



Attention

Introduction

Attention may be compromised in people with PTSD. Several tasks have been developed to assess attention. The most common task is The Stroop Colour Word Test, which presents colour names printed in an ink congruent to the colour name (e.g. blue), or incongruent to the colour name (e.g. blue). Participants are asked to either read the word or name the ink colour. A Stroop interference index is calculated by subtracting response times in the colour-naming condition from those in the incongruent condition. This serves as a measure of the attentional engagement, with more engagement indicating an attentional bias. The emotional Stroop task replaces colour-words with neutral and emotionally loaded stimuli (e.g., the word “violence” painted in blue compared to a neutral word in the same colour). Other tasks include the Continuous Performance Test that uses both visual and auditory stimuli and requires participants to respond to targets and ignore distractors. Also, the Trail Making Test requires participants to connect, in order, letters and/or numbers as quickly as possible.

Method

We have included only systematic reviews (systematic literature search, detailed methodology with inclusion/exclusion criteria) published in full text, in English, from the year 2010 that report results separately for people with PTSD. Reviews were identified by searching the databases MEDLINE, EMBASE, and PsycINFO. When multiple copies of reviews were found, only the most recent version was included. We prioritised reviews with pooled data for inclusion.

Review reporting assessment was guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) checklist that describes a preferred way to present a meta-analysis¹. Reviews with less than 50% of items checked have been excluded from the library. Note that early reviews may have been guided by less stringent reporting checklists than the PRISMA,

and that some reviews may have been limited by journal guidelines.

Evidence was graded using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) Working Group approach where high quality evidence such as that gained from randomised controlled trials (RCTs) may be downgraded to moderate or low if review and study quality is limited, if there is inconsistency in results, indirect comparisons, imprecise or sparse data and high probability of reporting bias. It may also be downgraded if risks associated with the intervention or other matter under review are high. Conversely, low quality evidence such as that gained from observational studies may be upgraded if effect sizes are large or if there is a dose dependent response. We have also taken into account sample size and whether results are consistent, precise and direct with low associated risks (see end of table for an explanation of these terms)². The resulting table represents an objective summary of the available evidence, although the conclusions are solely the opinion of staff of NeuRA (Neuroscience Research Australia).

Results

We found six systematic reviews that met our inclusion criteria³⁻⁸.

- Moderate to high quality evidence finds medium-sized effects of poorer attention in people with PTSD than in healthy controls (people not exposed to trauma and without PTSD). Similar findings were apparent in both children and adults.
- People with PTSD had greater attentional interference with PTSD-relevant stimuli and with emotionally positive stimuli than with emotionally neutral stimuli.
- In sexual victimisation survivors with or without PTSD, a small effect showed more attentional bias for sexual threat stimuli in those with PTSD.



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Joyal M, Wensing T, Levasseur-Moreau J, Leblond J, Sack A, Fecteau S

Characterizing emotional Stroop interference in posttraumatic stress disorder, major depression, and anxiety disorders: A systematic review and meta-analysis

PLoS ONE 2019; 14: e0214998

[View review abstract online](#)

Comparison	Attentional bias in people with PTSD vs. controls.
Summary of evidence	Moderate to high quality evidence (medium to large samples, consistent, precise, direct) finds medium-sized effects that people with PTSD had greater interference with PTSD-relevant and emotionally positive stimuli than emotionally neutral stimuli when compared to controls, with no differences with emotionally negative vs. neutral stimuli. Authors report that the findings support a hypoactive attentional control mechanism.
Emotional Stroop interference test	
<p>13 studies, N = 548</p> <p><i>Medium-sized effects showed people with PTSD had greater interference with PTSD-relevant and positive stimuli than neutral stimuli when compared to controls;</i></p> <p>PTSD-relevant words: 11 studies, $g = 0.65$, 0.36 to 0.95, $p < 0.001$, $I^2 = 58\%$, $Qp = 0.209$</p> <p>Positive words: 5 studies, $g = 0.38$, 0.11 to 0.66, $p < 0.01$, $I^2 = 0\%$, $Qp = 0.231$</p> <p><i>There were no differences with negative stimuli;</i></p> <p>7 studies, $g = 0.33$, -0.11 to 0.78, $p = 0.139$, $I^2 = 72\%$, $Qp = 0.04$</p> <p>Moderator analyses indicated that mean age of patients and female proportion did not influence results. Effect sizes were larger for motor than verbal responses.</p> <p>Authors report that the findings support a hypoactive attentional control mechanism, rather than a hyperactive threat detection mechanism.</p>	
Consistency in results[‡]	Inconsistent for negative stimuli only
Precision in results[§]	Precise
Directness of results	Direct

Latack JA, Moyer A, Simon VA, Davila J

Attentional Bias for Sexual Threat Among Sexual Victimization Survivors:



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A Meta-Analytic Review

Trauma Violence and Abuse 2017; 18: 172-84

[View review abstract online](#)

Comparison	Attentional bias for sexual threat stimuli in sexual victimisation survivors with PTSD vs. without PTSD.
Summary of evidence	Moderate to high quality evidence (small sample, consistent, precise, direct) finds a small effect of more attentional bias for sexual threat stimuli in sexual victimisation survivors with PTSD compared to sexual victimisation survivors without PTSD.
Modified Stroop test, probe detection (or dot-probe) task, eye tracking task, or a variation of the emotional spatial cuing task	
<i>A small effect showed more attentional bias for sexual threat stimuli in sexual victimisation survivors with PTSD;</i> 7 studies, N = 253, $g = 0.28$, 95%CI 0.04 to 0.54, $p = 0.05$, $I^2 = 0\%$	
Consistency in results	Consistent
Precision in results	Precise
Directness of results	Direct

Malarbi S, Abu-Rayya HM, Muscara F, Stargatt R

Neuropsychological functioning of childhood trauma and post-traumatic stress disorder: A meta-analysis

Neuroscience and Biobehavioral Reviews 2017; 72: 68-86

[View review abstract online](#)

Comparison	Attentional control in children (< 18 years) exposed to trauma with PTSD vs. healthy controls (no trauma or PTSD).
Summary of evidence	Moderate quality evidence (unclear sample size, unable to assess consistency, precise, direct) finds a small effect showing traumatised children with PTSD had less attentional control than healthy controls.
Attentional control	
<i>A small effect showed traumatised children with PTSD had less attentional control than healthy</i>	



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<i>controls;</i>	
3 studies, N not reported, $d = -0.35$, 95%CI -0.61 to -0.10, $p = 0.01$, I^2 not reported There was no significant difference in the analysis of traumatised children with vs. without PTSD.	
Consistency in results	Unable to assess; no measure of consistency is reported.
Precision in results	Precise
Directness of results	Direct

<i>Masson M, East-Richard C, Cellard C</i>	
A meta-analysis on the impact of psychiatric disorders and maltreatment on cognition	
Neuropsychology 2016; 30: 143-56 View review abstract online	
Comparison	Attention in people with PTSD vs. controls.
Summary of evidence	Moderate to high quality evidence (large sample, inconsistent, precise, direct) finds a medium-sized effect of poorer attention in people with PTSD than controls. There was no moderating effect of age (child vs. adult).
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<i>A medium-sized effect showed people with PTSD had poorer performance on attention tasks than controls;</i>	
7 studies, N = 433, $g = -0.61$, 95%CI -0.92 to -0.30, $p < 0.0001$, $Q = 14.66$, $p = 0.023$ Results were similar in subgroup analysis of age (7-17 years vs. ≥ 18 years).	
Consistency in results	Inconsistent
Precision in results	Precise
Directness of results	Direct

<i>Schuitevoerder S, Rosen JW, Twamley EW, Ayers CR, Sones H, Lohr JB, Goetter EM, Fonzo GA, Holloway KJ, Thorp SR</i>	
A meta-analysis of cognitive functioning in older adults with PTSD	



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Journal of Anxiety Disorders 2013; 27: 550-8 View review abstract online	
Comparison	Attention in older people with PTSD (>65 years) vs. controls.
Summary of evidence	Moderate to low quality evidence (small samples, inconsistent, imprecise, direct) no differences in attention between groups.
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<i>No significant differences between groups;</i> Trauma-exposed controls: 3 studies, N = 133, $g = -0.67$, 95%CI -1.66 to 0.88, $p > 0.05$, $I^2 = 89\%$ Healthy controls: 1 study, N = 28, $g = -0.28$, CI not reported	
Consistency in results	Inconsistent where applicable.
Precision in results	Imprecise where CIs reported.
Directness of results	Direct

Scott JC, Matt GE, Wrocklage KM, Crnich C, Jordan J, Southwick SM, Krystal JH, Schweinsburg BC

A quantitative meta-analysis of neurocognitive functioning in posttraumatic stress disorder

Psychological Bulletin 2015; 141: 105-40

[View review abstract online](#)

Comparison	Attention in people with PTSD vs. controls.
Summary of evidence	Moderate quality evidence (unclear sample size, unable to assess consistency, precise, direct) finds a medium-sized effect that people with PTSD had poorer attention performance than controls.
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<i>A medium-sized effect showed people with PTSD had poorer performance on attention tasks than controls;</i> 131 studies, N = unclear, $g = -0.50$, 95%CI -0.60 to -0.40, $p < 0.05$, I^2 not reported	
Consistency in results	Unable to assess; no measure of consistency is reported.



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Precision in results	Precise
Directness of results	Direct

Explanation of acronyms

CI = confidence interval, d , g = Cohen's d and Hedges' g , standardised mean differences, I^2 = the percentage of the variability in effect estimates that is due to heterogeneity rather than sampling error (chance), N = number of participants, Q = measure of heterogeneity, p = statistical probability of obtaining a result, vs. = versus



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Explanation of technical terms

* Bias has the potential to affect reviews of both RCT and observational studies. Forms of bias include; reporting bias – selective reporting of results; publication bias - trials that are not formally published tend to show less effect than published trials, further if there are statistically significant differences between groups in a trial, these trial results tend to get published before those of trials without significant differences; language bias – only including English language reports; funding bias - source of funding for the primary research with selective reporting of results within primary studies; outcome variable selection bias; database bias - including reports from some databases and not others; citation bias - preferential citation of authors. Trials can also be subject to bias when evaluators are not blind to treatment condition and selection bias of participants if trial samples are small⁹.

† Different effect measures are reported by different reviews.

Prevalence refers to how many existing cases there are at a particular point in time. Incidence refers to how many new cases there are per population in a specified time period. Incidence is usually reported as the number of new cases per 100,000 people per year. Alternatively some studies present the number of new cases that have accumulated over several years against a person-years denominator. This denominator is the sum of individual units of time that the persons in the population are at risk of becoming a case. It takes into account the size of the underlying population sample and its age structure over the duration of observation.

Reliability and validity refers to how accurate the instrument is. Sensitivity is the proportion of actual positives that are correctly identified

(100% sensitivity = correct identification of all actual positives) and specificity is the proportion of negatives that are correctly identified (100% specificity = not identifying anyone as positive if they are truly not).

Weighted mean difference scores refer to mean differences between treatment and comparison groups after treatment (or occasionally pre to post treatment) and in a randomised trial there is an assumption that both groups are comparable on this measure prior to treatment. Standardised mean differences are divided by the pooled standard deviation (or the standard deviation of one group when groups are homogenous) that allows results from different scales to be combined and compared. Each study's mean difference is then given a weighting depending on the size of the sample and the variability in the data. Less than 0.4 represents a small effect, around 0.5 a medium effect, and over 0.8 represents a large effect⁹.

Odds ratio (OR) or relative risk (RR) refers to the probability of a reduction (< 1) or an increase (> 1) in a particular outcome in a treatment group, or a group exposed to a risk factor, relative to the comparison group. For example, a RR of 0.75 translates to a reduction in risk of an outcome of 25% relative to those not receiving the treatment or not exposed to the risk factor. Conversely, a RR of 1.25 translates to an increased risk of 25% relative to those not receiving treatment or not having been exposed to a risk factor. A RR or OR of 1.00 means there is no difference between groups. A medium effect is considered if $RR > 2$ or < 0.5 and a large effect if $RR > 5$ or < 0.2 ¹⁰. InOR stands for logarithmic OR where a InOR of 0 shows no difference between groups. Hazard ratios measure the effect of an explanatory variable on the hazard or risk of an event.

Correlation coefficients (eg, r) indicate the strength of association or relationship



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between variables. They can provide an indirect indication of prediction, but do not confirm causality due to possible and often unforeseen confounding variables. An r of 0.10 represents a weak association, 0.25 a medium association and 0.40 and over represents a strong association. Unstandardised (b) regression coefficients indicate the average change in the dependent variable associated with a 1 unit change in the independent variable, statistically controlling for the other independent variables. Standardised regression coefficients represent the change being in units of standard deviations to allow comparison across different scales.

limit crosses an effect size of 0.5 in either direction, and for binary and correlation data, an effect size of 0.25. GRADE also recommends downgrading the evidence when sample size is smaller than 300 (for binary data) and 400 (for continuous data), although for some topics, these criteria should be relaxed¹¹.

‡ Inconsistency refers to differing estimates of effect across studies (i.e. heterogeneity or variability in results) that is not explained by subgroup analyses and therefore reduces confidence in the effect estimate. I^2 is the percentage of the variability in effect estimates that is due to heterogeneity rather than sampling error (chance) - 0% to 40%: heterogeneity might not be important, 30% to 60%: may represent moderate heterogeneity, 50% to 90%: may represent considerable heterogeneity and over this is considerable heterogeneity. I^2 can be calculated from Q (chi-square) for the test of heterogeneity with the following formula⁹;

$$I^2 = \left(\frac{Q - df}{Q} \right) \times 100\%$$

|| Indirectness of comparison occurs when a comparison of intervention A versus B is not available but A was compared with C and B was compared with C that allows indirect comparisons of the magnitude of effect of A versus B. Indirectness of population, comparator and/or outcome can also occur when the available evidence regarding a particular population, intervention, comparator, or outcome is not available and is therefore inferred from available evidence. These inferred treatment effect sizes are of lower quality than those gained from head-to-head comparisons of A and B.

§ Imprecision refers to wide confidence intervals indicating a lack of confidence in the effect estimate. Based on GRADE recommendations, a result for continuous data (standardised mean differences, not weighted mean differences) is considered imprecise if the upper or lower confidence



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