TECHNICAL COMMENTARY

Metacognitive training

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Introduction

Research has found that many people with schizophrenia have biased cognitive processes, and have a lack of insight about these problems[1, 2]. Biased cognitive processes are thought to underlie delusional beliefs. The aim of metacognitive training is to make patients aware of delusion-relevant cognitive biases and then to amend these biases.

Cognitive biases in people with schizophrenia involve a tendency to jump to conclusions based on a small amount of information, and make errors when trying to find reasons for their own and others' behaviours. Research has shown that people with schizophrenia are often unsure about their correct interpretation of information, but are over-confident about their incorrect interpretation of information.

Metacognitive training involves eight group sessions with three to ten patients and is based on three fundamental components. First, knowledge translation involves describing cognitive biases in a way that explains how they contribute to the formation of delusions. Second is the use of specific exercises to raise awareness about the negative consequences of cognitive biases, and third, patients are taught alternative thinking strategies to help them avoid the cognitive biases that can lead to delusional beliefs. Patients are encouraged to express personal examples of biases, and discuss ways to counter them, serving to provide corrective experiences in a supportive atmosphere.

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 2000 that report results separately for people with a diagnosis of schizophrenia, schizoaffective disorder, schizophreniform disorder or first episode schizophrenia. Reviews were identified by searching the databases MEDLINE, EMBASE, CINAHL, Current Contents, PsycINFO and the Cochrane library. Hand searching reference lists of identified reviews was also conducted. When multiple copies of reviews were found, only the most recent version was included. Reviews with pooled results were given priority for inclusion.

Review reporting assessment was guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) checklist which describes a preferred way to present a meta-analysis[3]. Reviews rated as having less than 50% of items checked have been excluded from the library. The PRISMA flow diagram is a suggested way of providing information about studies included and excluded with reasons for exclusion. Where no flow diagram has been presented by individual reviews, but identified studies have been described in the text, reviews have been checked for this item. 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,

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precise and direct with low associated risks (see end of table for an explanation of these terms)[4]. 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 three systematic reviews that met our inclusion criteria[1, 2, 5]. These are presented below in alphabetical order.

- High quality evidence suggests a small benefit of improved positive symptoms with metacognitive training with no benefit for delusions.

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Eichner C, Berna F

Acceptance and efficacy of metacognitive training (mct) on positive symptoms and delusions in patients with schizophrenia: A meta-analysis taking into account important moderators

Schizophrenia Bulletin 2016; 42(4): 952-62.

View review abstract online

Comparison	**Metacognitive training (8 weeks) vs. various control conditions.**
Summary of evidence	**High quality evidence (large samples, consistent, precise, direct) suggests metacognitive training may improve positive symptoms in people with schizophrenia. Moderate quality evidence (inconsistent) suggests it may also be more acceptable than control conditions.**
Mental state and acceptance of training	
Significant, small effect of improved positive symptoms and acceptance of the intervention with metacognitive training; Positive symptoms: 11 studies, N = 467, g = -0.34, 95%CI -0.53 to -0.15, $p < 0.05$, I^2 = 2.68% Delusions: 11 studies, N = 646, g = -0.41, 95%CI -0.74 to -0.07, $p < 0.05$, I^2 = 75.30% Acceptance of the intervention: 5 studies, N = 296, g = -0.84, 95%CI -1.37 to -0.31, $p < 0.05$, I^2 = 75.75% Moderator analyses showed that results remained significant when assessing results according to group vs. individual sessions or active vs. non-active control conditions. Using only studies being at low risk for bias regarding adequate randomisation, masking and complete outcome data showed reduced effect sizes for positive symptoms and delusions, with only positive symptoms remaining significant (g = -0.28, $p < 0.05$ and g = -0.18, $p > 0.05$ respectively). Authors found no evidence of publication bias.	
Consistency in results‡	Consistent for positive symptoms, inconsistent for delusions and acceptance of the intervention.
Precision in results§	Precise
Directness of results‖	Direct

Jiang J, Zhang L, Zhu Z, Li W, Li C

Metacognitive training for schizophrenia: a systematic review

Shanghai Archives of Psychiatry 2015; 27(3): 149-157

View review abstract online

Comparison	**Metacognitive training (8 weeks) vs. control conditions, mostly treatment as usual.**
Summary of evidence	**Moderate quality evidence (consistent, direct, unable to assess precision, large samples) suggests meta-cognitive training may improve positive symptoms but not delusions.**
Mental state	
Significant effect for improved positive symptoms in patients receiving metacognitive training; PANSS Positive: 4 RCTs, N = 249, MD = -2.29, 95%CI -4.30 to -0.28, $p < 0.05$, $I^2 = 34.8\%$, $p = 0.2033$ *No significant differences between groups for delusions;* PSYRATS Delusions: 4 RCTs, N = 387, MD = -0.75, 95%CI -2.72 to 1.21, $p > 0.05$, $I^2 = 60.2\%$, $p = 0.056$ Authors state that some bias may be present in the included studies.	
Consistency in results	Consistent
Precision in results	Unable to assess, MD not SMD
Directness of results	Direct

van Oosterhout B, Smit F, Krabbendam L, Castelein S, Staring ABP, van der Gaag M

Metacognitive training for schizophrenia spectrum patients: a meta-analysis on outcome studies

Psychological Medicine 2015; 45(1): 47-57

View review abstract online

Comparison	**Metacognitive training vs. various control conditions.**

Metacognitive training

Summary of evidence	**Moderate to high quality evidence (precise, indirect, mostly consistent, large samples) suggests a small benefit of metacognitive training for positive symptoms (reported in blinded studies only) and no benefit for delusions.**

Mental state

Non-significant, small trend effect for improved positive symptoms in patients receiving metacognitive training over controls;

All studies: 9 studies, (N = 214), *g* = 0.256, 95%CI -0.004 to 0.516, *p* = 0.054, Q = 12.507, Q-test *p* = 0.130, I^2 = 36%, *g* corrected for possible publication bias = 0.207

A small effect was reported in blinded studies for improved positive symptoms in patients receiving metacognitive training over controls;

Blinded studies: 4 studies, *g* = 0.359, 95%CI 0.09 to 0.63, *p* = 0.010, Q = 3.921, Q-test *p* = 0.270, I^2 = 23.5%, *g* corrected for possible publication bias = 0.223

No differences between groups when studies were analyzed separately by quality;

High quality studies: 2 studies, *g* = 0.279, 95%CI -0.18 to 0.74, *p* = 0.232, Q = 2.101, Q-test *p* = 0.147, I^2 = 52.4%

Low quality studies: 7 studies, *g* = 0.224, 95%CI -0.12 to 0.60, *p* = 0.182, Q = 10.367, Q-test *p* = 0.110, I^2 = 42.1%

No differences between groups in intention to treat analysis studies;

Studies with intention to treat analyses: 1 study, *g* = 0.098, 95%CI -0.22 to 0.42, *p* = 0.546

No differences between groups for delusions;

All studies: 7 studies, (N = 254), *g* = 0.223, 95%CI -0.05 to 0.49, *p* = 0.103, Q = 11.306, Q-test *p* = 0.079, I^2 = 46.9%, *g* corrected for possible publication bias = 0.034

No effect when studies are analyzed separately by quality;

High quality studies: 3 studies, *g* = 0.108, 95%CI -0.30 to 0.52, *p* = 0.604, Q = 6.863, Q-test *p* = 0.032, I^2 = 70.9%, *g* corrected for possible publication bias = -0.253

Low quality studies: 4 studies, *g* = 0.387, 95%CI 0.05 to 0.72, *p* = 0.024, Q = 1.643, Q-test *p* = 0.650, I^2 = 0%, *g* corrected for possible publication bias = 0.326

No differences in blinded studies;

Blinded studies: 5 studies, *g* = 0.174, 95%CI -0.12 to 0.47, *p* = 0.250, Q = 9.089, Q-test *p* = 0.059, I^2 = 56.0%, *g* corrected for possible publication bias = 0.028

No differences in intention to treat analysis studies;

Studies with intention to treat analyses: 2 studies, *g* = -0.017, 95%CI -0.48 to 0.45, *p* = 0.944, Q = 4.276, Q-test *p* = 0.039, I^2 = 76.6%

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Metacognitive training

Consistency in results	Consistent for all outcomes except delusions in high quality studies.
Precision in results	Precise
Directness of results	Indirect comparison (mixed control conditions – no analysis was conducted to assess any effects of different control conditions).

Explanation of acronyms

CI = Confidence Interval, *g* = Hedges' *g* = standardized mean difference (see below for interpretation of effect size), I^2 = % of heterogeneity in results, MD = mean difference, N = number of participants, *p* = statistical probability of obtaining that result ($p < 0.05$ generally regarded as significant), PANSS = Positive and Negative Syndrome Scale, PSYRATS = Psychotic Symptoms Rating Scales, Q = Q statistic for the test of heterogeneity, RCT = randomised controlled trial, vs. = versus

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[6].

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† 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) which 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. 0.2 represents a small effect, 0.5 a medium effect, and 0.8 and over represents a large effect[6].

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[7]. lnOR stands for logarithmic OR where a lnOR of 0 shows no difference between groups. Hazard ratios

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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.

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‡ 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[6];

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

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§ 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[8].

‖ 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.

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