sample, with nine studies indicating their samples were screened to ensure only participants who never had prior PTSD were included (Beevers, Lee, Wells, Ellis, & Telch, 2011; Betts et al., 2012; Bryant & Guthrie, 2007; Bryant et al., 2007; LeardMann et al., 2009; Orr et al., 2012; Polusny et al., 2011; van Zuiden, Geuze, et al., 2011; van Zuiden, Kavelaars, et al., 2011). Of the remaining seven, 10.58% of participants ($n = 3385$) had prior PTSD diagnoses (Apfel et al., 2011; Gil, 2005; Gil & Caspi, 2006; Inslicht et al., 2010; Kremen et al., 2007; Macklin et al., 1998; Merffert et al.,

2008). (For additional information on other premorbid psychiatric diagnoses, see Table 1).

2.2.5. Psychophysiological factors

Thirteen of the studies examined how psychophysiological factors predicted PTSD symptomatology. Ten of the 13 articles in this category were broadly related to arousal. Specifically, studies examined startle reactivity (Guthrie & Bryant, 2005; Orr et al., 2012; Pole et al., 2009), salivary MHPG elevations (Apfel et al., 2011); glucocorticoid receptors (van Zuiden, Geuze, et al., 2011; van Zuiden, Geuze, et al., 2012; van Zuiden, Heijnen, et al., 2012), EMG response (Guthrie & Bryant, 2006) and salivary cortisol (Heinrichs et al., 2005; van Zuiden, Kavelaars, et al., 2011). Of the studies examining arousal related factors, all but two (Heinrichs et al., 2005; van Zuiden, Kavelaars, et al., 2011) found that these factors predicted PTSD symptoms. One article examined gaze bias and found that shorter mean fixation time for fearful faces was associated with more PTSD symptoms (Beevers et al., 2011). While most of the articles in this category examined biological outputs (e.g., salivary cortisol), two articles examined the relationship between physiology and PTSD more broadly. Studies by LeardMann et al. (2009) and Lee et al. (1995) examined, more broadly, the pretrauma effects of physical health and physical stress on PTSD, and only one found a significant relationship (LeardMann et al., 2009).

2.2.6. Social ecological factors

Fourteen of the studies examined predictors that were classified into a category called social ecological factors because they represent supra-individual factors that are drawn from the individual's larger ecological system as opposed to intra-individual factors (e.g., personality). In broad terms, the variables examined by these 14 studies can be divided into two categories: 1) family of origin and 2) larger social ecology (i.e., social support beyond the family of origin and SES). (For more specific information, see Table 2). Seven of the 14 articles examined variables explicitly related to family of origin (Boney-McCoy & Finkelhor, 1996; Copeland et al., 2007; Inslicht et al., 2010; Koenen et al., 2007; Lee et al., 1995; Lengua et al., 2006; Polusny et al., 2011). Of these seven articles, five found that family of origin related variables were significant predictors of PTSD (Boney-McCoy & Finkelhor, 1996; Copeland et al., 2007; Inslicht et al., 2010; Koenen et al., 2007; Lengua et al., 2006). Another set of articles ($n = 5$) examined variables related to assault that were not explicitly confined to family, e.g., childhood assault where it is not stated that perpetrators were family members (Apfel et al., 2011; Littleton, Grills-Tauchel, Axsom, Bye, & Buck, 2012; van Zuiden, Geuze, et al., 2011; van Zuiden, Geuze, et al., 2012; van Zuiden, Heijnen, et al., 2012).

Of the 14 total articles, three articles examined factors outside the scope of family and/or assault. For example, Soet et al. (2003) examined social support that was not specifically family-related social support. Wright and colleagues found that stressors related to one's larger environment (e.g., work, home, finances) predicted PTSD (Wright, Cabrera, Eckford, Adler, & Bliese, 2012). Koenen et al. (2007) examined how more systemic, ecological factors were risk factors for PTSD. Specifically, Koenen et al. (2007) found that poverty before the age of 11 was a risk factor for later PTSD. This was the only study in this category that examined variables that were not related to some form of social support.

3. Discussion

We systematically reviewed prospective studies of trauma and PTSD to determine how pretrauma factors affected the development of PTSD symptomatology following an index trauma exposure. Categories of pretrauma predictor variables that influenced vulnerability to the disorder were identified. Subsequently, the 54 articles reviewed herein were distilled into six categories of predictors: 1) cognitive abilities; 2) coping and response styles; 3) personality

Table 2
Design information and outcomes.

Authors (year)	Purpose of study	Predictors	Pretrauma measures	Type of Trauma	PTSD measure	PTSD assessed in relation to single index trauma?	Full or Sub Criteria PTSD assessed?	Effect size	Conclusions
Apfel et al. (2011)	Examined if psychophysiological factors, childhood trauma and/or peritraumatic reactions predicted PTSD Sxs.	1. Psychophysiological factors 2. Social ecological factors	CAPS; SCID; LSC; LSC-R	First responders (i.e., active police duty)	PCL	Y	Sub	Peritraumatic distress $r^2 = .21$	Although psychophysiological factors (i.e., MHPG elevations) increased risk for PTSD Sxs, relationship fully mediated by peritraumatic distress. No direct correlation between childhood trauma and PTSD.
Asarnow et al. (1999)	Examined risk factors for PTSD Sxs in children after earthquake.	1. Coping & response styles 2. Psychopathology	SADS	Natural disasters (i.e., earthquake)	CPTSD-RI	Y	Sub	Anxiety $r^2 = .18$; Cognitive coping $r^2 = .24$	Anxiety and cognitive coping strategies predicted PTSD Sxs.
Beevers et al. (2011)	Examined if gaze bias predicted PTSD Sxs.	1. Psychophysiological	Eye tracking	War or military (i.e., war-zone stressors)	PCL	NR	Sub	Gaze fixation time $r^2 = .10$	Shorter mean fixation time for fearful faces was associated with higher PTSD Sxs as war zone stress increased.
Betts et al. (2012)	Examined verbal ability assessed at 5 years as predictor for PTSD Sxs at 21 years.	1. Cognitive abilities	PPVT-R	Other (i.e., birth cohort)	CIDI-Auto	Y	Full	Low verbal abilities for men and women OR = 2.02; Low verbal abilities for women OR = 3.89	Univariate analyses showed lowest verbal abilities were risk factor for PTSD. Multivariate analyses showed that, for women, lowest verbal ability predicted PTSD.
Boney-McCoy and Finkelhor (1996)	Examined family functioning and psychopathology as risk factor for PTSD Sxs.	1. Psychopathology 2. Social ecological factors	SCL-90-R; DIS-III	Child abuse (i.e., youth victimization)	PSS-SR	N	Sub	Victimization $d = .61$	Prior victimization and parental violence increased risk for PTSD Sxs.
Bramsen et al. (2000)	Examined pre-deployment personality traits (i.e., negativism, somatization) as risk factors for PTSD Sxs.	1. Personality factors	MMPI	War or military	MMPI; Self-Rating Inventory for PTSD	NR	Sub	Negativism $r^2 = .02$; somatization $r^2 = .01$	Personality variables (i.e., negativism, somatization) predicted PTSD Sxs severity.
Breslau et al. (2006)	Examined intelligence, anxiety disorders, and conduct problems in childhood as risk for PTSD.	1. Cognitive abilities 2. Psychopathology	DISC-R; Teacher Report Form; WISC-R	Other (i.e., birth cohort)	DIS-III	Y	Full	Anxiety disorders OR = 2.17; Teacher ratings OR = 2.26; IQ 101–115 OR = .54	Anxiety disorders and teachers' ratings of externalizing problems were predictors of PTSD. Those with IQ scores greater than 115 at age 6 years were at lower risk for PTSD than youth at or below the population mean.
Bryant and Guthrie (2007)	Examined cognitive factors (i.e., global negative appraisals) as a risk factor for PTSD.	1. Cognitive factors	DSM-IV; TEQ; CAPS; BDI-II; PTCI	First responders (i.e., firefighter duty)	PDS	Y	Full	Negative appraisals $r^2 = .20$	Negative appraisals about self predicted PTSD severity.
Bryant et al. (2007)	Examined association between overgeneralized retrieval of memories and PTSD.	1. Cognitive abilities	Autobiographical Memory Test; CAPS; TEQ; BDI-II	War or military (i.e., deployment)	PDS	Y	Full	Memory deficits $r^2 = .22$	Deficits in specific retrieval of memories predicted PTSD Sxs.
Constans et al. (2012)	Examined pre-Hurricane Katrina negative cognitions and mental illness as predictor of post-Katrina PTSD Sxs.	1. Coping & response styles 2. Psychopathology	VA assessment of mental illness;	Natural disaster (i.e., Hurricane Katrina)	SPRINT	Y	Sub	Negative cognitive bias $r^2 = .19$; Mental illness $r^2 = .12$	Pre-existing negative cognitive bias and mental illness both independently predicted PTSD post-Katrina. Negative cognitions partially mediated relationship between previous mental illness and PTSD.

Copeland et al. (2007)	Examined social ecological factors and psychopathology as predictors of PTSD.	1. Psychopathology 2. Social ecological factors	CAPA	Other (i.e., birth cohort)	CAPA	Y	Full	Anxiety OR = 8.2; Family adversity OR = 1.7	Hx of anxiety and adverse family environment were predictors of PTSD.
Engelhard et al. (2003)	Examined neuroticism as predictor for PTSD Sxs.	1. Personality factors	EPQ; PSS-SR; Negative Life Events and Trauma Questionnaire	Loss or injury (i.e., pregnancy loss)	PSS-SR	Y	Sub	Pretrauma arousal $r^2 = .19$	After controlling for pre-trauma arousal Sxs, the relationship between neuroticism and PTSD Sxs was no longer significant, suggesting that pretrauma arousal predicted PTSD.
Farach et al. (2008)	Examined preattack psychopathology (e.g., analogue GAD) fear and avoidance of emotional experience, and intolerance of uncertainty of post 9/11 attacks.	1. Psychopathology	GADQ-IV; BDI-II	Terrorism (i.e., 9/11 terrorist attack)	AEE; PDS	Y	Sub	N/A	Preattack GAD not associated with PTSD Sxs.
Gil (2005)	Examined trait coping style (i.e., problem, emotion, avoidance) as predictor of PTSD.	1. Coping & response styles	COPE	Terrorism	SCID	NR	Full	Avoidance coping = $d = .60$; Emotion coping = $d = .63$	High levels of trait avoidance coping style and high levels of trait emotion-focused coping predicted PTSD.
Gil and Caspi (2006)	Examined role of personality factors (i.e., novelty seeking, harm avoidance and reward dependence) and coping style (problem, emotion, avoidance) as predictor of PTSD.	1. Coping & response styles 2. Personality factors	COPE; TPQ	Terrorism (i.e., suicide bombers' attack)	SCID	NR	Full	Avoidance coping OR = 1.13; Harm avoidance personality OR = 1.32	Avoidance coping and harm avoidance personality dimension predicted PTSD Sxs.
Guthrie and Bryant (2005)	Examined auditory startle response as predictor of PTSD Sxs.	1. Psychophysiological factors	SCID; CAPS; TEQ; STAI; BAI; BDI-II; DES; AUDIT	First responders (i.e., firefighter duty)	SCID	Y	Sub	Skin conductance $r^2 = .18$	Skin conductance was risk factor for PTSD Sxs.
Guthrie and Bryant (2006)	Examined deficits in extinction as risk factor for PTSD Sxs.	1. Psychophysiological factors	SCID-IV CAPS; TEQ; STAI-T; BAI; BDI-II; AUDIT	First responders (i.e., firefighter duty)	CAPS; SCID-IV	Y	Sub	EMG $r^2 = .31$	Reduced extinction of aversively conditioned corrugator EMG response predicted PTSD Sxs.
Heinrichs et al. (2005)	Examined personality traits, psychophysiological factors (i.e., salivary cortisol, urinary catecholamine), and psychopathology as predictors of PTSD.	1. Personality factors 2. Psychophysiological factors 3. Psychopathology	GHQ; ZSDS; STAI; SCL-90-R; TAS; ICCB	First responders (i.e., firefighting duty)	PTSD Symptom Scale	N	Full	Personality traits $r^2 = .42$	Personality traits (i.e., combination of high levels of hostility and low levels of self-efficacy) were risk factors for the development of PTSD Sxs.
Hodgins et al. (2001)	Examined risk factors for PTSD Sxs in police recruits.	1. Personality factors	PCL-C; GHQ; NEO-FFI; DES; PLES	First responders (i.e., active police duty)	PCL-C	Y	Sub	Peritraumatic dissociation $r = .17$	Although personality factors, like neuroticism, were significant predictors of PTSD Sxs in Model 1, only peritraumatic dissociation was significant predictor in final model.
Inslicht et al. (2010)	Examined relationship between family Hx of psychopathology, substance use disorders, peritraumatic responses and PTSD Sxs.	1. Social ecological factors	SCID-IV; SCL-90-R; FHS; LSC-R; MAST	First responders (i.e., active police duty)	PCL-S	Y	Sub	Full model (i.e., Family Hx and peritraumatic stress) $R^2 = .25$	Family Hx of psychopathologies risk factors for peritraumatic distress, which in turn increased risk for PTSD.
Knezevic et al. (2005)	Examined if personality traits predicted PTSD Sxs.	1. Personality factors	NEO-PI	War or military (i.e., civilian air attacks)	Impact of Event Scale	Y	Sub	Personality $r^2 = .13$	Pretrauma personality predicted intrusion scores 1 year after the attacks.
Koenen et al. (2007)	Examined relationship between neurodevelopment,	1. Cognitive abilities 2. Psychopathology 3. Social ecological factors	Baley Motor Scale; McCarthy Motor Scale; Basic Motor Ability	Other (i.e., birth cohort)	DIS-IV; Diagnostic Interview	Y	Full	Low IQ OR = .6; SES OR = 3.4; Externalizing characteristics OR = 2.1	Low IQ, externalizing characteristics such as antisocial behavior, and

(continued on next page)

Table 2 (continued)

Authors (year)	Purpose of study	Predictors	Pretrauma measures	Type of Trauma	PTSD measure	PTSD assessed in relation to single index trauma?	Full or Sub Criteria PTSD assessed?	Effect size	Conclusions
	temperament, behavior, and family environment on development of PTSD.		Test; Stanford-Binet Intelligence Scales; Wechsler Intelligence Scale for Children-Revised		Schedule for Children				chronic environmental stressors such as low SES were PTSD risk factors.
Koenen et al. (2008)	Examined PTSD risks by examining developmental patterns of comorbidity throughout the first 3 decades of life.	1. Psychopathology	Diagnostic Interview Schedule for Children, Diagnostic Interview Schedule	Other (i.e., birth cohort)	Diagnostic Interview Schedule for Children; DIS-IV	Y	Full	Mental disorder OR = 5.7	96.3% of the participants diagnosed with current PTSD met criteria for another mental disorder (depression, anxiety disorders, conduct disorder, marijuana dependence) between 11–21 years old. 77.8% with PTSD met criteria for another mental disorder by age 15.
Kremen et al. (2007)	Examined relationship between cognitive ability and PTSD.	1. Cognitive abilities	DSM-III-R; AFQT	War or military	DSM-III-R	NR	Full	Medium-high cognitive abilities OR = .69; High cognitive abilities OR = .52	Pre-combat cognitive ability predicted PTSD such that higher pre-combat cognitive abilities served as a protective factor and lower cognitive abilities served as a risk factor.
La Greca et al. (1998)	Examined pre-disaster functioning as a predictor of children's' PTSD Sxs.	1. Psychopathology	RCMAS; SASC-R; HURTE	Natural disasters (i.e., hurricane)	PTSD-RI; HURTE	Y	Sub	At 3 mos. pre-disaster anxiety = $r^2 = .16$; attention problems $r^2 = .18$; and academic problems $r^2 = .21$; At 7 months, anxiety $r^2 = .16$.	Anxiety, inattention and academic problems contributed to PTSD Sxs at 3 months; only pre-existing levels of anxiety were significant predictors at 7 months.
LeardMann et al. (2009)	Examined whether baseline mental and physical health before combat exposure predicted PTSD.	1. Psychopathology 2. Psychophysiological factors	SF-36 V	War or military (i.e., combat exposure)	PCL-C	N	Both	Low mental health OR = 3.51; Low physical health OR = 2.22	Low physical or mental health before deployment increased the risk of PTSD. Specifically 58% of those with new onset PTSD fell below the 15th percentile for mental or physical health at baseline.
Lee et al. (1995)	Examined physical stress, childhood environment and psychological factors as predictors of PTSD.	1. Psychophysiological factors 2. Psychopathology 3. Social ecological factors	Questionnaire on socioeconomic class of parents; childhood environmental strengths; psychological soundness in college	War or military (i.e., combat exposure)	Questionnaires on attitudes toward the military, combat expose scale, physical Sxs with danger	Y	Both	N/A	No predictors included in the study were significant predictors of PTSD.
Lengua et al. (2005)	Examined personality factors and psychopathology of children after 9/11 attacks as predictors of PTSD Sxs.	1. Personality factors 2. Psychopathology	CBCL; RCMAS; CDI; YSR; SSRS; CBQ	Terrorism (i.e., 9/11 terrorist attack)	CPSS	Y	Sub	Depression $r^2 = .04$; Conduct problems $r^2 = .05$; Low social competence $r^2 = .05$; Low self-esteem $r^2 = .04$	Psychopathology (depression and conduct problems), low social competence and low self-esteem were risk factors for PTSD Sxs.
Lengua et al. (2006)	Examined psychopathology as predictor of PTSD Sxs in children after 9/11 attacks.	1. Coping & response styles 2. Psychopathology 3. Social ecological factors	CDI; CBCL; General Life Events Schedule for Children 24-item "What I felt Scale" Children's Coping Strategies Checklist	Terrorism (i.e., 9/11 terrorist attacks)	CPSS	Y	Sub	Preattack stress load $r^2 = .11$; Appraisal $r^2 = .04$; Avoidant $r^2 = .08$	Preattack stress load, appraisal, and avoidant coping styles predicted PTSD Sxs.
Littleton et al. (2012)	Examined response to school shootings for	1. Social ecological factors	SES; CES-D; MSPSS;	School shooting	PSS-SR	Y	Sub	Victimization $d = .30$	Prior victimization increased risk for PTSD.

Lommen et al. (2013)	women with and without prior sexual victimization history. Examined deficits in extinction learning as risk factor for PTSD Sxs.	1. Cognitive abilities	De Novo Conditioning task; PSS-SR; EPQ-N	War or military (i.e., deployment)	SCID	Y	Sub	Extinction learning $r^2 = .03$	Reduced extinction learning predicted PTSD Sxs.
MacDonald et al. (2012)	Examined how pre-deployment PTSD Sxs predicted post-deployment Sxs.	1. Psychopathology	PCL	War or military (i.e., war-zone stressors)	PCL	Y	Sub	Numb-Arousal $r^2 = .02$; Numb-Re-exper. $r^2 = .02$; Numb-Avoid $r^2 = .03$; Numb- Numb $r^2 = .16$; Arousal-Arousal $r^2 = .10$; Arousal-Re-exper. $r^2 = .02$; Arousal-Numb $r^2 = .01$ Intelligence $r^2 = .08$	Pre-deployment numbing was positively correlated with all post-deployment clusters, and pre-deployment hyperarousal was positively correlated with post-deployment hyperarousal, reexperiencing, and numbing increased risk for developing PTSD Sxs.
Macklin et al. (1998)	Examined cognitive ability as risk factor for PTSD Sxs.	1. Cognitive abilities	CES; AFQT; WAIS-R; Shipley Institute of Living Scale	War or military (i.e., Vietnam combat)	CAPS	NR	Sub		Lower pretrauma intelligence increased risk for developing PTSD Sxs.
McNally et al. (2011)	Examined if repressor coping style was protective factor for PTSD Sxs.	1. Coping & response styles	MAS; SDS; CD-RISC	War or military (i.e., war-zone stressors)	PCL-M	NR	Sub	Repressor coping Arousal $r^2 = .08$ ($r = 0.29$); Trait anxiety $r^2 = .14$ (.38)	Higher repressor coping predicted lower PTSD Sxs but relationship primarily attributed to trait anxiety.
Merffert et al. (2008)	Examined trait anger as predictor of PTSD Sxs.	1. Personality factors	STAXI-2; WAS; SOS; PDEQ; LSC-R	First responders (i.e., police service)	MCS-CV; CIHQ	Y	Sub	Trait anger $r^2 = .04$	Trait anger was a risk factor for PTSD Sxs.
Nolen-Hoekseman and Morrow (1991)	Examined psychopathology and ruminative response styles as predictors of PTSD Sxs.	1. Coping & response styles 2. Psychopathology	IDD; RSQ	Natural disasters (i.e., earthquake)	IDD* selected the PTSD Sxs	Y	Sub	Ruminative style $r^2 = .03$; Stress $r^2 = .11$	Ruminative style and stress predicted higher levels of PTSD Sxs 10 days after earthquake.
Orr et al. (2012)	Examined psychological, psychophysiological and personality variables as risk factors for PTSD.	1. Cognitive abilities 2. Psychopathology 3. Psychophysiological factors	WAIS-R EST-IQ; BDI; SCL-90-R GSI; STAI-T; SCID; CAPS; Left orbicularis oculi and corrugator EMG; skin conductance; heart rate	First responders (i.e., firefighting and police duty)	CAPS; SCID; IES-R	Y	Full	Low IQ OR = .95; Heart rate OR = 1.17	Low IQ and heart rate to were both independent predictors of PTSD Sxs.
Parslow et al. (2006)	Examined psychopathology and personality factors (i.e., neuroticism) as predictor of PTSD Sxs.	1. Personality factors 2. Psychopathology	Goldberg's Depression and Anxiety Scores; EPQ-R	Natural disaster (i.e., bush fire)	TSQ	Y	Sub	Depressive & Anxiety IRR = 1.03; Neuroticism IRR = 1.03	Depressive, anxiety, and neuroticism, were predictors of PTSD Sxs.
Parslow and Jorm (2007)	Examined neurocognitive deficits as risk factor for PTSD Sxs.	1. Cognitive abilities	WMS; AUDIT; Symbol-Digit Modalities Test; California Verbal Learning Test; The Spot-the-Word Test-Version A	Natural disasters (i.e., bush fire)	TSQ	Y	Sub	N/A	Poorer performance on neurocognitive tests was a vulnerability factor for PTSD Sxs.
Pole et al. (2009)	Examined pretrauma startle reactivity as predictor of PTSD.	1. Psychophysiological factors	SCID; LSC-R; SCL-90-R; SDS; left eye-blink EMG activity; Skin conductance level and Heart rate assessed	First responder (i.e., police duty)	PCL; CIHQ	Y	Full	Subjective fear $r^2 = .13$; Skin conductance $r^2 = .25$; Slower skin conductance = $r^2 = .25$	Startle measures (i.e., greater subjective fear under low threat, greater skin conductance under high threat, and slower skin conductance habituation) predicted PTSD.
Polusny et al. (2011)	Examined host of pre-deployment social ecological factors (e.g., childhood family environment) as risk factor for PTSD Sxs.	1. Social ecological factors	PCL-C; DRR1; Concerns about Family/Life Disruptions scale; Childhood Family Environment scale; Preparedness scale	War or military (i.e., military deployment)	PCL-M; Post-deployment Stressors scale; Post-deployment Social Support Scale	N	Sub	N/A	After controlling for post-deployment factors, none of pre-deployment factors predicted PTSD.
Rademaker et al. (2011)	Examined personality factors (i.e., negative affect and social inhibition) as risk factors for PTSD Sxs.	1. Personality factors	ETISR-SF; Type D personality scale	War or military (i.e., deployment stressors)	SRIP	NR	Sub	Negative affect $r^2 = .13$; Childhood emotional abuse $r^2 = .03$	Negative affect and self-reported exposure to childhood emotional abuse predicted PTSD Sxs.

Table 2 (continued)

Authors (year)	Purpose of study	Predictors	Pretrauma measures	Type of Trauma	PTSD measure	PTSD assessed in relation to single index trauma?	Full or Sub Criteria PTSD assessed?	Effect size	Conclusions
Rona et al. (2006)	Examined pre-deployment psychopathology before Iraq war as predictor of PTSD.	1. Psychopathology	PCL-C; GHQ-12; Self-Assessment of Health Status SF-36; WHO Audit	War or military (i.e., combat)	PCL-C	NR	Full	N/A	Results indicated screening for mental disorder did not predict PTSD.
Sandweiss et al. (2011)	Examined pre-deployment psychiatric status as predictor for PTSD Sxs.	1. Psychopathology	PHQ; ISS	War or military (deployment stressors)	PCL-C	NR	Sub	Psychiatric Sxs OR = 2.52	Previous psychiatric Sxs increased risk for post-deployment PTSD.
Schnurr et al. (1993)	Examined pre-deployment MMPI scores as predictors of PTSD Sxs.	1. Personality factors	MMPI	War or military (deployment stressors)	SCID	NR	Both	Hypochondriasis $d = .42$; Psychopathic deviant $d = .57$; Masculinity-femininity $d = .47$; Paranoia $d = .50$	Pre-deployment personality predicted LT PTSD Sxs in Vietnam Veterans.
Silverman et al. (1999)	Examined psychopathology as risk factor for PTSD Sxs.	1. Psychopathology	SCL-90-R; MCS-CV	Other (i.e., visiting WWII concentration camps)	IES; MCS-CV	NR	Sub	N/A	Previous psychiatric Sxs (paranoia, depression, obsessive-compulsive tendencies, psychosis) increased risk of PTSD Sxs.
Soet et al. (2003)	Examined personality factors, social support, coping styles as predictors of PTSD.	1. Coping & response styles 2. Psychopathology 3. Social ecological factors	PAI; W-DEQ Version A; CBSEI; MOS; STAI; Past Traumatic Experience; SOC	Loss or Injury (i.e., childbirth)	TES	Y	Both	Self-efficacy $d = .54$; Locus of control $d = .54$; Trait anxiety $d = 1.02$; Global coping $d = .70$; Social support $d = .43$	Personality factors (i.e., self-efficacy, less internal locus of control, higher trait anxiety), poorer global coping abilities, and lower levels of social support predicted PTSD Sxs.
van Zuiden, Geuze, et al. (2011)	Examined dexamethasone binding capacity of leukocytes, as a measure of glucocorticoid receptor number, as predictor of PTSD symptoms.	1. Psychophysiological factors 2. Social ecological factors	SRIP; SCL-90; ETI-DV; Dexamethasone Binding; mRNA expression of GR target genes	War or military (i.e., war-zone stressors)	SRIP	NR	Sub	GR OR = 7.53; Child trauma $d = .76$	Pre-deployment high number of GR in peripheral mononuclear cells increased risk for PTSD Sxs. Child trauma also significant predictor.
van Zuiden, Kavelaars, et al. (2011)	Examined whether pre-deployment personality and psychophysiological factors (i.e., cortisol) predicted development of PTSD Sxs.	1. Personality factors; 2. Psychophysiological factors	CMH; TCI-SF; ETI-DV	War or military (i.e., deployment stressors)	SRIP	NR	Sub	Model $R^2 = .24$	High hostility and low self-directedness predicted PTSD; also mediated relationship between child trauma and age and PTSD. Psychophysiological arousal (i.e., cortisol) not associated with PTSD.
van Zuiden, Geuze, et al. (2012)	Examined glucocorticoid receptor pathway	1. Psychophysiological 2. Social ecological factors	SRIP; SCL-90; ETI-DV; Dexamethasone binding; GR number; GR	War or military (i.e.,	SRIP	NR	Sub	High GR number OR = 2.63; <i>FKBP5</i> OR = .069; <i>GILZ</i>	High GR number, low <i>FKBP5</i> mRNA expression, high <i>GILZ</i> mRNA

	components as PTSD risk factor.		subtype; GR target gene mRNA expression; cortisol levels	combat-zone stressors)				OR = 4.98; Childhood trauma OR = 1.80	expression, childhood trauma each associated with high level of PTSD Sxs.
van Zuiden, Heijnen, et al. (2012)	Examined if sensitivity of leukocytes for GCs is risk factor for PTSD Sxs.	1. Psychophysiological factors 2. Social ecological factors	CIS-20R; SCL-90; SRIP; ETI; Dexamethasone binding; GR number; GR subtype; GR target gene mRNA expression; cortisol levels	War or military (i.e., combat-zone stressors in Afghanistan)	SRIP	NR	Sub	OR = 1.065	Sensitivity of leukocytes for GCs is risk factor for PTSD.
Vasterling et al. (2010)	Examined how pre-deployment PTSD Sxs predicted post-deployment Sxs.	1. Psychopathology	PCL	War or military (i.e., war-zone stressors)	PCL	Y	Sub	Active duty: Pre-deployment PCL scores $r^2 = .34$; National Guard: Pre-deployment PCL scores $r^2 = .16$	Pre-deployment PCL scores predicted post-deployment PTSD Sxs.
Weems et al. (2007)	Examined negative affect and trait anxiety as predictor for PTSD Sxs.	1. Personality factors	STAIC-T; RCADS; PANAS-C	Natural disasters (i.e., Hurricane Katrina)	The Child Posttraumatic Stress Disorder Checklist	Y	Sub	Negative affect $r^2 = .11$; Trait anxiety $r^2 = .07$	Negative affect and trait anxiety predicted development of PTSD Sxs.
Wright et al. (2012)	Examined how functional impairment predicted PTSD Sxs.	1. Social ecological	PCL; PHQ; Anger items	War or military (i.e., war-zone stressors)	PCL	N	Sub	Functional impairment $r^2 = .02$	Pre-deployment functional impairment predicted post-deployment PTSD

Note. Sxs = Symptoms; CAPS = Clinician Administered PTSD Scale; SCID = Structured Clinical Interview for DSM disorders; LSC = Life Stressor Checklist; LSC-R = Life Stressor Checklist-R; MHPG = 3-Methoxy-4-hydroxyphenylglycol; PCL = PTSD checklist; SADS = Schedule for Affective Disorders and Schizophrenia for School-Age Children-Epidemiologic version; CPTSD-RI = Children's Posttraumatic Stress Disorder Reaction Index; PPVT-R = Peabody Picture Vocabulary Test-Revised; CIDI-Auto = Composite International Diagnostic Interview Version 2.1; OR = Odd Ratio; SCL-90-R = Symptom Checklist-90-Revised; DIS III = National Institute of Mental Health Diagnostic Interview Schedule; PSS-SR = PTSD Symptom Scale-Self Report; MMPI = Dutch Short Version; DISC-R = Revised Version of the Diagnostic Interview Schedule for Children; WISC-R = Wechsler Intelligence Scale for Children-Revised; DSM-IV = Structured Clinical Interview for DSM-IV; TEQ = Traumatic Events Questionnaire; BDI-II = Beck Depression Inventory (Version 2); PTCI = Posttraumatic Cognitions Inventory; PDS = Posttraumatic Stress Disorder Scale; SPRINT = Short PTSD Rating Interview; CAPA = Child and Adolescent Psychiatric Assessment; Hx = History; EPQ = Eysenck Personality Questionnaire; GAD = Generalized Anxiety Disorder; GADQ-IV = Generalized Anxiety Disorder Questionnaire-IV; AEE = Assessment of Exposure to the Events; COPE = Multidimensional Coping Inventory; TPQ = Tridimensional Personality Questionnaire; STAI = State-Trait Anxiety Inventory; BAI = Beck Anxiety Inventory; DES = Dissociative Experiences Scale; AUDIT = Alcohol Use Disorders Identification Test; SCID-IV = Structured Clinical Interview for DSM-IV; STAI-T = Trait version of the State Trait Anxiety Inventory; EMG = Electromyography; GHQ = General Health Questionnaire; ZSDS = Zung Self-Rating Depression Scale; TAS = Toronto Alexithymia Scale; ICCB = Inventory on Competence and Control Beliefs; NEO-FFI = The NEO-Five Factor Inventory; PLES = The Scale for Traumatic Stress Incidents in Police Work; PCL-C = PTSD Checklist-Civilian Version; FHS = Family History Screen; MAST = Michigan Alcoholism Screening Test; PCL-S = PTSD Checklist-Specific; NEO-PI = NEO Personality Inventory; DSM-III-R = Structured Clinical Interview for DSM-III-R; AFQT = Armed Forces Qualification Test; RCMAAS = Revised Children's Manifest Anxiety Scale; SAS-R = Social Anxiety Scale for Children-Revised; HURTE = Hurricane-Related Traumatic Experiences; PTSD-RI = Posttraumatic Stress Disorder-Reaction Index for Children; SF-36 V = Multi-purpose Short Form survey with 36 questions, Modified version; CDI = Child Depression Inventory; CBCL = Child Behavior Checklist; CPSS = Child PTSD Symptom Scale; YSR = Youth Self Report; SSRS = Social Skills Rating Scale; CBQ = Child Behavior Questionnaire; SES = Sexual Experiences; CES-D = Center for Epidemiologic Studies Depression Scale; MSPSS = Multidimensional Scale of Perceived Social Support; EPQ-N = Eysenck Personality Questionnaire-short version; CES = Combat Exposure Scale; WAIS-R = Wechsler Adult Intelligence Scale-Revised; MAS = Manifest Anxiety Scale; SDS = Social Desirability Scale; CD-RISC = Connor-Davidson Resilience Scale; STAXI-2 = State-Trait Anger Expression Inventory, 15-item scale (major components of state anger); WAS = World Assumption Scale; SOS = The Sources of Support; PDEQ = Peritraumatic Dissociation Questionnaire; MCS-CV = The Mississippi Combat Scale-Civilian Version; CIHQ = Critical Incident History Questionnaire; IDD = Interview to Diagnose Depression; WAIS-R EST-IQ = Estimated WAIS-R Full Scale IQ from Shipley Institute of Living Scale; SCL-90-R GSI = Symptom Checklist 90-Revised; IES-R = Impact of Event Scale-Revised; RSQ = Response Styles Questionnaire; WMS = Wechsler Memory Scale; TSQ = Trauma Screening Questionnaire; EPQ-R = Eysenck Personality Questionnaire-Revised; IRR = Incident Rate Ratio; DRRI = Deployment Risk and Resilience Inventory; PCL-M = PTSD Checklist-Military Version; ETISR-SF = Dutch self-report short-form version of the Early Trauma Inventory; SRIP = Self-Rating Inventory for PTSD symptoms; GHQ-12 = General Health Questionnaire 12; WHO Audit = World Health Organization's Alcohol use Disorders Identification Test; PHQ = Primary Care Evaluation of Mental Disorders Patient Health Questionnaire; ISS = Injury Severity Score; LT = Life Time; IES = Impact of Events Scale; PAI = Pregnancy Attitude Index; W-DEQ Version A = Wijma Delivery Expectancy Questionnaire; CBSEI = Childbirth Self-Efficacy Inventory; MOS = Medical Outcomes Study Social Support Survey; SOC = Sense of Coherence Scale; TES = Traumatic Event Scale; ETI-DV = Early Trauma Inventory-Dutch Version; GR = glucocorticoid receptor; GCs = glucocorticoids; CIS-20R = Dutch 20-item Checklist Individual Strength; CMH = Cook-Medley Hostility Scale; TCI-SF = Temperament-Character Inventory; STAIC-T = The State-Trait Inventory for Children; RCADS = The Revised Child Anxiety and Depression Scale; PANAS-C = The Positive and Negative Affect Schedule-Child Version.

factors; 4) psychopathology; 5) psychophysiological factors; and 6) social ecological factors (e.g., family of origin, social support, poverty).

Examination of these categories revealed that many of these categories, long considered aspects of posttrauma psychopathology, were actually present before the index trauma. For instance, consider the predictor category of psychophysiological factors. Cross-sectional studies have suggested that psychophysiological arousal may be a PTSD risk factor (Orr et al., 2003). However, arousal is a hallmark symptom of PTSD. Thus, it has been impossible to discern if the very symptoms thought to be part of PTSD's expression were also causal elements in its etiology. Ten prospective studies in this review examined the chronological ordering of pretrauma arousal (either biological or psychological) and PTSD; eight concluded that arousal was a predictor of PTSD (Apfel et al., 2011; Guthrie & Bryant, 2005; Guthrie & Bryant, 2006; Orr et al., 2012; Pole et al., 2009; van Zuiden, Geuze, et al., 2011; van Zuiden, Geuze, et al., 2012; van Zuiden, Heijnen, et al., 2012). The results from these eight studies suggest that arousal may not be simply a symptom of PTSD but rather one of its etiological antecedents. Just as arousal is a currently classified as a symptom of PTSD so, too, are hostility and anger. The results from six studies suggested that negative affect, hostility and anger represented pretrauma vulnerability for PTSD (Bramsen et al., 2000; Heinrichs et al., 2005; Merffert et al., 2008; Rademaker et al., 2011; van Zuiden, Kavelaars, et al., 2011; Weems et al., 2007). Likewise the results from the pretrauma predictor category of coping and response styles indicated that avoidance and rumination, also symptoms of PTSD (DSM-IV; American Psychiatric Association, 2000), are characteristics that precede the trauma (Gil, 2005; Gil & Caspi, 2006; Nolen-Hoekseman & Morrow, 1991). The consequences of these findings are suggestive of a tautology whereby certain dispositions and coping styles place people at risk for developing a condition that, definitionally, involves a negative disposition.

Another variable implicated in cross-sectional research was pretrauma intelligence. While there has long been an established association between lower intelligence and PTSD (e.g., McNally & Shin, 1995), cross-sectional work has been unable to determine if lower intelligence is a cause or a consequence of PTSD. In the present review, there were 10 studies that examined cognitive abilities prior to the index trauma; interestingly, all 10 of these studies found that lower pretrauma cognitive abilities were a risk factor for PTSD.

In terms of the pretrauma psychopathology category, the notion of distress following trauma is certainly not a new concept. In fact, one of the earliest surviving works of literature, the *Epic of Gilgamesh*, describes Gilgamesh's great distress following the death of his friend, Enkidu (George, 2003). In more recent years, empirical data has corroborated the observations of ancient authors, concluding that psychiatric sequelae do follow traumatic exposure (e.g., North et al., 1999). But as it has become increasingly evident that psychopathology is not an inevitable consequence of trauma another question has emerged: Does having other forms of psychopathology comprise immunity to subsequent forms of psychopathology? Results from 19 of 23 studies that used pretrauma psychopathology as a predictor of PTSD indicate prior psychiatric functioning is a predictor of PTSD symptomatology (Asarnow et al., 1999; Boney-McCoy & Finkelhor, 1996; Breslau et al., 2006; Constans et al., 2012; Copeland et al., 2007; Koenen et al., 2007, 2008; La Greca et al., 1998; LeardMann et al., 2009; Lengua et al., 2005, 2006; MacDonald et al., 2012; Nolen-Hoekseman & Morrow, 1991; Orr et al., 2012; Parslow et al., 2006; Sandweiss et al., 2011; Silverman et al., 1999; Soet et al., 2003; Vasterling et al., 2010). These findings, suggesting that illness begets illness, raise interesting questions about the constellation of symptoms thought to be pathognomonic markers of trauma. Further research that disambiguates the symptoms of trauma from other disorders may ultimately do much to inform interventions that address underlying pathology in the most effective ways.

Out of the six pretrauma predictor categories only one represented supra-individual phenomena. This category, named social ecological factors, encompassed articles that examined how factors beyond the

individual (e.g., family, community) affected vulnerability to PTSD; the other five categories all reflected intra-individual characteristics (e.g., intelligence, personality). The diagnosis of PTSD—arguably more so than any other mental disorder—is predicated on extra-individual phenomena. Trauma, the core component of the diagnosis, is definitionally an extra-individual event that transpires between an individual and the environment. The 14 studies that constitute this pretrauma predictor category provide critical prospective evidence that a host of factors in the individuals larger ecology influence vulnerability to the disorder. Although a range of social ecological predictor variables were considered by these 14 articles, thereby limiting the specificity of conclusions that can be drawn, seven of the 14 articles had significant findings related largely to various aspects of family functioning. One article considered the interplay between larger socioeconomic factors and found that poverty was a predictor of PTSD (Koenen et al., 2007). Taken together, the findings of these 14 articles offer exciting research avenues for further investigation into the precise mechanisms of how negative circumstances in the larger social ecology (e.g., poverty, family distress, unemployment) affect vulnerability to PTSD.

How can these six types of pretrauma predictors be used to inform future work and, ultimately, clinical interventions? Perhaps, these categories of predictors are best conceptualized along a continuum of “risk factor malleability.” At one end of this continuum are the categories that represent fixed predictors, which based on previous research are generally stable across the lifespan; Such predictors would include: personality and cognitive abilities (e.g., Costa & McCrae, 1988). Toward the other end of the continuum are the predictors that previous research suggests are more malleable, including coping styles and life stressors (Ekkers et al., 2011). The remaining predictors identified in this review (i.e., pretrauma psychopathology and psychophysiological factors) would likely be positioned somewhere between the two ends. By conceptualizing the predictors along such a continuum, this may provide an interesting opportunity for future research. It may also help in allocating resources to areas that are the most susceptible to change in terms of both prevention and treatment. Research that explores how these categories of pretrauma factors may be useful to direct public health efforts aimed at preventing PTSD and targeting early interventions at high-risk groups posttrauma would certainly be of use.

The concept of a pretrauma risk factor continuum can also be conceptualized in ways similar to how conditional risk for PTSD is associated with various types of traumas. In addition to some pretrauma risk factors being more “malleable” than others, it may also be the case that all pretrauma vulnerabilities are not created equal. In other words, certain vulnerabilities may place people at greater risk than others. Although this review does not answer these questions, it highlights them in the hopes of drawing further attention and, ultimately, inquiry into who is at greatest risk for PTSD and why.

Another contribution of this review is that it now provides a point of comparison between pretrauma studies of PTSD versus retrospective studies of pretrauma functioning. In particular, the present review—offering a single, concise synthesis of pretrauma prospective studies—can be compared against Ozer et al. (2003) meta-analytic review, the most comprehensive review of cross-sectional studies exploring predictors of PTSD. Theirs, a review of 2,647 articles that spanned 16 years, found seven predictor categories including 1) prior trauma, 2) prior psychological adjustment, 3) family history of psychopathology, 4) perceived life threat during the trauma, 5) posttrauma social support, 6) peritraumatic emotional responses, and 7) peritraumatic dissociation. The comparison between Ozer et al.'s (2003) predictor categories, which draws almost entirely from cross-sectional studies, and the categories synthesized by this review highlights important points.²

² The primary reason that there is limited overlap between the studies included in Ozer et al.'s (2003) review and the present review is because the majority of studies in this review were published after 2000, the year Ozer and colleagues concluded their literature search.

First, there is considerable overlap in the predictors put forth by the cross-sectional and prospective, longitudinal studies. Specifically, Ozer et al.'s (2003) categories of prior trauma, prior psychological adjustment, and family history of psychopathology are all subsumed by this review's category, called social ecological factors. While our category has been expanded to include larger systemic factors like poverty, it, too, includes family history of psychopathology and prior history of trauma. Our review also found that multiple studies identified pretrauma psychopathology as a predictor of subsequent PTSD. Taken together, the results from these two review articles provide compelling and converging evidence that pretrauma environmental and psychopathologic vulnerabilities contribute to the course of PTSD.

The second important point is the divergence in findings between the previous meta-analysis and the current review. Interestingly, the remaining four of Ozer's seven categories are not pretrauma assessments, but rather are self-reports of peri or posttraumatic exposure; these include: perceived life threat during the trauma, posttrauma social support, peritraumatic emotional responses, and peritraumatic dissociation. In fact, Ozer et al. (2003) state that "peritraumatic psychological processes, not prior characteristics, are the strongest predictors of PTSD" (Ozer et al., 2003, p. 52).

However, given that their methodological investigation of prior characteristics was stymied by an almost complete absence of prospective studies, their conclusion about the effects of prior pretrauma characteristics seems beset by the same methodological problems that hinder all retrospective accounts of trauma. Thus, an important contribution of the current review is that it has provided a summary of studies that have surmounted some of the limitations posed by retrospective research. As the 54 studies reviewed here were selected because of their focus on pretrauma influences, the majority of studies did not examine peritraumatic factors as they, by definition, do not occur pretrauma.³ Therefore, the studies included here and the others examined by Ozer et al. (2003) are generally not examining overlapping phenomena and are, thus, unable to provide a point of comparison on the predictive influence of pretrauma versus peritraumatic factors.

Future research should seek to elucidate the gap between what we know from these 54 studies and what we know from earlier retrospective work. For example, as the Ozer et al. (2003) has elucidated, there is much evidence to demonstrate that both peritraumatic and posttraumatic risk factors, too, play a role in the PTSD risk trajectory. For example, if peritraumatic dissociation is a robust predictor of PTSD, then what are the pretrauma predictors of dissociation? As is the case with PTSD, peritraumatic dissociation is a complex phenomenon that does not occur consistently across trauma survivors (Lensvelt-Mulders et al., 2008). Again the perennial question of pretrauma vulnerability emerges: What, then, are the pretrauma factors that influence dissociation? It is also known that lack of social support posttrauma is risk factor for PTSD (Ozer et al., 2003). Another interesting question emerges: What are the pre and peritrauma factors that influence social engagement? Future research that examines this complex and reciprocal relationship between pretrauma, peritrauma and posttrauma factors and will do much to clarify the full picture surrounding PTSD risk.

Our review also identifies limitations in the extant literature. First, the type of index trauma varied widely across studies with many studies focused on a single type of trauma. It is well documented that the conditional risk of PTSD varies by the type of event and developmental timing of exposure (e.g., Breslau et al., 1998). The predictor categories and our subsequent inferences do not consider trauma timing or type. Thus, it is not possible to specify how the effects of predictors may vary based on trauma type or developmental timing. For example,

several genetic studies have shown the effect of genotype on risk for PTSD is different for childhood versus adult trauma exposure (Binder et al., 2008; Xie et al., 2010).

Second—and further related to the issue of an index trauma—several articles did not anchor their assessment of PTSD to a specific index trauma. While 33 of the studies asked participants at the post-trauma assessment to rate their symptoms in relation to the index traumatic event, five of the studies explicitly stated they did not ask participants to report on their PTSD symptomatology with a specific index event in mind. The remaining 16 studies did not report this information and it is subsequently unknown.

The lack of tethering the event to a specific event is problematic for an obvious methodological reason; the risk of PTSD is not shared equally amongst all events (e.g., Breslau et al., 1998). Thus, if participants were not instructed to think of the specific event germane to the study in question, it leaves open the possibility that participants were responding about symptomatology to a diverse range of events.

Third, differences in the definition of PTSD case status across studies are an additional limitation in extant research. It has likewise limited our ability to draw conclusions. Fourteen of the studies assessed full DSM-III or DSM-IV criteria for PTSD whereas 36 used subclinical criteria. The distinction between full and sub-criteria PTSD is important as earlier work has shown important differences in individuals with full diagnostic PTSD compared to those with sub-threshold PTSD (Breslau, Reboussin, Anthony, & Storr, 2005).

Fourth, the predictor variable categories were created with as much specificity as could be generated based on the information available. However, the predictors are fairly broad and there is certainly room for more specificity in future studies to further operationalize the predictor variables in more specific terms that may help us gain clearer insight into the precise mechanisms that affect the etiology of PTSD. Consider, for instance, the category of cognitive functioning. Although several studies indicated that impaired cognitive functioning is a pretrauma vulnerability for PTSD, there is considerable variability in both the neuropsychological instrumentation used and cognitive domains assessed. As a function of substantial variability in a relatively small collection of studies, some domains of cognitive function have been assessed by only one study. For example, the domain of memory has received considerable attention in the PTSD literature (van der Kolk, 1994; van der Kolk & Fisler, 1995); however, only one article in this review, examined the domain of memory (Parslow & Jorm, 2007).

Finally, what is arguably the largest limitation of this review is, ironically, the same that compromises the conclusions of retrospective studies critiqued earlier in this review. Although every study included in this review assessed individuals prior to and following an index traumatic exposure(s), the majority of these traumas occurred during a time-delimited period. Subsequently, traumas transpiring prior to the commencement of these studies could have affected baseline functioning in ways unable to be captured in these articles. Given that most individuals will be traumatized multiple times during their lives (Breslau et al., 1998), it is likely that individuals experienced multiple traumas before the baseline assessment of these prospective studies. The insidious consequence is that despite the impressive foresight and strong methodological designs of these studies, their conclusions about pretrauma functioning are clouded by the unmeasured effects of other traumas occurring before the commencement of these very studies designed to assess pretrauma functioning.

What are possible solutions to this dilemma? One possible methodological antidote to this quandary is the birth cohort model. Of the 54 studies included in this review, five were birth cohort studies. These studies offer particularly rich data and conclusions. Certainly, the resources required to conduct birth cohort studies are substantial; however, other psychopathologies, like depression and conduct disorder, have received substantial attention through birth cohort studies (e.g., Bardone, Moffitt, Caspi, & Dickson, 1996; Fergusson, Boden, & Horwood, 2008). Of course, birth cohort studies come with their own

³ The three exceptions were articles by Apfel et al. (2011), Hodgins et al. (2001), and Inslicht et al. (2010), which in addition to pretrauma factors, also examined peritraumatic dissociation. However, even the Apfel et al. (2011), and Inslicht et al. (2010) articles explicitly noted that it was pretrauma factors that were predictive of peritraumatic dissociation, which in turn predicted PTSD.

limitations. In addition to being resource intensive, they also do not address questions of intergenerational and genetic transmission of trauma. However, given the profound personal and public health consequences trauma and PTSD, it may be prudent to invest further resources in understanding more about the relationship between trauma and PTSD.

There are several limitations in the current review. First, this article is a qualitative review of 54 quantitative studies. Although this is not a meta-analysis, it is hoped that this literature review will offer a first step in providing an aggregate and conceptual understanding of the findings across multiple prospective, longitudinal studies of PTSD. Furthermore, a non-quantitative review allowed for consideration of a wider range of predictors, given that many of the predictors were considered by only a small number of studies. Once there are larger collections of studies exploring similar predictor variables, a meta-analysis would then represent a useful contribution. Another limitation is that we reviewed only articles in English and did not include non-peer reviewed sources. Finally, genetic studies of PTSD were not included in this review. As genotype is established at conception, genetic studies of PTSD are inherently prospective. However, a number of reviews have already done much to elucidate this relationship between genes and PTSD (Cornelis, Nugent, Amstadter, & Koenen, 2010). Thus, we felt like those efforts need not be duplicated here.

4. General conclusions

Although sequelae of trauma can be profound, the conclusions of these 54 studies suggest that not all negative aspects of trauma are outcomes of it; rather these studies suggest that certain factors predispose individuals to PTSD. The major conclusion of this review is that many factors, historically thought to be consequences of trauma, are most likely risk factors for PTSD. More specifically, some studies suggest that the very symptoms of PTSD are, in fact, not symptoms of an index trauma, but may play a causal role in its etiology. The idea of pretrauma vulnerability is certainly not a new notion, but it appears to be one that merits further attention. PTSD continues to exact a major toll on individuals, families and communities, and its public health implications are profound (Meltzer-Brody, Hidalgo, Connor, & Davidson, 2000). As we continue our attempt to understand PTSD in an effort to ultimately mitigate its effects, we may be well served delve deeper into the nature of pretrauma risk factors in order to aid in the identification and treatment of those most at risk.

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