Remission from post-traumatic stress disorder in adults: A systematic review and meta-analysis of long term outcome studies

Nexhmedin Morina [a,*], Jelte M. Wicherts [b], Jakob Lobbrecht [a], Stefan Priebe [c]

[a] Department of Clinical Psychology, University of Amsterdam, Amsterdam, The Netherlands
[b] Department of Methodology and Statistics, Tilburg University, The Netherlands
[c] Unit for Social and Community Psychiatry, Queen Mary University of London, UK

HIGHLIGHTS

- We conducted a meta-analysis on spontaneous long-term remission from PTSD.
- Remission was defined as reporting PTSD at baseline and not after at least ten months.
- 42 studies and 81,642 participants were included.
- Overall, 44.0% of participants remitted from PTSD after a mean of 40 months.

ARTICLE INFO

ABSTRACT

Posttraumatic stress disorder (PTSD) is a frequent mental disorder associated with significant distress and high costs. We conducted the first systematic review and meta-analysis on spontaneous long-term remission rates, i. e., without specific treatment. Data sources were searches of databases, hand searches, and contact with authors. Remission estimates were obtained from observational prospective studies of PTSD without specific treatment. Remission was defined as the actual percentage of PTSD cases at baseline who are non-cases after a minimum of ten months. Forty-two studies with a total of 81,642 participants were included. The mean observation period was 40 months. Across all studies, an average of 44.0% of individuals with PTSD at baseline were non-cases at follow-up. Remission varied between 8 and 89%. In studies with the baseline within the first five months following trauma the remission rate was 51.7% as compared to 36.9% in studies with the baseline later than five months following trauma. Publications on PTSD related to natural disaster reported the highest mean of remission rate (60.0%), whereas those on PTSD related to physical disease reported the lowest mean of remission rate from PTSD (31.4%). When publications on natural disaster were used as a reference group, the only type of traumatic events to differ from natural disaster was physical disease. No other measured predictors were associated with remission from PTSD. Long-term remission from PTSD without specific treatment varies widely and is higher in studies with the baseline within five months following trauma.

© 2014 Elsevier Ltd. All rights reserved.

Contents

* Corresponding author at: University of Amsterdam, Department of Clinical Psychology, Weesperplein 4, 1018 XA Amsterdam, The Netherlands. Tel.: +31 20 525 8607; fax: +31 20 525 6810.
E-mail address: n.morina@uva.nl (N. Morina).

1. Introduction

Epidemiological research indicates that most people experience at least one potentially traumatic event during their lifetime (Breslau, Davis, Andreski, & Peterson, 1991; Creamer, Burgess, & McFarlane, 2001; Kessler, Sonnega, Bromet, Hughes, & Nelson, 1995; Perkonigg, Kessler, Storz, & Wittchen, 2000). In many parts of the world, individuals are exposed to large-scale traumatic events, such as wars or natural disasters (Neria, Nandi, & Galea, 2008; Priebe et al., 2010). Whilst traumatic experiences can lead to a range of mental health problems, post-traumatic stress disorder (PTSD) is the most documented disorder following trauma. The diagnostic criteria for PTSD require the onset of characteristic symptoms following exposure to a traumatic event that must be present for more than one month (American Psychiatric Association, 2000). The prevalence estimates of PTSD are high. For example, in the European and US general population the 12-month prevalence of PTSD has been estimated between 2.0 and 3.5% (Kessler, Chiu, Demler, Merikangas, & Walters, 2005; Wittchen et al., 2011). PTSD is associated with significant mental and physical distress (Nemeroff et al., 2006) as well as high economic burden (Kessler, 2000; Sabes-Figuera et al., 2012; Wittchen et al., 2011).

There is good empirical evidence for the moderate efficacy of trauma-focused psychological interventions (Ehlers et al., 2010) and to a lesser degree for pharmacotherapy (Stein, Ipser, & McAnda, 2009). Yet, a significant number of individuals with PTSD do not seek treatment for their complaints (Gavrilovic, Schützwohl, Fazel, & Priebe, 2005), or fail to receive treatment, e.g., when they live in areas with limited or no access to mental health services after war or natural disasters (Morina, Rushiti, Salihu, & Ford, 2010). The question arises as to how important it is to expand the provision of treatment to all those people with PTSD who are currently without treatment. This can only be assessed based on data about the long-term outcomes of PTSD without treatment. Available prospective studies on the course of PTSD indicate different trajectories in different populations. Differences across studies are presumed to occur due to the different nature of traumatic events, methodological differences, current living conditions, and psychological factors (Brewin, Andrews, & Valentine, 2000; Ozer, Best, Lipsey, & Weiss, 2003; Schnurr, Lunney, & Sengupta, 2004). There is lack of a published systematic review on the remission rate of PTSD without specific treatment. Accordingly, we conducted a systematic review and meta-analysis of prospective studies to assess the remission rate of PTSD without specific treatment. Furthermore, the study aimed at identifying variables that explain variations in remission estimates across studies.

2. Method

Observational prospective studies on the natural course of PTSD published since 1980 (i.e., since the introduction of PTSD in DSM-III) (American Psychiatric Association, 1980) were located in the following computerized bibliographic databases: PUBMED, PsycINFO, and the PILOTS database managed by the US National Center for PTSD. The following search terms were used: *post-traumatic stress disorder or post-traumatic stress disorder or PTSD AND long* or prognos* or follow-up or prospect* or cohort* or endur* or prolong* or persist* or ongoing or contin* or durable or outcome study or natural history or clinical course*. In addition, a hand search of the following journals assumed to be likely to publish relevant articles was conducted: *American Journal of Psychiatry, Archives of General Psychiatry, British Journal of Psychiatry, Journal of Nervous and Mental Disease, and Journal of Traumatic Stress.* Finally, an iterative bibliography search was performed on citations published of all articles included in the review. The last search was conducted in March 2013.

Publications had to meet the following criteria: 1) use of a prospective design, 2) a sample size of at least 40 participants at the first assessment; 3) at least 80% of participants older than 17 years; 4) report of remission rates of PTSD, 5) use of a validated PTSD measurement (diagnostic interview or self-report) that was based on either DSM or ICD criteria for PTSD, 6) follow-up conducted at least ten months after the first assessment, 7) report of response and drop-out rates, and 8) the majority of participants were not treated for PTSD during the study (i.e., intervention studies were excluded as well as studies reporting that the majority of participants had received PTSD-related treatment during the observation period of the study). We decided to include studies with a follow-up conducted at least ten months after the first assessment in order to examine the long term course of the diagnosis of PTSD. If a publication provided information on more than one follow-up being conducted at least ten months after the first assessment, we used the data from the last follow-up period if this provided the necessary information on remission from PTSD.

Relevant data from relevant publications were extracted using a construed coding protocol. In studies with more than two measurement points, the first valid assessment and the last assessment were used. Age was entered as a mean for each single study. If age was reported in categories, mean age was attained by multiplying number of participants with the median age in the respective category. The median of the category 65 + was 75 years. The marital status of participants was determined in percentages per sample, with cohabiting and married participants being the same category. The remaining participants were coded as not living together. The response rate at baseline was the percentage of participants who were included at baseline compared to all those contacted who met study criteria. Number of drop-outs was attained by subtracting the number of study completers from the total of included participants at baseline.

The following variables were used as study-level predictors: type of sampling (population based vs. critical population), type of instrument used to assess PTSD (self-report measurement vs. diagnostic interview), nature of assessment (face-to-face vs. via telephone), gender (proportion men), age at study baseline, partnership at baseline, employment status at baseline, country where study conducted (Western vs. non-Western), treatment between baseline and follow-up, time between trauma and baseline (<six months vs. ≥), time between assessments (months between baseline and last assessment), drop-out rate at follow-up, type of traumatic exposure (abbreviated vs. extended), co-morbid depression or anxiety disorders at baseline, and nature of the trauma (separately analyzed using dichotomous variables, e.g. natural disaster vs. accidental injury). In four studies, the time between trauma and baseline could not be estimated due to missing information. Comorbid depression or anxiety disorders at baseline were used as predictors if the authors had reported co-occurring depression or anxiety disorders at baseline among individuals with PTSD. The temporal component of trauma events was dummy coded according to Terr's proposition (Terr, 1991). Type 1 corresponded to a relatively abbreviated exposure such as a motor vehicle accident. Prolonged exposure to traumatic

events such as exposure to war-related events was defined as Type 2. The nature of the traumatic event was classified as one of eleven categories: natural disaster, war-related events among veterans, war-related events among civilians, accidental injury, fire/explosion, terrorist attack, interpersonal violence, imprisonment, disease, death of significant others, or as a combination of the categories above. In total, no more than two studies were based on war veterans, fire/explosion, imprisonment, and death of significant others, respectively, therefore these categories were not included in the analyses. However, the two studies conducted among war veterans were combined with the studies conducted with civilian war survivors as part of the category war survivors. With regard to the examination of the association between nature of traumatic events and remission from PTSD, we decided to use natural disaster as the reference group. The decision was based on the findings that exposure to natural disasters is associated with lower levels of PTSD than exposure to other traumatic events (Neria et al., 2008). Accordingly, we expected that remission from PTSD will be highest in studies following exposure to natural disaster.

2.1. Statistical analysis

The primary outcome variable was the actual percentage of individuals meeting criteria for PTSD at baseline and not at follow-up (remission). The relevant frequencies were transformed using the Freeman–Tukey transformation to allow for pooling of the samples. To account for the differences in sample sizes, an inverse-variance weighted effect-size was computed for the included studies (Borenstein, Hedges, Higgins, & Rothstein, 2009). As larger sample sizes yield more accurate estimates of the effect sizes found in the population compared to smaller sample sizes, they were attributed a larger weight.

Because a preliminary analysis indicated substantial heterogeneity in the data (Q_{41} = 1250.66, p < 0.001, I^2 = 97%), we used random-effects model to estimate the mean and variance of remission and mixed effects models in the subsequent meta-regression analyses (Raudenbush, 2009). In addition, prospective studies are prone to high dropout rates, which could obscure an accurate estimate of the course. To account for the influence of dropout, an estimate of the number of PTSD cases among the dropouts was calculated using available data regarding PTSD cases lost during follow-up. Four large-scale studies included in the meta-analysis were reported on these data (Berninger et al., 2010; Brackbill et al., 2009; Hedtke et al., 2008; Koren, Arnon, & Klein, 2001). The estimate revealed that individuals with PTSD at baseline were 1.3 times more likely to drop out than individuals without PTSD. This estimate was applied when the relevant data was missing by multiplying the number of dropouts in the study by the estimate. This was inversed to correct for dropout regarding new cases.

2.2. Meta-regression analysis

Mixed-model meta-regression models were used to explain the amount of heterogeneity in the data by extracted variables of interest (Borenstein et al., 2009; Raudenbush, 2009). First, the influence of differences in study methodology and sample characteristics was examined. Subsequently, the predictive power of the main predictors was examined: time between exposure to traumatic events and first assessment, time between assessments, type of trauma, and nature of trauma. Comparable to a regression procedure, the change in predictive power of the model using the variables was evaluated, i.e., the change in Cochran's heterogeneity Q-statistic and the p-value of that statistic. Meta-regressions were conducted for each predictor separately. In light of the relatively low power associated with the current set of 42 samples, we used p = .10 as the nominal significance level (Hedges & Pigott, 2001).

Analyses were performed using the metafor package in R (Viechtbauer, 2010). Reported results are expressed in the Freeman–Tukey effect size and based on Restricted Maximum Likelihood

(Raudenbush, 2009). Percentages presented below were back-transformed (Miller, 1978). We used a funnel plot analysis to assess the likelihood of publication bias.

3. Results

3.1. Selection and inclusion of studies

The initial search identified 21.029 potential hits (see Fig. 1 for the flow diagram). The first review resulted in a total of 99 publications eligible for inclusion. After contacting authors regarding missing information related to the prevalence of PTSD at both assessment points in potentially relevant articles, 49 publications were excluded because of missing information and eight publications were identified as double publications of already included studies. A total of 42 studies were finally included. Data were extracted by the first and the third author. An inter-rater reliability analysis regarding the coded information from the included articles and using the kappa statistic for dichotomous variables and intraclass correlation (ICC) for continuous variables was performed to determine consistency among raters. This resulted in an excellent inter-rater reliability of R = 0.90. Disagreements were jointly discussed until an agreement was reached. Of all publications, 41 were in English and one in German.

3.2. Characteristics of included studies

The included studies provided data from an aggregate sample of 81,642 participants from five continents. Their mean age was 42.3 (SD = 11.7) and 48.8% of participants were male.

The first assessment took place after a mean of 43.1 months (SD = 106.2, range: 1–593, median = 7.5) following trauma (N-weighted M = 32.9, SD = 35.6, median = 30). The follow-up took place after a weighed mean of 40.0 months (SD = 43.3 range: 10–204; median = 24) after the first assessment (N-weighted M = 29.4, SD = 15.6, median = 30). Study and sample characteristics, main outcome variables, and remission rates for each included study are summarized in the online Supplementary material.

3.3. Remission from PTSD

The funnel plot in Fig. 2 depicts the effect sizes for remission from PTSD against studies' standard error, along with the type of PTSD found in each included study. The funnel plot did not appear asymmetric: Z = 0.39, p = 0.69. Overall, in a random effects model, the mean effect size for remission from PTSD was 0.75 (95% CI = 0.68–0.83, k = 42, I^2 = 97%). Stated in percentages, 44.0% of participants remitted from PTSD after a mean of 40 months. Remission rates among all studies varied substantially, ranging from 8% to 89%. Fig. 3 shows the attributed weight, effect size, and type of PTSD (i.e., Type 1 or 2) across included studies.

3.4. Meta-analytic regression

The association between study characteristics and methodology and remission rate was analyzed by separate meta-analytic regressions. Due to the small number of studies reporting specific treatment, the treatment categories concerning psychological treatment were collapsed into one category 'treatment'. The results are presented in Table 1. Studies with the baseline conducted within the first five months (a total of eleven studies) were more likely to have reported higher remission rates. Of individuals with PTSD at baseline in these studies, 51.7% (ES = 0.84) did not meet criteria for PTSD at follow-up as compared to 36.9% (ES = 0.68) of those with the baseline later than five months following trauma (a total of 27 studies). None of the other investigated study characteristics was significantly associated with remission from PTSD.
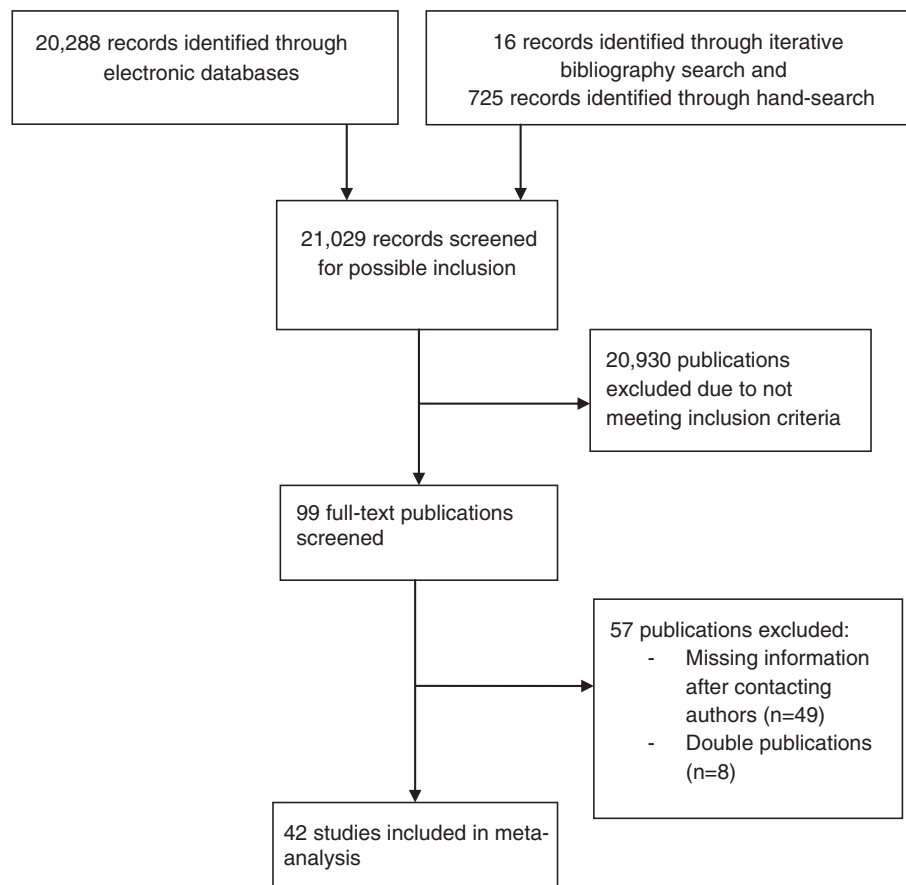
Fig. 1. Flowchart of study selection.

Publications with participants with PTSD following exposure to a natural disaster reported the highest mean of remission rate (60.0%), whereas publications with participants with PTSD associated with a physical disease (such as myocardial infarction, subarachnoid hemorrhage, or acute coronary syndrome) reported the lowest mean of remission rate from PTSD (31.4%). Table 2 presents the results of the univariate regression analysis on the nature of traumatic events with natural disaster as the reference group. The mean remission rate in studies on PTSD related to a disease was significantly lower than the mean remission rate in studies on PTSD following exposure to a natural disaster (p = 0.045).
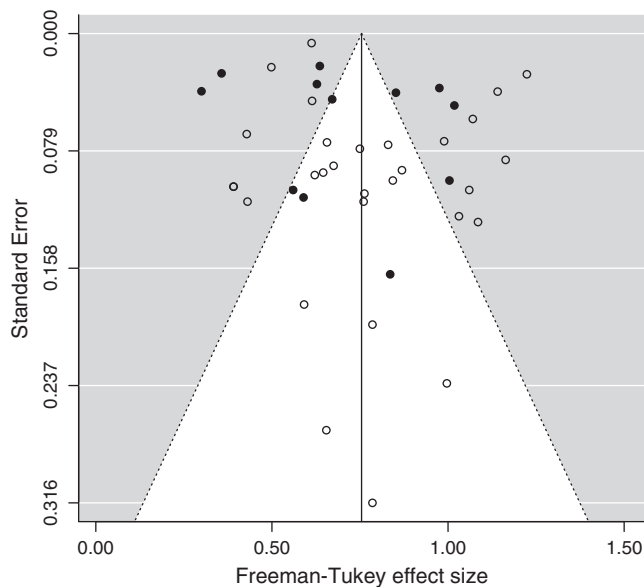

Fig. 2. Funnel plot of the included studies (n = 42). *Note*: open circles represent short-lived traumatic events (Type 1).
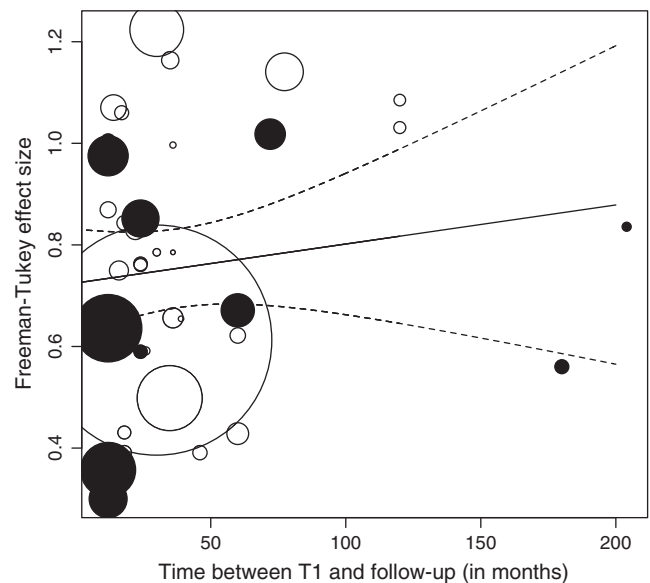

Fig. 3. Effect size, attributed weight, and type of trauma across included studies (n = 42). *Note*: open circles represent short-lived traumatic events (Type 1).

Table 1
Univariate meta-regression analysis of study characteristics.

Variable	Remission from PTSD					
	B_0	SE	B_1	SE	R^2	k
Population-based sampling	0.813**	0.103	−0.069	0.112	0.000	42
Diagnostic interview	0.706**	0.051	0.117	0.079	0.041	42
Face-to-face assessment	0.711**	0.071	0.064	0.086	0.000	42
Gender: male vs. female	0.858**	0.095	−0.002	0.002	0.001	22
Age (baseline)	0.699*	0.276	0.001	0.007	0.002	16
Partner	0.918**	0.230	−0.003	0.003	0.000	10
Employment	0.737**	0.162	−0.001	0.002	0.000	10
Western country	0.682**	0.084	0.093	0.095	0.000	42
Treatment	1.077**	0.296	−0.009	0.006	0.129	7
Baseline ≥ 5 months	0.839**	0.077	−0.156+	0.090	0.054	38
Baseline until follow-up	0.725**	0.054	0.001	0.001	0.000	42
Drop-out at follow-up	0.745**	0.076	0.000	0.002	0.000	42
Comorbid depression at baseline	0.666	0.439	0.002	0.009	0.000	5
Comorbid anxiety disorders at baseline	0.759**	0.085	−0.003	0.002	NA	4

Note: ** = p < .01; * = p < .05; + = p < .10; For a predictor to be significant, B_1 must be significant; B = regression coefficients; SE = standard error; k = number of studies; NA = not applicable because no heterogeneity observed in this subset.

The other types of traumatic events did not significantly differ from the category of natural disaster (see Table 2).

3.5. Sensitivity analyses

Given that the sample in the study by Brackbill et al. (2009) was larger than the number of the remaining studies combined, all analyses were repeated excluding the study by Brackbill. The mean effect size for remission from PTSD among the 41 remaining studies was 0.75 (95% CI = 0.68–0.83; I^2 = 95%). Stated in percentages, 44.4% of participants remitted from PTSD after a mean of 40 months. Finally, all meta-analytic regression analysis reported above were re-conducted without the study by Brackbill. Similarly to the main analyses, time between trauma and baseline was the only variable associated with remission from PTSD (R^2 = 0.10, p = 0.09). The study by Brackbill was conducted later than five months after trauma. When this study was removed from the analysis, 37.0% (ES = 0.69) of participants in the remaining studies with the baseline later than five months following trauma were remitted from PTSD at follow-up as compared to 51.7% (ES = 0.84) of those with a baseline within the first five months following trauma. No other variable about characteristics of the study or study methodology was significantly associated with remission rates of PTSD.

4. Discussion

The meta-analysis shows that the number of participants remitting from PTSD after at least ten months varies greatly. On average nearly half of participants diagnosed with PTSD remit from this disorder after

a mean of more than three years. Studies with the first assessment of PTSD within the first five months following trauma reported a higher remission rate of PTSD than those with a later first assessment of PTSD. Further, participants with PTSD in relation to physical disease reported a lower remission rate than participants with PTSD following a natural disaster. No other assessed variable was associated with remission from PTSD.

Strengths of the meta-analysis include the large amount of participants from 42 prospective studies as well as the fact that the studies were conducted in different contexts, following exposure to a variety of traumatic events and in different continents. Different factors were tested as moderators, and sensitivity analyses were conducted while excluding the survey with the largest sample size (Brackbill et al., 2009). The meta-analysis has also limitations. Most importantly, the number of assessed potential factors to be associated with remission from PTSD was limited. For instance, only five and four publications reported comorbidity rates of depression or anxiety, respectively, among participants with PTSD at baseline.

Research on the development of PTSD has suggested several factors to be associated with PTSD, such as characteristics of traumatic events, peri-traumatic psychological reactions, occurrence of acute PTSD, personality factors, additional life stress, lack of social support, and demographic variables (Brewin et al., 2000; Ehlers, Mayou, & Bryant, 1998; Ozer et al., 2003). Most of these factors were not assessed in the studies included in the current meta-analysis. From the factors included (see Tables 1 and 2), time of baseline and PTSD in relation to disease were the only factors associated with remission from PTSD. The significant difference in remission rates from PTSD in studies with the first

Table 2
Univariate meta-regression analysis regarding the nature of traumatic events.

Remission from PTSD					
Variable	B_0	SE	B_1	SE	R^2
Natural disaster (k = 5)	[Reference]	[Reference]	[Reference]	[Reference]	[Reference]
War survivors (k = 7) (veterans and civilians)	0.890**	0.110	−0.228	0.144	0.135
Civilian war survivors (k = 5)	0.890**	0.119	−0.255	0.167	0.134
Accidental injury (k = 5)	0.890**	0.118	−0.226	0.175	0.075
Terrorist attack (k = 10)	0.890**	0.111	−0.055	0.135	0.000
Interpersonal violence (k = 4)	0.889**	0.132	−0.080	0.203	0.000
Physical disease (k = 5)	0.890**	0.098	−0.287*	0.144	0.266

Notes: Reference group: natural disaster; ** = p < .01; * p < .05; k is the number of studies; for a predictor to be significant, B_1 must be significant; B = regression coefficient; SE = standard error.

assessment within the first five months following trauma as compared to those with a later first assessment (51.7% vs. 36.9%) indicates that PTSD assessed after five months following trauma is somewhat more likely to be chronic. The studies with a baseline within five months following trauma included a range of traumatic events, such as disease, accidental injury, terrorist attack, interpersonal violence, or mixed trauma (see Supplementary material). This reflects the nature of traumatic events reported in the studies with a baseline later than five months following trauma. Furthermore, none of the included studies assessed PTSD in relation to childhood traumatic events. It should be noted, however, that regardless of the time of first assessment, the number of individuals still suffering from PTSD more than three years after the initial assessment of this diagnosis is very high indicating a chronic character of PTSD. Accordingly, our results point towards a need for concerted action at different levels, including increased funding for clinical and public health research to identify effective strategies for prevention and early treatment for PTSD following exposure to traumatic events. Early prevention programs as well as early interventions for those with chronic PTSD would not only decrease subjective distress but also overall societal burden due to high health care costs and other costs associated with PTSD (Sabes-Figuera et al., 2012). Over the last decades, several specific interventions for PTSD have been developed and trauma-focused psychological interventions have demonstrated effectiveness in rigorous clinical trials (Bisson et al., 2007; Ehlers et al., 2010; Foa, Keane, Friedman, & Cohen, 2009). For example, the meta-analysis by Bisson et al. (2007) yielded that trauma focused cognitive behavior interventions are significantly more effective than waiting lists regarding both clinician-rated (standardized mean differences [SMD] = 1.40) and self-rated PTSD symptoms (SMD = 1.70). A SMD of 1.40 or higher indicates that more than 90% of patients receiving trauma focused interventions had significantly less symptoms of PTSD than the average patient on the waiting list. Established effective treatments need to be made widely available for individuals with PTSD, whilst research should develop effective prevention interventions for individuals exposed to traumatic events.

The highest remission rate was reported in studies on PTSD among survivors of natural disaster. This finding is in line with studies revealing that the PTSD prevalence rate in survivors of natural disasters is somewhat lower than in survivors of other forms of traumatic events (Neria et al., 2008). However, it is rather surprising that the remission rate of PTSD in the course of physical disease was the only one to significantly differ from the remission rate of PTSD among survivors of natural disaster. This may be explained by the fact that the remission rate of PTSD varied fundamentally in the studies within the single categories of traumatic events (see Supplementary material). For example, the remission rate in the studies on PTSD among survivors of accidental injury varied between 70.2% (Blanchard et al., 1996) and 13% (Bryant & Harvey, 2002). The finding that individuals with PTSD due to a physical illness reported the lowest remission from PTSD might be explained by the notion that these individuals carry in them the illness that caused the disorder and thus may not only be constantly reminded about it but also be physically less capable of coping with it.

The other assessed factors were not significantly associated with remission from PTSD. Perhaps most surprising is the finding that remission from PTSD does not increase with longer observation periods. This finding may be surprising, considering the large range of the follow-up that extended between 10 and 204 months, with a weighed mean of 40 months after the first assessment. The reviewed studies do not support the notion that "time heals all wounds". However, there is a large variability of the remission rate between all studies, regardless of the time period between baseline and follow-up (see Supplementary material). For example, in studies with a longer follow-up than 100 months, the rate of remission from PTSD rages from 27.3% (Maercker, Gaebler, & Schuetzwohl, 2013) to 75.0% (Perkonigg et al., 2005). This large variability in the rate of remission from PTSD cannot be explained by the factors assessed in the reviewed studies. Future

research should identify more relevant predictors of remission from PTSD. Such research should include pre-traumatic, peri-traumatic as well as post-traumatic conditions, as potential predictors.

One important issue is whether the instruments used to establish PTSD were valid. Instruments with poor validity may overestimate the prevalence of PTSD at baseline or at follow-up. Yet, the use of more valid diagnostic interviews was not associated with a different remission rate as compared to self-report measurements. PTSD in the included studies was diagnosed based on symptoms in the past month. Given that PTSD symptoms can fluctuate, remission rates reported in the studies might be rather positive as patients not meeting PTSD criteria in the previous month, but before or after that month, would be considered as a remission. This indicates that some of the individuals not meeting criteria for PTSD at follow-up might not have been in permanent remission from PTSD. Accordingly, this suggests that spontaneous long-term permanent remission from PTSD is likely to be even lower than the reported average remission rate of 44.0%.

The high variability across studies makes prognoses in specific samples and contexts difficult. Future research on remission from PTSD should assess different potential factors that might explain the wide variability in remission from PTSD, such as details of social support which has been shown to impact on the development of PTSD and might also be relevant for overcoming it (Brewin et al., 2000; Ozer et al., 2003). Reporting of these factors should be provided separately for individuals with PTSD at baseline, if appropriate. Most of the studies included in the current review reported for example on employment rates for the whole sample, yet failed to provide this information for individuals with PTSD at baseline separately. Knowledge about factors influencing remission from PTSD might help improve preventing PTSD as well as treatment of PTSD.

Overall, PTSD tends to remit in only about half of individuals after a period of more than three years, and the prognosis deteriorates if PTSD is diagnosed later than five months following trauma. This indicates that effective treatment should be widely provided for individuals with PTSD to avoid long term distress and reduce the associated costs for the affected individuals, their families, and society at large.

Appendix A. Supplementary data

Supplementary data to this article can be found online at http://dx.doi.org/10.1016/j.cpr.2014.03.002.

References

American Psychiatric Association (1980). *Diagnostic and statistical manual of mental disorders* (3rd ed.) Washington, D.C. American Psychiatric Association.
American Psychiatric Association (2000). *Diagnostic and statistical manual of mental disorders DSM-IV-TR fourth edition (text revision).* Washington, D.C. American Psychiatric Association.
Berninger, A., Webber, M. P., Niles, J. K., Gustave, J., Lee, R., Cohen, H. W., et al. (2010). Longitudinal study of probable post-traumatic stress disorder in firefighters exposed to the World Trade Center disaster. *American Journal of Industrial Medicine, 53*(12), 1177–1185. http://dx.doi.org/10.1002/ajim.20894.
Bisson, J. I., Ehlers, A., Matthews, R., Pilling, S., Richards, D., & Turner, S. (2007). Psychological treatments for chronic post-traumatic stress disorder — Systematic review and meta-analysis. *British Journal of Psychiatry, 190*, 97–104. http://dx.doi.org/10.1192/bjp.bp.106.021402.
Blanchard, E. B., Hickling, E. J., Buckley, T. C., Taylor, A. E., Vollmer, A., & Loos, W. R. (1996). Psychophysiology posttraumatic stress disorder related to motor vehicle accidents: Replication and extension. *Journal of Consulting and Clinical Psychology, 64*(4), 742–751. http://dx.doi.org/10.1037/0022-006X.64.4.742.
Borenstein, M., Hedges, L. V., Higgins, J. P. T., & Rothstein, H. R. (2009). *Introduction to meta-analysis.* Chichester, UK John Wiley & Sons, Ltd.
Brackbill, R. M., Hadler, J. L., DiGrande, L., Ekenga, C. C., Farfel, M. R., Friedman, S., et al. (2009). Asthma and posttraumatic stress symptoms 5 to 6 years following exposure to the world trade center terrorist attack. *JAMA — Journal of the American Medical Association, 302*(5), 502–516.
Breslau, N., Davis, G. C., Andreski, P., & Peterson, E. (1991). Traumatic events and posttraumatic stress disorder in an urban population of young adults. *Archives of General Psychiatry, 48*(3), 216–222.

Brewin, C., Andrews, B., & Valentine, J. (2000). Meta-analysis of risk factors for posttraumatic stress disorder in trauma-exposed adults. *Journal of Consulting and Clinical Psychology*, 68(5), 748–766. http://dx.doi.org/10.1037/0022-006X.68.5.748.

Bryant, R. A., & Harvey, A. G. (2002). Delayed-onset posttraumatic stress disorder: A prospective evaluation. *Australian and New Zealand Journal of Psychiatry*, 36(2), 205–209. http://dx.doi.org/10.1046/j.1440-1614.2002.01009.x.

Creamer, M., Burgess, P., & McFarlane, A. (2001). Post-traumatic stress disorder: Findings from the Australian National Survey of Mental Health and Well-Being. *Psychological Medicine*, 31(7), 1237–1247.

Ehlers, A., Bisson, J., Clark, D. M., Creamer, M., Pilling, S., Richards, D., et al. (2010). Do all psychological treatments really work the same in posttraumatic stress disorder? *Clinical Psychology Review*, 30(2), 269–276. http://dx.doi.org/10.1016/j.cpr.2009.12.001.

Ehlers, A., Mayou, R. A., & Bryant, B. (1998). Psychological predictors of chronic posttraumatic stress disorder after motor vehicle accidents. *Journal of Abnormal Psychology*, 107(3), 508–519.

Foa, E. B., Keane, T. M., Friedman, M. J., & Cohen, J. A. (2009). *Effective treatments for PTSD: Practice guidelines from the International Society for Traumatic Stress Studies* (2nd ed.) New York Guilford Press.

Gavrilovic, J. J., Schützwohl, M., Fazel, M., & Priebe, S. (2005). Who seeks treatment after a traumatic event and who does not? A review of findings on mental health service utilization. *Journal of Traumatic Stress*, 18(6), 595–605.

Hedges, L. V., & Pigott, T. D. (2001). The power of statistical tests in meta-analysis. *Psychological Methods*, 6(3), 203–217. http://dx.doi.org/10.1037/1082-989X.6.3.203.

Hedtke, K. A., Ruggiero, K. J., Fitzgerald, M. M., Zinzow, H. M., Saunders, B. E., Resnick, H. S., et al. (2008). A longitudinal investigation of interpersonal violence in relation to mental health and substance use. *Journal of Consulting and Clinical Psychology*, 76(4), 633–647. http://dx.doi.org/10.1037/0022-006X.76.4.633.

Kessler, R. (2000). Posttraumatic stress disorder: The burden to the individual and to society. *Journal of Clinical Psychiatry*, 61, 4–14.

Kessler, R. C., Chiu, W. T., Demler, O., Merikangas, K. R., & Walters, E. E. (2005). Prevalence, severity, and comorbidity of 12-month DSM-IV disorders in the National Comorbidity Survey Replication. (vol 62, pg 617, 2005). *Archives of General Psychiatry*, 62(7), 709.

Kessler, R. C., Sonnega, A., Bromet, E., Hughes, M., & Nelson, C. B. (1995). Posttraumatic-stress-disorder in the national comorbidity survey. *Archives of General Psychiatry*, 52(12), 1048–1060.

Koren, D., Arnon, I., & Klein, E. (2001). Long term course of chronic posttraumatic stress disorder in traffic accident victims: A three-year prospective follow-up study. *Behaviour Research and Therapy*, 39(12), 1449–1458. http://dx.doi.org/10.1016/S0005-7967(01)00025-0.

Maercker, A., Gaebler, I., & Schuetzwohl, M. (2013). Course of trauma sequelae in ex-political prisoners in the GDR. A 15-year follow-up study. *Nervenarzt*, 84(1), 72–78. http://dx.doi.org/10.1007/s00115-012-3646-y.

Miller, J. (1978). Inverse of Freeman–Tukey double arcsine transformation. *American Statistician*, 32(4), 138. http://dx.doi.org/10.2307/2682942.

Morina, N., Rushiti, F., Salihu, M., & Ford, J. D. (2010). Psychopathology and well-being in civilian survivors of war seeking treatment: A follow-up study. *Clinical Psychology & Psychotherapy*, 17(2), 79–86. http://dx.doi.org/10.1002/cpp.673.

Nemeroff, C. B., Bremner, J. D., Foa, E. B., Mayberg, H. S., North, C. S., & Stein, M. B. (2006). Posttraumatic stress disorder: A state-of-the-science review. *Journal of Psychiatric Research*, 40(1), 1–21. http://dx.doi.org/10.1016/j.jpsychires.2005.07.005.

Neria, Y., Nandi, A., & Galea, S. (2008). Post-traumatic stress disorder following disasters: A systematic review. *Psychological Medicine*, 38(4), 467–480. http://dx.doi.org/10.1017/S0033291707001353.

Ozer, E., Best, S., Lipsey, T., & Weiss, D. (2003). Predictors of posttraumatic stress disorder and symptoms in adults: A meta-analysis. *Psychological Bulletin*, 129(1), 52–73. http://dx.doi.org/10.1037//0033-2909.129.1.52.

Perkonigg, A., Kessler, R., Storz, S., & Wittchen, H. (2000). Traumatic events and posttraumatic stress disorder in the community: Prevalence, risk factors and comorbidity. *Acta Psychiatrica Scandinavica*, 101(1), 46–59. http://dx.doi.org/10.1034/j.1600-0447.2000.101001046.x.

Perkonigg, A., Pfister, H., Stein, M. B., Hofler, M., Lieb, R., Maercker, A., et al. (2005). Longitudinal course of posttraumatic stress disorder and posttraumatic stress disorder symptoms in a community sample of adolescents and young adults. *American Journal of Psychiatry*, 162(7), 1320–1327. http://dx.doi.org/10.1176/appi.ajp.162.7.1320.

Priebe, S., Bogic, M., Ashcroft, R., Franciskovic, T., Galeazzi, G. M., Kucukalic, A., et al. (2010). Experience of human rights violations and subsequent mental disorders — A study following the war in the Balkans. *Social Science & Medicine*, 71(12), 2170–2177.

Raudenbush, S. W. (2009). Analyzing effect sizes: Random effects models. In H. Cooper, L. V. Hedges, & J. C. Valentine (Eds.), *The handbook of research synthesis and meta-analysis* (pp. 295–315) (2nd ed.). New York Russell Sage Foundation.

Sabes-Figuera, R., McCrone, P., Bogic, M., Ajdukovic, D., Franciskovic, T., Colombini, N., et al. (2012). Long-term impact of war on healthcare costs: An eight-country study. *PLoS One*, 7(1), e29603. http://dx.doi.org/10.1371/journal.pone.0029603.

Schnurr, P., Lunney, C., & Sengupta, A. (2004). Risk factors for the development versus maintenance of posttraumatic stress disorder. *Journal of Traumatic Stress*, 17(2), 85–95. http://dx.doi.org/10.1023/B:JOTS.0000022614.21794.f4.

Stein, D. J., Ipser, J., & McAnda, N. (2009). Pharmacotherapy of posttraumatic stress disorder: A review of meta-analyses and treatment guidelines. *CNS Spectrums*, 14(1), 25–31.

Terr, L. (1991). Childhood traumas — An outline and overview. *American Journal of Psychiatry*, 148(1), 10–20.

Viechtbauer, W. (2010). Conducting meta-analyses in R with the metafor package. *Journal of Statistical Software*, 36(3), 1–48.

Wittchen, H. U., Jacobi, F., Rehm, J., Gustavsson, A., Svensson, M., Jonsson, B., et al. (2011). The size and burden of mental disorders and other disorders of the brain in Europe 2010. *European Neuropsychopharmacology*, 21(9), 655–679. http://dx.doi.org/10.1016/j.euroneuro.2011.07.018.