TECHNICAL COMMENTARY

POST-TRAUMATIC STRESS DISORDER LIBRARY

Visuospatial ability

Introduction

Visuospatial ability refers to a person's capacity to identify visual and spatial relationships among objects. Visuospatial ability is measured in terms of the ability to imagine objects, to make global shapes by locating small components, or to understand the differences and similarities between objects.

Several tests have been designed to assess visuospatial ability. The Weschler Adult Intelligence Scale (WAIS) block-design subtest requires subjects to use small blocks to recreate a larger block pattern. The WAIS picture arrangement subtest assesses perceptual skills and involves study participants placing pictures in a logical order. The WAIS Object Assembly subtest assesses speed and accuracy of jigsaw puzzle completion. The WAIS Picture Completion task requires participants to visually scan an image and identify what is missing. The WAIS Matrix Reasoning subtest requires participants to select the missing design in a patterned sequence. The Benton Judgement of Line Orientation Test requires participants to identify the orientation of a line in comparison to a target line; and both the Rey-Osterrieth Complex Figure Test (ROCFT) and the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) visuospatial/constructional subtest, involve replicating a complex figure from memory.

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-analysis[1]. 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 four systematic reviews that met our inclusion criteria[3-6].

- Moderate to high quality evidence finds medium-sized effects of poorer visuospatial ability in people with PTSD compared to traumatised or non-traumatised controls without PTSD. There was no moderating effect of age.

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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	**Visuospatial ability in children (< 18 years) exposed to trauma with PTSD vs. controls.**
Summary of evidence	**Moderate quality evidence (unclear sample size, unable to assess consistency, precise, direct) finds small to medium-sized effects that traumatised children with PTSD had poorer visuospatial ability than non-traumatised and traumatised controls (without PTSD).**
Visuospatial ability	
Small to medium-sized effects showed children with PTSD had poorer visuospatial ability; Non-traumatised controls: 5 studies, N not reported, d = -0.53, 95%CI -0.81 to -0.25, p = 0.01, I^2 not reported. Traumatised controls (no PTSD): 4 studies, N not reported, d = -0.42, 95%CI -0.67 to -0.17, p = 0.01, I^2 not reported	
Consistency in results‡	Unable to assess; no measure of consistency is reported.
Precision in results§	Precise
Directness of results‖	Direct

Masson M, East-Richard C, Cellard C

A meta-analysis on the impact of psychiatric disorders and maltreatment on cognition

Neuropsychology 2016; 30: 143-56

View review abstract online

Comparison	**Visuospatial ability in people with PTSD vs. controls.**
Summary of evidence	**Moderate to high quality evidence (small sample, consistent, precise, direct) finds a medium-sized effect of poorer visuospatial ability in people with PTSD. There was no**

	moderating effect of age (child vs. adult).
Visuospatial ability	
A medium-sized effect showed people with PTSD had poorer performance on visuospatial ability; 4 studies, N = 142, g = -0.66, 95%CI -0.99 to -0.33, $p < 0.0001$, Q = 2.56, p = 0.464 Results were similar in subgroup analysis of age (7-17 years vs. ≥ 18 years).	
Consistency in results	Consistent
Precision in results	Precise
Directness of results	Direct

Schuitevoerder S, Rosen JW, Twamley EW, Ayers CR, Sones H, Lohr JB, Goetter EM, Fonzo GA, Holloway KJ, Thorp SR

A meta-analysis of cognitive functioning in older adults with PTSD

Journal of Anxiety Disorders 2013; 27: 550-8

View review abstract online

Comparison	**Visuospatial ability in older people with PTSD (>65 years) vs. controls.**
Summary of evidence	**Moderate to high quality evidence (small sample, consistent, precise, direct) found a medium-sized effect of poorer visuospatial ability in people with PTSD compared to trauma-exposed controls.**
Visuospatial ability	
A medium-sized effect showed poorer visuospatial ability in people with PTSD: Trauma-exposed controls: 2 studies, N = 76, g = -0.61, 95%CI -0.81 to -0.42, $p < 0.05$, I^2 = 0%	
Consistency in results	Consistent
Precision in results	Precise
Directness of results	Direct

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

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

Psychological Bulletin 2015; 141: 105-40

View review abstract online

Comparison	**Visuospatial ability in people with PTSD vs. controls.**
Summary of evidence	**Moderate quality evidence (unclear sample size, unable to assess consistency, precise, direct) finds a small effect that people with PTSD had poorer visuospatial performance than controls.**
Visuospatial ability	
A small effect showed people with PTSD had poorer performance on visuospatial tasks; 12 studies, N = unclear, g = -0.38, 95%CI -0.58 to -0.20, $p < 0.05$, I^2 not reported	
Consistency in results	Unable to assess; no measure of consistency is reported.
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 small[7].

† 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 effect[7].

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[8]. lnOR stands for logarithmic OR where a lnOR 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 between variables. They can provide an indirect indication of prediction, but do not confirm causality due to possible and often unforseen 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.

‡ 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 formula[7];

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

§ 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 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 relaxed[9].

‖ 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.

References

1. Moher D, Liberati A, Tetzlaff J, Altman DG, PRISMAGroup (2009): Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *British Medical Journal* 151: 264-9.
2. GRADEWorkingGroup (2004): Grading quality of evidence and strength of recommendations. *British Medical Journal* 328: 1490.
3. Malarbi S, Abu-Rayya HM, Muscara F, Stargatt R (2017): Neuropsychological functioning of childhood trauma and post-traumatic stress disorder: A meta-analysis. *Neuroscience and Biobehavioral Reviews* 72: 68-86.
4. Masson M, East-Richard C, Cellard C (2016): A meta-analysis on the impact of psychiatric disorders and maltreatment on cognition. *Neuropsychology* 30: 143-56.
5. Scott JC, Matt GE, Wrocklage KM, Crnich C, Jordan J, Southwick SM*, et al.* (2015): A quantitative meta-analysis of neurocognitive functioning in posttraumatic stress disorder. *Psychological Bulletin* 141: 105-40.
6. Schuitevoerder S, Rosen JW, Twamley EW, Ayers CR, Sones H, Lohr JB*, et al.* (2013): A meta-analysis of cognitive functioning in older adults with PTSD. *Journal of Anxiety Disorders* 27: 550-8.
7. CochraneCollaboration (2008): Cochrane Handbook for Systematic Reviews of Interventions. Accessed 24/06/2011.
8. Rosenthal JA (1996): Qualitative Descriptors of Strength of Association and Effect Size. *Journal of Social Service Research* 21: 37-59.
9. GRADEpro (2008): [Computer program]. Jan Brozek, Andrew Oxman, Holger Schünemann. *Version 32 for Windows*

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