UNIVERSITY OF PADOVA

Department of General Psychology
University of Padua, Padua, Italy[1]

Department of Psychiatry and Psychotherapy
University Medical Center Hamburg-Eppendorf, Hamburg, Germany[2]

Master's Degree in Cognitive Neuroscience and Clinical Neuropsychology

Final Dissertation

Metacognitive Training for Psychosis (MCT): A Systematic Review of the Meta-Analyses Regarding the Effectiveness of Psychotic Symptom Reduction in Schizophrenia

Supervisor
Prof. Dr. Chiara Spironelli[1]

Co-supervisor
Prof. Dr. Steffen Moritz[2]

Candidate: Antonia Meinhart
Student ID number: 2037918

Academic Year 2022-2023

Index

Abstract

This meta-review aimed at summarizing and providing a detailed, as well as comprehensive overview of the current data and findings regarding the effectiveness of metacognitive training (MCT) in the reduction of schizophrenia symptoms, specifically overall symptoms, positive symptoms [including delusions and hallucinations], and negative symptoms. A total of nine meta-analyses, two re-analyses, and two letters to the author were discussed and analyzed in a systematic review. Study overlap (CCA; Pieper et al., 2014) and methodological quality were assessed (AMSTAR-2; Shea et al., 2017). A classification of the evidence was carried out using metaumbrealla.org (Gosling et al., 2023). None of the meta-analyses were considered to be of high methodological quality or having provided convincing evidence in favor of MCT. However, the most recent meta-analysis (Penney et al., 2022) provided a considerable amount of evidence in favor of MCT, as it is the largest meta-analysis on this topic to date and was ranked highest in methodological quality. Future research should aim at testing the robustness of these findings. Nonetheless, this meta-review is subject to several limitations associated with the strict guidelines of the AMSTAR-2 checklist, as well as the use of metaumbrella.org (Gosling et al., 2023), the statistical analysis tool for meta-reviews. This dissertation was conducted under the supervision of the main developer of MCT, Steffen Moritz.

Keywords: metacognition, metacognitive training, meta-review, psychosis, schizophrenia

CHAPTER ONE

Metacognitive Training for Psychosis (MCT): A Systematic Review of the Meta-Analyses Regarding the Effectiveness of Psychotic Symptom Reduction in Schizophrenia

Schizophrenia and Psychosis

First developments in the conceptualization of schizophrenia and psychosis have been largely credited to Emil Kraepelin (1856-1926), who popularized the term *dementia praecox* to describe a group of disorders characterized by a set of symptoms including steady deterioration of functioning, emergence of delusions and hallucinations, disorganized thought, and catatonia (Kendler, 2020b). In addition to Kraepelin's publications on *dementia praecox*, Eugen Bleuler (1857-1939) provided a more comprehensive definition and overview of the *schizophrenias* (transl. Greek *schizo-* = "split", *phren-* = "mind"; Merriam-Webster, n.d.-c), including research on heredity and environmental influences regarding the risk for schizophrenia (Kendler, 2020a). Today, schizophrenia is defined as a group of highly heterogeneous mental disorders commonly characterized by recurring episodes of psychosis, during which a person experiences difficulty separating reality from delusion or hallucination (Owen et al., 2016).

Lifetime prevalence of schizophrenia is estimated at about 1%, with first episodes of psychosis typically emerging in early adulthood (McCutcheon et al., 2020). Its chronic course, early onset, and set of debilitating symptoms often leads to significant impairments in daily life, social and cognitive functioning, as well as lowered employment rates (80-90%) and decreased life expectancy (10-20 years) (Owen et al., 2016). In 2019, schizophrenia was ranked as one of the worldwide leading disorders requiring long-term disability adjustments in individuals aged 25 to 49 years old (Vos et al., 2020). Lifetime rates of suicide for individuals with schizophrenia reach

about 10% (Keepers et al., 2020), whereas varying rates of attempted suicide have been reported at about 18% to 55% (Sher & Khan, 2019). Comorbidity of schizophrenia and other health conditions (*e.g.*, additional psychiatric disorders, substance use disorders, diabetes, obesity), as well as limited access to the necessary psychiatric treatment have been listed as additional factors to the morbidity and mortality in patients with schizophrenia (Keepers et al., 2020). Moreover, the financial burden – be it for the patient, family, or societal costs – are high, reaching about an annual $155 billion in healthcare costs in the USA (Wander, 2020).

Notwithstanding a wide set of biological, genetic, developmental, and environmental risk factors have been studied since the early days of schizophrenia research (*e.g.*, Howes et al., 2022; Nakamura & Takata, 2023), schizophrenia remains a highly heterogeneous disorder, with clinical presentations ranging from exhibiting primarily positive symptoms to primarily negative or cognitive symptoms (Faden & Citrome, 2018). Thus, in addition to an array of available pharmacological interventions, defining a uniform conceptualization and classification for schizophrenia and its related disorders, or drawing up effective and specified treatment plans for patients have presented as quite a challenge.

Classification and Diagnostic Tools

After its most recent publication, the eleventh edition of the International Classification of Diseases (ICD-11) and the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) share similar conceptualizations and classifications for schizophrenia and several subtypes – after having diverged on the relevant criteria for some time – in order to facilitate appropriate clinical applicability and diagnosis of the schizophrenia spectrum disorders (Valle, 2020). The DSM-5 lists three criteria (A, B and C) required to be fulfilled for a schizophrenia diagnosis: A) two or more of the following symptoms, which must be present for

one month or longer (at least one of the symptoms must be (i), (ii), or (iii): (i) delusions, (ii) hallucinations, (iii), disorganized speech, (iv) grossly disorganized or catatonic behavior, (v) negative symptoms (*e.g.*, diminished emotional expression), B) a substantial period of time since onset of the disturbance characterized by impairment in one of the major areas of functioning (i.e., work, interpersonal relations, self-care), C) a six-month period of present symptoms including at least one month of symptoms (less if treated) meeting criterion A and periods of residual symptoms (*i.e.*, negative) (McCutcheon et al., 2020). Symptom severity in schizophrenia is commonly measured using the Positive and Negative Symptom Scale (PANSS; Kay et al., 1987) and the Psychotic Symptom Rating Scale (PSYRATS; Haddock et al., 1999) used to assess delusions and hallucinations. Additionally, the Brief Psychiatric Rating Scale (BPRS; Overall & Gorham, 1962) may be used to assess a broad set of several different psychiatric symptoms (*e.g.*, depression, anxiety, somatic symptoms) including psychotic symptoms.

Symptomatology

The core set of symptoms in schizophrenia are commonly classified into three groups: positive symptoms, negative symptoms, and cognitive impairments (Owen et al., 2016). Positive symptoms include delusions, hallucinations, as well as disorganized thought and speech. Delusions can be described as 'fixed false beliefs' that are held with strong conviction and self-certainty, while they are objectively illogical or irrational (Baker et al., 2019; Feyaerts et al., 2021). In other words, delusions are generally resistant to revision, even when presented with evidence or information that is contradictory to the delusional content. The content of such delusions can take on wide-ranging themes and contents, such as the belief of oneself being dead (Cotard delusion) or an impostor having replaced a friend or family member (Capgras delusion), among others (Feyaerts et al., 2021). Hallucinations are described as a sensory perception without an external

stimulus present, and can be distinguished into unimodal auditory verbal, visual, tactile, and olfactory hallucinations, or occur in a multimodal manner (Lim et al., 2018). Out of these, auditory verbal hallucinations are the most common in patients with schizophrenia, endured by ca. 60-80% of patients (Lim et al., 2018) and can be quite persistent even with the treatment of neuroleptic medication (Nathou et al., 2019). Negative symptoms can be described as reduced functioning or a diminished, and sometimes lacking, set of behaviors regarding expression (*e.g.*, blunted affect, alogia), interest, and motivation (*e.g.*, anhedonia) (Correll & Schooler, 2020; Galderisi et al., 2018).

To date, an extensive body of electrophysiological research investigating anatomical and other biological correlates of schizophrenia have found abnormal firing of neural oscillations, resulting in disruptions of the serotonergic, dopaminergic, glutamatergic systems, a variety of other neurotransmitters (*e.g.*, gamma-aminobutyric acid), as well as anatomical abnormalities which have been linked to increased positive, negative, and also cognitive symptoms in patients with chronic and first-episode psychosis (*e.g.*, McCutcheon et al., 2020; Steinmann et al., 2019; Stępnicki et al., 2018; Yang & Tsai, 2017). Nonetheless, the emergence, increase and maintenance of positive and negative symptoms have also been linked to deficits in the predictive processing of perception (hallucinations; Weilnhammer et al., 2020), as well as several cognitive deficits and biases (delusions and negative symptoms; Baker et al., 2019; Galderisi et al., 2018; McLean et al., 2016).

In line with this, patients with schizophrenia and related spectrum disorders tend to exhibit deficits in social cognition and overall social functioning, including impairments in the domains of emotion processing, social perception and mentalization, and attributional style (Green et al., 2019). Several cognitive biases are commonly found in people with schizophrenia and psychosis.

A multitude of studies have indicated that patients with schizophrenia show impairments in correctly attributing one's mental state to others and vice versa, a construct that has been termed Theory of Mind (ToM; Premack & Woodruff, 1978) which has been linked to deficits in neurocognition, which may in turn amplify negative symptoms in people with schizophrenia (Thibaudeau et al., 2020). Additionally, the data-gathering bias of Jumping To Conclusions (JTC) describes drawing confident and premature conclusions without considering the full set of evidence or information, and has been found to occur more likely in individuals with psychosis and schizophrenia than in the general population (Dudley et al., 2015). JTC has been suggested as being one of the most important biases, and is not only considered a precursor, but also a preserver of positive symptoms such as delusions and hallucinations (McLean et al., 2016). It is suggested that a lack of metacognition amplifies such confidence and, in turn, diminishes the patients' rate of making assessments about their judgments (Takeda et al., 2018). Another cognitive bias that has been linked with mainly delusions in psychosis is the Bias Against Disconfirmatory Evidence (BADE), which describes the unsuccessful attempt at correcting a belief when presented with information arguing against that belief (McLean et al., 2016). These complex, wide-ranging expressions clinical manifestations in schizophrenia can make the devising of treatment and therapy a challenging matter.

Treatment Options and Therapeutical Approaches

In the practice guideline published by the American Psychiatric Association (APA), a set of pharmacological and non-pharmacological interventions that are recommended for the treatment of patients with schizophrenia and psychosis (Keepers et al., 2020). While positive symptoms respond relatively well to pharmacological treatment, negative symptoms and cognitive symptoms are often omitted (Faden & Citrome, 2018), leaving room for improvement. In the

domain of psychological and cognitive interventions for schizophrenia, several approaches have been intensively studied and eventually gained popularity over time, such as psychoeducation, cognitive remediation (CR), cognitive behavioral therapy for psychosis (CBT; CBTp) and metacognitive training for psychosis (MCT). The main focus and aims of CR are the training of cognitive deficits via scientific principles of learning enhancement, which should subsequently enhance functional outcomes (Bowie et al., 2020). CBT aims at alleviating distress or dysfunctional behavior by means of remediation, during which a patient challenges feelings or interpretations of experiences, specifically symptoms and functioning, and their consequences (Jones et al., 2018), and has been listed by the APA as part of the psychosocial interventions recommended for patients with schizophrenia (Keepers et al., 2020). While CBTp has shown to be modestly to strongly effective in treating positive symptoms of schizophrenia, such as hallucinations and delusions (Turner et al., 2020), it has been indicated that CBTp effectiveness in improving patients' distress and quality of life, as well as risk of relapse is less compelling (Jones et al., 2018; Laws et al., 2018).

It has been suggested that lack of self-reflection, lack of insight, and increased self-conviction, as well as cognitive distortions and biases may be linked to so-called metacognitive deficits (Bruno et al., 2012). The term *metacognition* is built out of the combination of two words, namely *meta* (transl. Greek "after", "beyond" or "above") and *cognoscere* (transl. Latin "to know" or "to learn") (Merriam-Webster, n.d.-a, n.d.-b), and is used to define the process of 'thinking about thinking'. Metacognition can also be described as the 'cognition and knowledge about cognitive phenomena' (Flavell, 1979). Although metacognitive deficits are most likely present in the majority of patients with schizophrenia, patients with delusions in particular are thought to be

severely impaired in that regard (Bruno et al., 2012). MCT aims at exerting its effect by improving metacognition.

Metacognitive Training for Psychosis (MCT)

MCT, as developed by S. Moritz and T. S. Woodward, is a psychoeducational treatment tool for patients with schizophrenia or psychosis that first emerged in the early 2000s. The training focuses on the body of research on interventions in the cognitive-behavioral domain and relating the necessary knowledge to the patients (Moritz & Woodward, 2007a, 2007b). Thus, MCT can be described as a combination or merge of CBT, CR, and psychoeducation (Moritz et al., 2014).

Aims and Objectives

MCT addresses metacognitive biases or distortions that are commonly detected in patients with schizophrenia (Moritz & Woodward, 2007b), such as JTC, overconfidence in errors, and BADE, which have been suggested to exacerbate positive and cognitive symptoms present in psychosis (Lemmers-Jansen & Moritz, 2021; Moritz et al., 2022). To alleviate and reduce these symptoms, as well as in hopes of preventing further relapses, MCT subsequently aims at analyzing and correcting patterns of biased and overconfident thinking (Köther et al., 2017; Moritz et al., 2014).

MCT is a group intervention of ten independent modules, which are separated into two parallel-running cycles (with differing exercises), with sessions held one to two times a week (Lemmers-Jansen & Moritz, 2021). Recommended group size is three to ten patients, whereas recommended session length is 45-60 minutes. At the beginning of each session, the group is reminded of the group rules (*e.g.*, being mindful of other participants, confidentiality, not interrupting others, etc.) and introduced to the topic of the module at hand, followed by completing a range of guided exercises and relating the discussed domain to situations of daily living and

psychosis. A protocol of each session documents relevant elements such as attendance (*i.e.*, number of female/male/other patients attended), participation, commentary regarding exercises or slides, overall mood (*e.g.*, cheerful, constructive), understanding of topic, and weather conditions – all of which are used for assessment, evaluation, and betterment of the training. At the end of each session patients are asked to fill out an anonymous survey regarding a subjective assessment of MCT, which is used for evaluation and further development of the training. Additionally, patients receive a handout including exercises and in-depth notes on each module, as well as a red and yellow card (see *Figure 1*), which can be used in situations of acute symptomatology or emergency to provide a meta-cognitive approach to the situation at hand and – if needed – resort to calling a trusted person (*e.g.*, friends, family, therapist) for help.

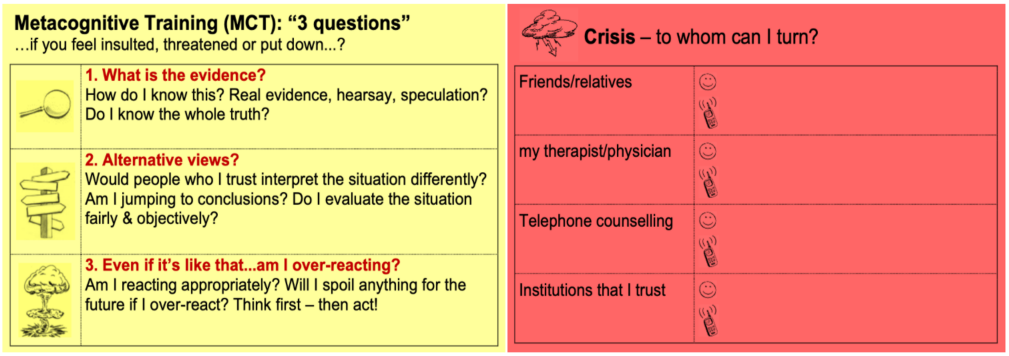


Figure 1. *Examples of Red and Yellow Cards Consigned to Schizophrenia Patients, which Can Be Used in Case of Acute Symptomatology or Emergency.*

Manual and Modules

The official MCT manual and presentation slides can be found free of charge and available in over 39 languages on the University Clinic Hamburg-Eppendorf website using the following link: http://www.uke.de/mct. The manual consists of a detailed introduction, overview, and step-by-step instructions to the topic of cognitive distortions in psychosis, metacognitive training as a therapeutic tool, and an outline of each module including the target domain, basic task and objective of the module, sources of materials and theoretical background, general and specific

advice for the instructors, as well as example exercises. One cycle of MCT sessions includes a total of eight independent modules and two additional or optional modules addressing emotional problems, problem-solving errors and cognitive biases commonly found in people with schizophrenia (see *Figure 2* for an overview). Moreover, each module includes a set of exercises to provide an interactive environment for visualizing and discussing cognitive biases 'in action'. The two parallel running cycles of modules (A and B) provide alternative sets of exercises to ensure that patients who may choose to join more than eight sessions can still discuss and benefit from novel exercises for each module.

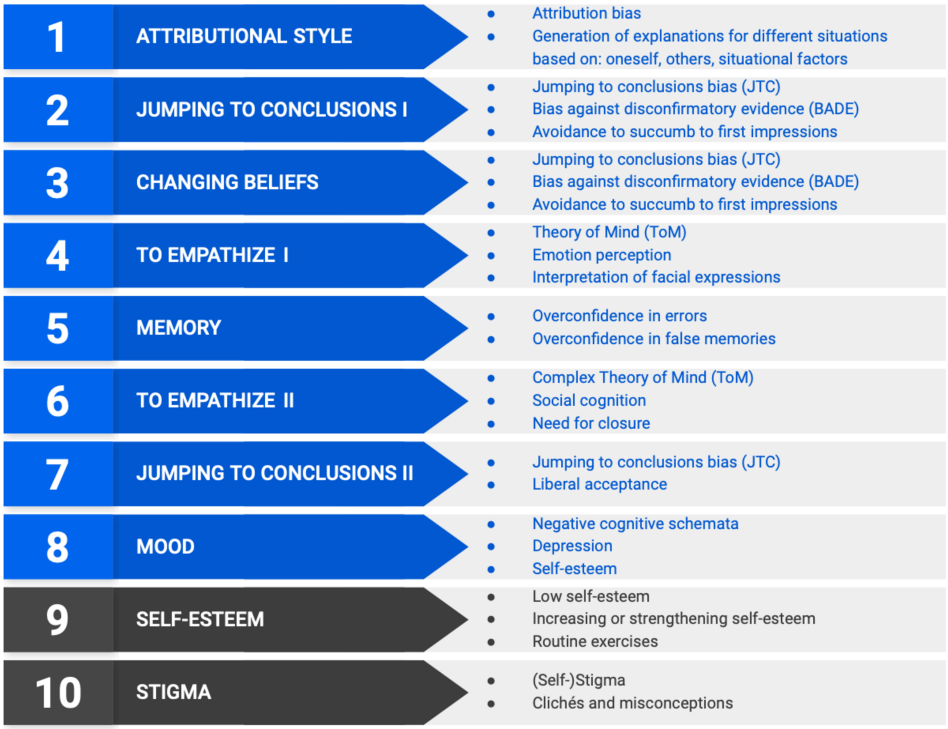


Figure 2. *Metacognitive Training for Psychosis (MCT) Modules and Focus Domains.*

MCT Adaptations

Additional adaptations for MCT have been developed over the past decade, including individualized MCT (MCT+; see Vitzthum et al., 2014) and MCT for the acute psychiatric setting (MCT-Acute; Fischer et al., 2022). Additionally, the developers designed a 'self-help' app. The COGITO app is a free self-help app (see www.uke.de/cogito) which adapts techniques from CBT

and MCT into a set of exercises aimed at the reduction of depressive symptoms and to increase self-esteem. Users can collect medals for having completed an exercise, or edit the exercises to fit their needs and targeted symptoms. While this app is intended to aid as a subsidiary tool and accommodate further support patients outside of the acute health care setting, it should by no means replace clinically established treatment and therapy plans.

Providing a Critical Review of the Meta-Analyses for the Effectiveness of MCT on Psychotic Symptom Reduction

Although several quantitative reviews addressing the topic of MCT, its adherence, feasibility and effectiveness have been published during the past ten years, critical meta-reviews assessing methodological approaches, risk of bias, and effect sizes are lacking. The aim of this systematic review is to provide a comprehensive overview on the evidence regarding the effectiveness of MCT on psychotic symptom reduction in schizophrenia, specifically overall symptoms, positive symptoms, including delusions and hallucinations, as well as negative symptoms. For this aim, several databases were searched for meta-analyses assessing the effectiveness of MCT and assessed in a systematic narrative review. Moreover, study quality, as well as study overlap were evaluated. A classification and interpretation of the provided evidence for each meta-analysis was implemented, as well.

CHAPTER TWO

Methods

Records for this meta-review were systematically searched and obtained through the databases '*PsycINFO*', '*PsycNET*', '*PubMed*' and '*MEDLINE*'. The data search was conducted for quantitative studies (*i.e.*, meta-analyses) on the effectiveness and efficacy of MCT published between 2007 and June 1st, 2023. The following search terms were used: (meta-analysis OR metaanalysis OR quantitative review) AND (schizophrenia OR psychosis) AND (metacognitive train* OR meta-cognitive train* OR MCT). All retrieved records were imported into rayyan.ai (Ouzzani et al., 2016) for further synthesis, which is a web-based browser designed for conducting systematic reviews. The initial search yielded a total of 460 results, from which 60 duplicate articles were removed. The remaining articles were further examined and included for review if the following criteria were met: a) quantitative study design or meta-analysis including at least one study on MCT, b) study samples including participants with a DSM and/or ICD diagnosis of a schizophrenia spectrum disorder, d) interventions must include MCT (group or individualized), e) in case of mixed-intervention analysis (*e.g.*, MCT in addition to other interventions, such as CBT) a subgroup analysis for MCT was performed, f) primary outcome parameters were clinical symptoms (*i.e.*, positive symptoms [mainly delusions and hallucinations], negative symptoms, overall symptoms, and/or change in cognitive biases). Meta-analyses on case studies were excluded from this review. All included articles were written in English. There were no restrictions on type of control conditions, setting (*e.g.*, in-patient, out-patient) or follow-up measures. Letters to the authors that include re-analysis of the data were included and discussed in the final review. Upon consideration, the main developer of MCT, Steffen Moritz, suggested an additional article (Burlingame et al., 2022) to be included in the review. Reference lists of included meta-analyses

were searched for relevant studies, as well. In case of missing data regarding the meta-analyses, the relevant authors were contacted for further information. A total of nine meta-analyses and four letters to the authors/re-analyses were included in the final meta-review (see *Figure 3*).

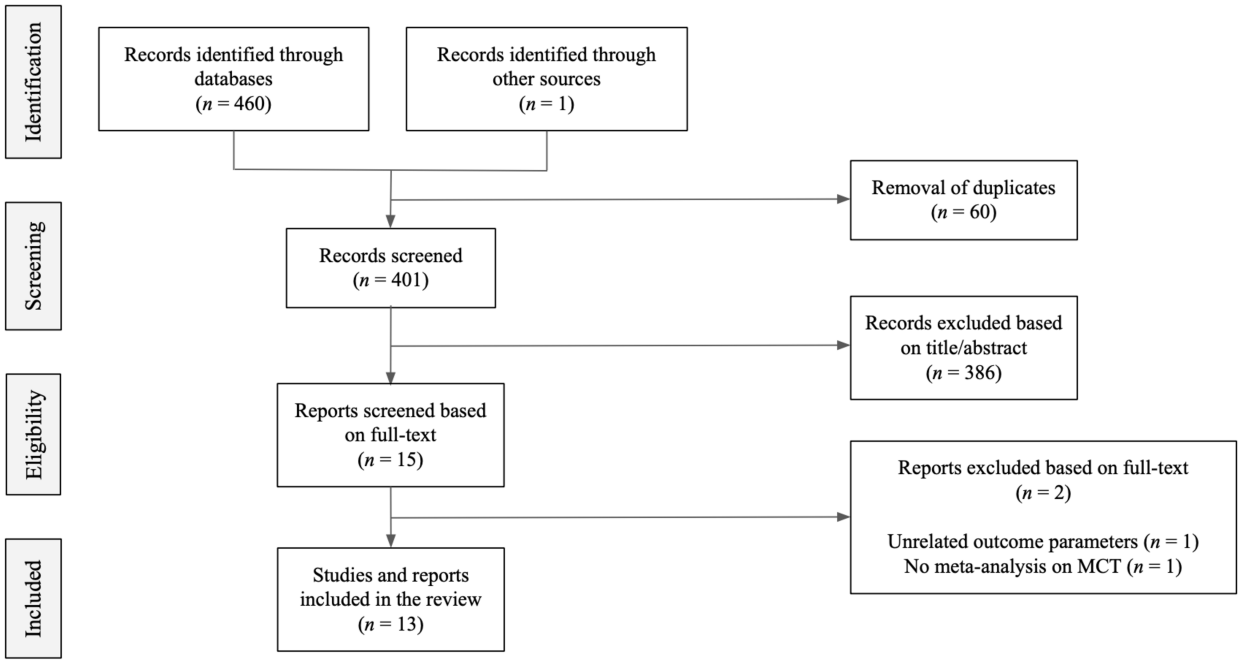


Figure 3. *Flowchart of Included Studies and Articles for Meta-Review.*

All included meta-analyses and letters to the authors were discussed in a systematic narrative review. Study overlap, *i.e.*, the extent to which meta-analyses included the same primary studies, was assessed by calculating the corrected covered area (*CCA*; Pieper et al., 2014), and can be categorized into very high (>15%), high (11-15%), moderate (6-10%), and slight (0-5%). The assessment of study overlap has been recommended for meta-reviews (Hennessy et al., 2019) to critically evaluate results and effect sizes of meta-analyses which have included and assessed a majority of the same primary studies. Additionally, data extraction and stratification were performed for all meta-analyses. Methodological quality of meta-analyses was evaluated using A MeaSurement Tool to Assess Systematic Reviews (AMSTAR-2), which is scored on 16 items to classify high, moderate, low, and critically low-quality studies (Shea et al., 2017). Analyzable

study data was entered into metaumbrella.org (Gosling et al., 2023) – an online statistical application – and its associated *R* package which have been developed and designed for conducting meta-reviews. The browser-based tool uses a random-effects model to convert the entered data into a common effect size (Hedges' *g*; Hedges, 1981), provides a 95% confidence interval and assesses level of heterogeneity using the I^2 statistic (Higgins et al., 2003). Furthermore, risk of potential biases (*i.e.*, small study bias, excess significance bias) is assessed, and evidence classification is performed. Additionally, prediction intervals and large study effects were assessed. The resulting data can be classified into the following five categories: a) convincing evidence (Class I: sample size > 1,000, *p*-value < 10e-6, I^2 < 50%, *p*-value Egger's test > .05 and *p*-value Ioannidis test > .05), b) highly suggestive evidence (Class II: sample size > 1,000, *p*-value < 10e-6, largest study with a statistically significant effect and class I criteria not met), c) suggestive evidence (Class III: sample size > 1,000, *p*-value < 10e-3, class I-II criteria not met), d) weak evidence (Class IV: *p*-value < .05, class I-III criteria not met), and e) non-significant (ns: *p*-value > .05).

CHAPTER THREE

Results

Systematic Review of the Meta-Analyses

Jiang et al. (2015)

In their 2015 meta-analysis, Jiang et al. aimed to review the literature assessing the efficacy of MCT in treating schizophrenia. The authors investigated several outcome parameters divided into primary (psychotic symptom severity as assessed by the PANSS) and secondary (global and mental state, general functioning, quality of life, engagement with service, economic costs, treatment satisfaction, adverse effects, and dropout rate) outcomes. The study was registered with PROSPERO (CRD42015016609). See *Table A1* in the Appendix for a detailed description of the characteristics of this meta-analysis.

Studies included in this meta-analysis had to meet specific inclusion criteria, such as a RCT design, the description of the allocation procedure, to include a sample comprised of at least 50% of patients diagnosed with a schizophrenia spectrum disorder as provided in the DSM-IV ('Schizophrenia Spectrum and Other Psychotic Disorders') or ICD-10 (F.20-29), include patients that received a standardized pharmacological treatment, and to include an experimental group that underwent adjunctive group MCT with a minimum of eight standardized sessions. The initial data search yielded ten studies, however, after careful consideration, a total of five studies were included in the data analysis for MCT effects on positive symptom severity and delusions. All studies were randomized controlled trials published before January 31st, 2015. Nine out of the ten initially selected studies employed eight sessions of MCT over the course of four weeks, while one administered sixteen sessions over four weeks. Notwithstanding study samples included both in- and outpatients, the sample sizes included were small. Furthermore, the majority of studies did

not conduct follow-up data analysis. Moreover, three studies did not use blind assessment. Control treatments were either CogPack, treatment as usual (TAU), supportive therapy (ST), or newspaper discussion (ND). Despite initially planning to remove non-normal data, the team decided to pool data results, due to the majority of studies not meeting the criteria for parametric analysis. No funnel plots regarding key outcomes were produced to assess reporting bias, as a maximum of only four of the ten needed studies for creating funnel plots fulfilled the inclusion criteria and no other protocols were available. Heterogeneity was assessed using Chi-square and I^2 statistical tests.

Subgroup analyses were performed when heterogeneity was detected for four studies in the assessment of delusions (I^2 = 60.2%; tau^2 = 2.373, p = .056), however, no evidence for an effect for MCT was found between the two studies that used TAU as a control condition (I^2 = 84%; p-value for Chi-square = .01), or for the two studies using an alternative control condition (I^2 = 0%; p-value for Chi-square = .90). Although authors reported evidence for a small but significant effect for MCT on positive symptom reduction (no effect size given), the number of studies included in this analysis (*i.e.*, Briki, Monnin et al., 2014, Favrod et al., 2014; Moritz et al., 2013; van Oosterhout et al. 2014) was notably small with a cumulated sample size of 249 participants, and thus these results should be interpreted with caution.

The authors were unable to assess any effects on several other outcome parameters (*e.g.*, delusions), as only two of the included studies had investigated these variables. Furthermore, three articles were rendered high-risk for attribution bias, while two studies showed high levels of attrition bias. The risk for selection bias, detection bias, and reporting bias were low for all studies that could be evaluated. All studies showed a high level of risk for other bias.

After the assessment of study quality and data analysis, Jiang and colleagues rendered the results of their meta-analysis as inconclusive, due to the considerably small number of studies

included in their analysis, as well as the small sample sizes, varying methodological approaches, contradictory follow-up results, and unstandardized methods for the assessment of MCT's effectiveness.

The authors recommend that further research should be conducted on randomized trials that utilize intention-to-treat analysis, routine follow-up assessments, and standardized measures on global and specific outcomes. Such research could potentially provide a more comprehensive and informed decision on the effectiveness of MCT, as well as its potential for routine use in schizophrenia treatment. Jiang et al.'s (2015) study was funded by several different sources, including the Shanghai Health System Leadership in Health Research Program (XBR2011005), the Science and Technology Commission of Shanghai Municipality (13z2260500), the Shanghai Shen Kang Hospital Development Center (SHDC12014111), as well as the Shanghai Municipal Commission of Health and Family Planning (2013ZYJB0020). No conflict of interest was noted by the authors.

Van Oosterhout et al. (2015), Moritz et al. (2015), van Oosterhout et al. (2016)

With prior studies yielding inconclusive results on the effectiveness and efficacy of MCT, van Oosterhout et al. (2015) conducted a meta-analysis covering the effects of MCT on positive symptoms, delusions, and data-gathering bias. The researchers followed the PRISMA guidelines for carrying out their meta-analysis, as recommended by Liberati et al. (2009). See *Table A1* in the Appendix for a detailed description of the characteristics of this meta-analysis.

The studies included in this review had to meet certain criteria, encompassing the use of MCT as the experimental treatment, reports of pre- and post-test measures, as well as the inclusion of comparative trials with or without the use of randomization. Moreover, studies should a) include a minimum of 75% of patients diagnosed with a schizophrenia spectrum disorder, b) be published

in peer-reviewed journals, and c) use positive symptom and delusion ratings, as we all use data-gathering as an outcome measure. Control conditions of any kind were accepted. Moreover, notwithstanding there were no restrictions as to the language that the studies were published in, all included articles were written in English.

The data search yielded a total of 11 studies which fulfilled the inclusion criteria. Out of these, nine articles were used to assess effects for positive symptoms, seven studies for reporting effects on delusions, and three studies that provided results for effects on data-gathering bias. Additional supplementary material was also consulted. Effect sizes were corrected for small sample bias, by using Hedges' *g*, as well as for publication bias, by using Duval and Tweedie's trim-and-fill procedure (Duval & Tweedie, 2000b). However, allegiance bias could not be assessed. Quality assessment of the studies was performed using the Clinical Trial Assessment Measure (CTAM; Tarrier & Wykes, 2004), with a cut-off score of 65, separating low-quality studies from those of high quality (Wykes et al., 2007). The following criteria were applied: sample characteristics, treatment description, allocation, control condition, assessment of outcomes, and analysis. Analysis was done separately for each outcome measure. Heterogeneity was assessed using the I^2 statistic and X^2 test.

Data analysis revealed that the sample was moderately heterogeneous on all three outcome measures, which the authors ascribed to differences in methodology, treatment dosages, and patients' symptom severity at baseline, among others. The main analysis found no evidence of an effect for MCT on positive symptoms, delusions, or data gathering bias. Studies with a CTAM score above 65 showed no significant effect sizes across all three outcome parameters. When considering studies with a CTAM score below 65, evidence for a significant effect was found for delusions (n = 4, g = 0.33, 95% CI [0.05, 0.72], p = .024), but not for positive symptoms or data-

gathering bias. In their conclusion, van Oosterhout et al. (2015) state that the findings did not support the notion that MCT has a positive effect on positive symptoms of schizophrenia, delusions, or data-gathering bias. Moreover, the authors noted moderate levels of heterogeneity and potential risk of bias, therefore these results should be considered with caution. There were no reports of financial support for this review. The authors noted no conflicts of interest.

Following the publication of this meta-analysis, Moritz et al. (2015) issued a response to the article, challenging several aspects of their review. Van Oosterhout et al. (2016) addressed these statements in a letter of correspondence and provided a re-analysis of their original findings (van Oosterhout et al., 2015). In their commentary, Moritz et al. (2015) pointed out that multiple studies providing favorable results for MCT (*i.e.*, Aghotor et al., 2010; Erawati et al., 2014; Moritz, Kerstan et al., 2011; So et al., 2015) were excluded in van Oosterhout et al.'s (2015) meta-analysis. It has to be noted that the study by So et al. (2015) was yet to be published at the time that van Oosterhout et al.'s (2015) meta-analysis was being conducted. In their meta-analysis, van Oosterhout et al. (2016) reasoned that the mentioned studies were omitted as they failed to meet the inclusion criteria, such as not being a comparative randomized or non-randomized trial, not reporting pre- and post-measurements, and not using either delusion ratings, positive symptom ratings or data gathering as an outcome measure. One study by Moritz, Kerstan et al. (2011) was omitted for reporting effect sizes for subscales rather than total scores on the PANSS and PSYRATS. In a sample of 48 participants, the effect sizes were neither significant for total PANSS score, nor for the total score of the PSYRATS hallucinations and delusions subscales. Moritz, Veckenstedt et al. (2011) found a marginally significant effect on delusional conviction ($F_{1,45}$ = 4.18, p = .05, η^2 = .09), as well as evidence for a medium-sized effect for the PANSS delusion subscore ($F_{1,45}$ = 4.97, p = .03, η^2 = .10). Furthermore, van Oosterhout et al.'s (2015) adherence to

PRISMA guidelines was questioned when the authors had not reached out to Moritz, Kerstan et al. (2011) for additional information on their study results, however, this point of criticism is not further addressed by the original authors.

According to Moritz et al. (2015), the moderate-to-high heterogeneity levels found in van Oosterhout et al.'s (2015) meta-analysis were likely affected by non-randomized trial studies (i.e., Rocha & Queirós, 2013), citing several sources discussing the moderating effects of study design for this claim (*i.*e., Reeves et al. 2008; Shadish, 2011).The authors showed that removing this particular study from data analysis lowered levels of heterogeneity (from I^2 =36% to I^2 = 0%; Q = 6.67, p = .464) and provided evidence for a small significant effect for MCT on positive symptoms (n = 8, g = 0.31, p = .003) (Moritz et al., 2016). Moreover, in an analysis that excluded non-randomized trials from the original dataset, the researchers found evidence for a significant medium-sized effect for MCT on positive symptoms (n = 6, g = 0.36, p = .003; I^2 = 11.3%; Q = 5.64, p = .343). Moritz et al. (2015), make a similar claim, however for a randomized-controlled study by van Oosterhout et al. (2014), showing that the removal of this study led to lowered levels of homogeneity (from I^2 = 46.9% to I^2 = 0%; Q = 2.47, p = .781) and yielded evidence for a small-to-medium effect (n = 6, g = 0.33, p = .003) on delusions. Van Oosterhout et al. (2016) argue that this particular study should not be removed from analysis for the sake of homogeneity, as it provides a large sample size and low risk of bias (Jiang et al., 2015). In their re-analysis, van Oosterhout et al. (2016) included the data of several studies that were excluded prior (*i.e*., Aghotor et al., 2010; Gawęda et al., 2015; Moritz, Kerstan et al., 2011; So et al.; 2015), and removed two non-randomized studies (*i.e.*, Erawati et al., 2014; Rocha & Quierós, 2013) from the data. The results provided evidence for a significant, but small effect on positive symptoms (g = 0.32) and delusions (g = 0.31). No p-values were reported. Nonetheless, no evidence for an effect on data

gathering was found. Van Oosterhout et al. (2016) found no evidence of an effect for MCT on any of the three outcome parameters when only including intention-to-treat studies of high-quality in their analysis.

Van Oosterhout et al.'s (2014) study was further discussed, as Moritz et al. (2015) mention that MCT+, as defined by the developers, is a hybrid of three different therapeutic approaches, namely group MCT, CBT, and cognitive remediation. In their article, van Oosterhout et al. (2016) viewed MCT+ as a combination of MCT and CBT, and suggested that possible effects found in Moritz, Veckenstedt et al. (2011) could be ascribed to the effects of CBT on positive symptoms, rather than MCT. Van Oosterhout et al. (2016) expressed that their understanding of MCT+ was based on definitions provided by Moritz, Veckenstedt et al. (2011), which compared the principles of MCT+ to those of CBT, among others. Moritz et al. (2015) also suggested that the sample of van Oosterhout et al.'s (2014) study included patients with severe delusions, which may have affected the training outcomes, stating reasons such as medication side-effects, lack of insight, and a potential lack of experienced clinicians that administer the training sessions. Moritz et al. (2015) suggested that patients experiencing such severe positive symptoms might instead benefit more from individual therapy, as opposed to group intervention. In their response, van Oosterhout et al. (2016) demonstrated that studies with high delusion baseline scores (*i.e.*, Favrod, 2014; So et al., 2015; van Oosterhout et al., 2014), showed a larger effect size for MCT on psychotic symptoms (g = 0.49) than studies with low delusion baseline scores (g = 0.25) (*i.e.*, Briki, Monnin et al. 2014; Gawęda et al. 2015; Moritz, Veckenstedt et al. 2011; Moritz et al., 2013), suggesting that group MCT might be more effective for patients with higher, rather than lower, paranoia baseline scores. No *p*-values were reported.

Lastly, Moritz et al. (2015) concluded their commentary on van Oosterhout et al.'s (2015) meta-analysis by stating that, while further improvements and research on MCT are needed, it should be kept in mind that "blanket negative pronouncement" (p. 61) could undermine the potentially beneficial effects that this therapeutic approach has to offer. Moreover, the removal of non-randomized studies from the data set, as an attempt to control for potential bias, should be considered, as it resulted in lowered levels of homogeneity, as well as it provided significant evidence for a medium-sized effect on positive symptoms. Van Oosterhout et al. (2016) summarized their correspondence by maintaining that, despite having conducted a deliberate data search and analysis, the data on MCT effectiveness lacks the necessary evidential support to be confidently incorporated into routine use. While van Oosterhout's re-analysis provided evidence for small-to-medium effect sizes on positive symptoms and delusions, all findings should be interpreted with caution. Several limitations should be considered, as the small number of articles included in both meta-analyses was further reduced when comparing outcomes for high- and low-quality studies. Additionally, there was no evidence of an effect on positive symptoms, delusions, and data-gathering bias when only high-quality, intention-to-treat studies were assessed.

Eichner and Berna (2016)

The third meta-analysis was initially conducted by Eichner (2015) as part of a Master thesis. A year later, an edited version of this paper was published by Eichner and Berna (2016). The aim of this meta-analysis was to examine the effects of MCT on positive symptoms (as assessed by the PANSS) and delusions (as assessed by the PSYRATS and PDI-21) in schizophrenia, as well as acceptance of the intervention.

In their article, Eichner and Berna (2016) criticize the statistical methodology, adherence to recommended guidelines in case of missing data, as well as the inclusion and exclusion criteria

that were chosen in previous meta-analyses conducted by Jiang et al. (2015) and van Oosterhout et al. (2015), both of which were unable to make conclusive inferences about their studies' results regarding MCT effectiveness for schizophrenia symptoms. In order to address the critical issues that were pointed out in previous meta-analyses, the authors employed a broad set of inclusion criteria to increase sample size and statistical power, by including randomized and non-randomized trials. The researchers followed the PRISMA guidelines. In case of missing data, the authors contacted the studies' authors in line with the Cochrane guidelines, citing Chapter 7 of Higgins and Deeks (2011). See *Table A1* in the Appendix for a detailed description of the characteristics of this meta-analysis.

Studies included in this review were required to meet several criteria: a) a schizophrenia spectrum disorder was diagnosed for all participants according to the criteria of the DSM-IV-TR, b) MCT was used as the experimental treatment, c) a minimum of one of the outcome parameters of interest (i.e., positive symptoms, delusions, intervention acceptance) were assessed, d) control conditions of any kind were accepted. However, any studies that used any other additional intervention to MCT, such as reasoning training, as well as social cognition and interaction training were excluded from the meta-analysis in order to control for any results in the data that cannot be ascribed to one or the other psychological intervention. Even though the authors did not use language restrictions as part of their criteria, all studies that were eventually included in the meta-analysis were written in English. A total of 158 studies were initially identified in the data search, of which 15 articles were included in the final meta-analysis. Out of these, 11 studies were used to assess effects of MCT on positive symptoms and delusions. Effect sizes were presented using Hedges' *g* to correct for small sample bias. For studies providing only mean change scores or results for subscales, the effect sizes were estimated using the suggested protocol by Lipsey and

Wilson (2000). Missing standard deviations from posttest scores were imputed using pretest scores measures. To control for potential biases Eichner and Berna (2016) implemented independent coding protocols. Moreover, non-randomized group allocation, non-blinded studies, studies with drop-out rates higher than 20% and studies that did not use an intent-to-treat approach were all considered high risk for bias. Publication bias was estimated using funnel plots. Missing data were accounted for according to the trim and fill procedures recommended by Duval and Tweedie (2000a, 2000b). Data analysis was performed using random effects models. Heterogeneity was assessed using I^2 statistics, τ statistics, as well as Q statistics, including confidence intervals. Additionally, the authors conducted a sensitivity analysis and subgroup analyses for the effect of an active control intervention, as well as the effect of individualized versus group MCT.

In their main analysis, Eichner and Berna (2016) found evidence for a medium sized effect for MCT on positive symptoms (n = 11, g = -0.34, 95% CI [-0.53, -0.15], $p < .01$). The level of heterogeneity was low (I^2 = 2.68%, 95% CI [0.00, 68.70]; Q = 10.28, p = .42; τ = 0.05, 95% CI [0.00, 0.48]). When controlling for publication bias, the effect for MCT on positive symptoms was of small size (n = 11, g = -0.29, 95% CI [-0.50, -0.07], p = .01). Evidence for a medium sized effect was found for MCT on delusions (n = 11, g = -0.41, 95% CI [-0.74, -0.07], p = .02). However, the level of heterogeneity was high (I^2 = 75.30%, 95% CI [49.13, 92.85]; Q = 40.49, $p < .01$; τ = 0.48, 95% CI [0.27, 0.99]).

The authors did not find that studies high and low in risk of randomization bias, as well as masking bias and bias in regards to missing data, significantly differed in effect sizes. Additionally, a sensitivity analysis was conducted. The removal of individual studies did not result in a significant difference in effect size for MCT on positive symptoms. However, removal of Erawati et al.'s (2014) study resulted in a reduced, marginally significant effect size for MCT on delusions

(n = 10, g = -0.25, 95% CI [-0.51, 0.00], p = .05), as well as lowered heterogeneity (I^2 = 52.80%, 95% CI [17.74, 87.31]; Q = 19.07, p = .02; τ = 0.29, 95% CI [0.01, 0.71]). Similarly, removing the study by So et al. (2015) from data analysis resulted in a lowered, marginally significant effect size for MCT on delusions (n = 10, g = -0.33, 95% CI [-0.65, 0.00], p = .05). However, the level of heterogeneity was not reduced by the removal of this study (I^2 = 72.82%, 95% CI [41.47, 92.52]; Q = 33.12, p < .01; τ = 0.44, 95% CI [0.23, 0.94]). After the removal of van Oosterhout et al.'s study (2014), the effect size for MCT on delusion increased (n = 10, g = -0.49, 95% CI [-0.81, -0.16], p < .01), while levels of heterogeneity were lowered (I^2 = 66.37%, 95% CI [31.98, 91.67]; Q = 26.76, p < .01; τ = 0.42, 95% CI [0.21, 1.00]).

An analysis of baseline differences between groups revealed no significant differences between pre-test scores for MCT on positive symptoms and delusions. Moreover, no evidence was found for significantly different effects within these subgroup analyses for the effect of an active control condition, and for the effect of individual versus group MCT. The authors conclude that their results support the effectiveness of MCT on positive symptoms and delusions in schizophrenia, and suggest the implementation of MCT into routine care.

While Eichner and Berna (2016) did find evidence for a medium sized effect for MCT on delusions, these findings should be interpreted with caution, as high levels of heterogeneity limit the generalizability of the study's results. The small effect size for MCT on positive symptoms may be more generalizable, however. Nonetheless, the results of this meta-analysis may be subject to several additional limitations. The authors note that, as different outcome measures were incorporated in their review (*e.g.*, means, standard deviations, change scores), some of which were partially incomplete for some studies, their calculations of effect size may have been affected by the use of imputed outcome measures. Moreover, articles that investigated the effects of individual

MCT were generally of lower quality, thus challenging the validity of these studies' findings. The subgroup analyses had low power, due to small sample size. Studies on long-term effects for MCT on positive symptoms or delusions were few. There was no report of financial support for this review. The authors declare no conflict of interest.

Liu et al. (2018)

In 2018, Liu et al. published a meta-analysis on MCT effectiveness on delusion severity (as assessed by the PSYRATS, PANNS, and BABS) in schizophrenia. This meta-analysis was the first to not only report on immediate effects, but also on longitudinal effects at six months post intervention. The authors did not declare whether they followed specific guidelines recommended for conducting meta-analyses (e.g., PRISMA, PROSPERO). See *Table A1* in the Appendix for a detailed description of the characteristics of this meta-analysis.

Studies were required to fulfill several criteria to be accepted for meta-analysis, such as a) including a sample of participants that were diagnosed with a schizophrenia spectrum disorder assessed under the DSM-IV, DSM-IV-TR or ICD-10 criteria, b) the inclusion of a minimum of one MCT group, c) the inclusion of one control group, d) to measure delusion severity as one of the outcomes, and e) and to incorporate pre- and post-test assessment. Furthermore, all articles were written in either English or Chinese. After an initial search in which 116 studies were identified, a total of 11 were included in the meta-analysis. Effect sizes were assessed using Hedges' *g* in order to correct for small sample bias. In case of missing post-test scores, Liu et al. (2018) used pre-test standard deviations to impute incomplete data. Additionally, effect sizes were estimated using sum of change scores in accordance with the suggested protocol by Lipsey and Wilson (2000). To check for publication bias, the authors used funnel plots, as well as Begg's and Egger's statistical tests (Begg & Mazumdar, 1994; Egger et al., 1997). Heterogeneity was assessed

using I^2 and Q statistics. Subgroup analyses were performed to test for potential moderating effects of several categorical variables (*i.e.*., individual and group MCT, immediate and prolonged post-intervention effects, Western and Eastern sample).

In the main analysis, Liu et al. (2018) studied immediate and prolonged post-treatment effects of MCT on delusion severity. The authors found evidence for a medium sized effect for MCT on immediate outcomes (n = 11, g = -0.38, 95% CI [-0.64, -0.12], p < .01), but the level of heterogeneity was high (I^2 = 63.25%; Q = 27.21, p < .01). Evidence for a medium sized effect was found for MCT on outcomes at six months post-intervention (n = 4, g = -0.35, 95% CI [-0.58, -0.12], p < .01), with a low level of heterogeneity (I^2 = 0.00%; Q = 2.95, p = .40). Publication bias was indicated by an asymmetric funnel plot. Further testing, using Rosenthal's fail-safe N analysis (Rosenthal & DiMatteo, 2001), showed a significant effect, and revealed that a total of 61 additional studies would be needed to render the results non-significant. However, Begg's and Egger's statistical tests did not indicate publication bias.

In their discussion, Liu et al. (2018) concluded that immediate and prolonged post-intervention effects (of up to six months) of MCT on delusion severity were small-to-moderate, thus supporting the notion that MCT reduces symptoms of delusions in schizophrenia. They further suggest that the number of total studies included, the number of high-quality randomized controlled trials, as well as time range, may be responsible for the discrepancy between the results of this meta-analysis and previous reviews done on MCT effectiveness (*i.e.*, Jiang et al., 2015; van Oosterhout et al., 2014; van Oosterhout et al., 2015). However, it should be kept in mind that Liu et al.'s (2018) meta-analysis included a small number of studies with high levels of heterogeneity. Additionally, the authors note that these limitations could have led to insufficient power in the subgroup analyses. Although the medium sized effect at six months post-intervention may be more

generalizable than the medium sized effect for immediate outcomes, only four studies were included in this analysis. Thus, significant results should be interpreted with caution. The authors did not report receiving any financial support for this review. No conflicts of interest were reported.

Philipp et al. (2018)

In the following year, Philipp et al. (2018) conducted a meta-analysis on the effectiveness and acceptability of metacognitive interventions on different mental disorders, namely schizophrenia and psychosis, obsessive-compulsive disorder (OCD), depression, anxiety, and others. The primary outcome for intervention effectiveness was symptom severity (assessed by symptom rating scales or disorder-specific questionnaires), whereas improvement in overall symptomatology, treatment response and satisfaction, metacognitive processes changes and quality of life (QoL) were secondary outcomes. The authors included three types of interventions: MCT, metacognitive therapy, and metacognition reflection and insight therapy. The review was registered with PROSPERO (CRD42016051006) and followed PRISMA and Cochrane guidelines, following the rationale provided by Moher et al. (2009), Shea et al. (2007), as well as Higgins and Green (2008). See *Table A1* in the Appendix for a detailed description of the characteristics of this meta-analysis.

The following inclusion criteria for selected studies had to be met: a) RCT or non-RCT design, b) included participants of age 18 years or older, c) who meet a diagnosis according to the formal classification criteria (*e.g.*, ICD, DSM) or validated and reliable questionnaires, d) metacognitive interventions had to meet the authors' working definition, e) control conditions were to be active or non-active treatments that aim at symptom alleviation via psychological methods. Studies were included regardless of patients' comorbidities and treatment settings. The initial data search yielded 4,404 articles of which 49 studies were first included in the final review; however,

only 39 of these were able to present sufficient data for analysis. Furthermore, out of these, a total of 19 studies, with a sample of 1,127 patients, were assessed for MCT effectiveness on symptom severity in schizophrenia. Effect sizes were presented in standardized mean differences (*SMD*) for a sample size of > 5 and 95% confidence intervals. If more than two studies presented data for the same outcome and comparison, they were combined for further analyses. The authors used random-effects models. Risk of bias was assessed following Cochrane guidelines (Higgins & Green, 2008) and ROBINS-I tool (Sterne et al., 2016), depending on whether the study used a RCT or non-RCT. Response rates were defined with a minimum decrease in schizophrenia symptom severity of 30% when compared to baseline scores. Reporting bias was assessed using funnel plots and Egger's test (Egger et al., 1997). Heterogeneity was assessed using I^2 and Q statistics. Neither subgroup analyses nor meta-regression analyses were performed in the case of categorical or metric predictors, respectively. Sensitivity analyses were performed on RCTs. In order to control for the effects of study design on pooled effects, the authors contrasted these results with the results based on all studies' data.

In the main analysis, Philipp et al. (2018) compared MCT effectiveness on positive symptoms of schizophrenia with that of either standard or psychological treatments, such as psychoeducation and supportive therapy, cognitive remediation tasks, or newspaper discussion. Evidence of a significant effect was found when MCT was compared with cognitive remediation tasks (n = 4, *SMD* = -0.39, 95% CI [-0.67, -0.10], p = .01), but not when compared with standard treatment, psychoeducation and supportive therapy, or newspaper discussion. However heterogeneity was moderate (I^2 = 35.2%; Q = 4.35, p = .23). When post hoc analysis regarding positive symptom severity reduction was conducted, evidence of an effect was found favoring MCT over all other control groups (n = 19, *SMD* = -0.31, 95% CI [-0.5, -0.12], p = .001).

Heterogeneity was moderate (I^2 = 51.0%; Q = 36.79, p = .01). Moreover, the authors suggest that risk of bias could be possible in regards to blinding, outcome assessment and conflicts of interest, while maintaining that this meta-analysis' search strategy should have rendered publication bias unlikely. Small sample size of the groups may have affected the meta-analyses, potentially lowering statistical power, as well as effects of pharmacological therapy as part of standard treatment, which considerably reduces psychotic symptom severity, therefore making it more difficult to detect further effects of MCT on positive schizophrenia symptoms.

The results of this meta-analysis should therefore be interpreted with caution. Philipp et al.'s (2019) research was financially supported by the German Federal Ministry of Education and Research (grant number 01KG1511). Steffen Moritz, the main developer of MCT, was part of the research team, which the authors consider as a conflict of interest. Additionally, co-author Levente Kriston served as an independent statistician in MCT trials.

Barnicot et al. (2020)

Barnicot et al. (2020) conducted a meta-analysis on the effectiveness of a wide range of psychological interventions for schizophrenia spectrum disorders in an acute inpatient setting. The primary outcomes of this study were general psychopathology, positive symptoms, as well as treatment compliance, social functioning, and relapse or rehospitalization. The types of interventions included were MCT, CBT, acceptance and commitment therapy (ACT), Eye Movement Desensitisation and Reprocessing (EMDR), interpersonal, motivational, and psychoeducational, as well as social skills. Even though the authors did not explicitly state whether any recommended guidelines for constructing meta-analyses (e.g., PRISMA, PROSPERO) were followed for their review, a PRISMA flow chart for the screening and selection of studies was presented in the text. Additionally, the authors referred to the Cochrane guidelines several times

throughout the article. See *Table A1* in the Appendix for a detailed description of the characteristics of this meta-analysis.

All studies included in the meta-analysis were RCTs assessing psychological interventions in an acute inpatient setting, *i.e.*, a hospital ward specialized for the treatment of mental illness, with a short-term length of stay (< 90 days). Several additional requirements were to be met in order to fulfill the inclusion criteria: a) use of a psychological intervention meeting the definition given by the American Psychiatric Association (2013), b) use of a control condition employing either TAU, a psychological intervention, a non-psychological intervention or non-directive psychological intervention, c) use of a sample meeting the diagnostic criteria for a schizophrenia spectrum disorder as assessed by the ICD-11 (World Health Organization, 2018), as well as d) the assessment of outcome parameters pertaining to patients' symptomatology. Moreover, studies were excluded using several criteria, including the use of a sample with the majority of participants being either under 18 or over 65 years of age, the recruitment of participants from either a forensic or residential treatment facility specializing in certain disorders (*e.g.*, eating disorders), the used interventions being limited to biological or pharmacological treatments, or being administered mostly non-verbal, the study either not having been published in a peer-reviewed publication or having been issued as part of a conference abstract. The data search yielded a total of three RCTs on MCT effectiveness with a total sample size of 94 participants, of which the authors included all three studies in their analysis. However, data for each outcome parameter was only included in the meta-analysis when a minimum of five RCTs were available. The authors implemented this measure in order to increase statistical power for the detection of treatment effects, citing Jackson and Turner (2017). Nonetheless, the authors presented results for the effectiveness of MCT in unstandardized weighted mean differences (*WMD*). This strategy was adopted according to the

authors as some studies reported change scores, while others presented their data in absolute scores, citing the Cochrane Collaboration and Deeks et al. (2011). Heterogeneity was calculated using the I^2 statistic, however, the authors did not report this measure for MCT effectiveness by itself, but instead taken for all types of intervention cumulatively. Moreover, all three studies on the effectiveness of MCT showed unclear risk of bias. Publication bias was not assessed on any of the three studies, as they were not included in the main meta-analysis.

The authors reported no evidence of a significant difference between intervention and control conditions for general psychopathology (n = 3, *WMD* = -3.22, 95% CI [-8.84, 2.21], p = .26, power = 38%). However, evidence for a significant difference was reported for MCT effectiveness on positive symptoms (n = 3, *WMD* = -2.29, 95% CI [-4.07, -0.51], p = .01, power 40%). Both of these analyses were notably underpowered due to the small sample size of the included studies.

As none of the RCTs on the effectiveness of MCT in an acute patient setting were eventually included in the meta-analysis, it was not possible to draw a definite conclusion on the MCT's effectiveness on schizophrenia symptoms based on the small sample size, ambiguous risk of bias and insufficient power of the three studies.

Additionally, it was not possible to convert the presented unstandardized weighted mean differences into an effect size, such as Hedges' g, and could therefore not be correctly presented in any of the following tables or figures. Barnicot et al. (2020) reported that no financial support for this meta-analysis was received. No conflict of interest was declared by the authors.

Sauvé et al. (2020)

In their 2020 meta-analysis, Sauvé et al. investigated the efficacy of a number of psychological interventions on positive symptoms, cognitive biases, and insight in schizophrenia.

The authors examined not only MCT, but also its multiple adaptations, such as MCT+, MCT-T, MCT-JTC, MCTd, as well as multiple combined interventions. The study was registered with PROSPERO (CRD 42017065218) and followed PRISMA guidelines. See *Table A1* in the Appendix for a detailed description of the characteristics of this meta-analysis.

A series of criteria were to be met in order for studies to be included in the review: a) they had to include a sample diagnosed with a schizophrenia spectrum disorder, b) to examine the effects of psychological interventions on positive symptoms, cognitive biases, and insight, c) to be of a RCT or naturalistic study design) and d) to be peer-reviewed. Studies were excluded if they employed CBTp or SCIT interventions. The initial data search yielded 7,844 results, of which 29 studies with a total of 2,738 participants were eventually included in the meta-analysis. Effect sizes were presented using Hedges' *g* in order to control for small sample bias. To accommodate for between-studies effect size variation, the authors used a random effects model, as recommended by Lipsey and Wilson (2000). For studies that only presented pre- or post-treatment scores, the authors decided to apply a conservative value of 0.7, citing Rosenthal (1991). Outcomes presented in percentages were converted into Hedges' g by calculating the numbers of participants and events in the sample. In case of multiple methods of assessment (*i.e.*, PANSS and PSYRATS) and varying follow-up measures in the primary studies, pooled effect sizes were generated to acquire a composite score. Overall risk of bias was evaluated on three criteria: randomization, masking, and incompleteness of outcome data. Low and high risk of bias, as well as potential effects of control conditions on effect sizes were then assessed in subgroup analyses using significance tests and the *Q* statistic. Publication bias was evaluated using funnel plots and Egger's test (Egger et al., 1997), as well as the fail-safe N test (Rosenthal, 1979). Heterogeneity was assessed using I^2 and *Q* statistics.

In the main analysis, a total of 19 studies were assessed on the effectiveness of psychological interventions on positive symptoms, of which 16 evaluated MCT and its adaptations (*e.g.*, MCT+, MCT-JTC), specifically. Analysis revealed evidence of a significant effect of moderate size for psychotic symptoms (g = 0.30, 95% CI [0.13, 0.48], $p < .005$). However, the studies were found to have a moderate level of heterogeneity (I^2 = 51.5%; Q = 37.1, p = .008). Publication bias was considered unlikely when assessed by means of funnel plots and Egger's test ($t(17)$ = 1.01, p = .33), nonetheless, a potential publication bias was detected when using Rosenthal's fail-safe N test, N = 99 with a cut-off of 105. Larger effect sizes were found for studies high in risk of bias than for all studies, high or low in risk of bias, combined (g = 0.40, 95% CI [0.17, 0.63], p = .001). However, no significant effect was found for studies with low levels of risk of bias (g = 0.19, 95% CI [-0.06, 0.44], p = .13). Regardless, no significant difference in effect sizes for studies high and low in risk of bias was found (Q = 1.45, p = .23). There was no significant difference in the effects for either presence or absence of an active control condition (Q = 0.01, p = .92).

A total of 20 studies were assessed on the effectiveness of psychological interventions on cognitive biases in schizophrenia. Eleven of these studies used MCT or one of its adaptations. Evidence for a significant, but small effect was found (g = 0.27, 95% CI [0.13, 0.41], $p < .001$). Moreover, heterogeneity was low (I^2 = 23.66%; Q = 24.649, p = .21). Publication bias was considered unlikely when assessed using funnel plots and Egger's test ($t(18)$ = 1.48, p = .16), however, a potential publication bias was detected when using Rosenthal's fail-safe N test, N = 80 with a cut-off of 110. Larger effect sizes were found for studies high in risk of bias than for all studies, high or low in risk of bias, combined (g = 0.35, 95% CI [0.18, 0.53], $p < .001$). Regardless, no evidence for a significant effect was found for studies with low levels of risk of bias (g = 0.14,

95% CI [−0.07, 0.34], $p = .19$). Additionally, there was no significant difference in effect sizes for studies high and low in risk of bias ($Q = 2.43$, $p = .12$). There was no significant difference in the effects for either presence or absence of an active control condition ($Q = 0.91$, $p = .64$).

Sauvé et al. (2020) note that, while the significant effect sizes for the effectiveness of psychological interventions on positive symptoms and cognitive biases could be attributable to studies high in risk of bias, overall risk of bias and control condition did not play a significant role in increasing effect sizes for the effectiveness of psychological interventions on positive symptoms and cognitive biases. Additionally, it is suggested that assessment tools commonly for a variety of cognitive biases (*i.e.*, beads/fish task) have been criticized in several aspects of its validity and reliability, leading the authors to believe that this type of intervention may have affected the effect size for cognitive biases. Moreover, most studies evaluated change in positive symptoms using assessment tools with good reliability such as the PSYRATS. Considering that not only MCT, but also its adaptations, and a variety of other interventions were included in this meta-analysis - albeit studies on the effectiveness of MCT being the majority - considerably lowers the validity and generalizability of its findings in regards to the effectiveness of MCT on psychotic symptom reduction. The authors did not conduct subgroup analyses for each type of intervention due to small sample size.

Sauvé et al. (2020) reported no financial support for this meta-analysis from a not-for-profit sector or granting agency. Nonetheless, the authors reported receiving salary grants. One of the authors, Martin Lepage, reported receival of several grants, as well as personal fees - all of which were independent of the submitted work.

Burlingame et al. (2020), Moritz et al. (2022), Burlingame et al. (2022)

The third included meta-analysis of 2020 was conducted by Burlingame et al. These researchers investigated the effectiveness of multiple group interventions for schizophrenia symptoms (positive and negative), as well as general functioning (*e.g.*, global assessment of functioning, hospitalization, self-esteem) and treatment-specific outcomes. The latter was added to examine whether improved schizophrenia outcomes and general functioning could be attributed to an improvement in treatment-specific outcomes. The target group interventions were MCT, CBT, CR, social skills training (SS), psychoeducation (PE), multifamily group therapy (MFG), and integrated psychological therapy (IPT). The study was registered with PROSPERO (CRD42013004419) and followed the PRISMA guidelines. See *Table A1* in the Appendix for a detailed description of the characteristics of this meta-analysis.

All studies included in the meta-analysis were randomized controlled trials (RCTs) that assessed schizophrenia outcomes and symptoms by means of the PANSS and the BPRS. The authors employed several inclusion criteria: a sample of adult participants of which at least 85% are diagnosed with a schizophrenia spectrum disorder as assessed by the DSM or ICD, must use TAU, active control, or waitlist (WL) control group as the control condition, and instruction of intervention groups carried out by professional therapists. Language of publication was restricted to English, Spanish, German and Italian. The data search initially yielded 8,746 results, 52 of which were included in the study. Out of these, a total of seven studies were examined on the effectiveness of MCT for positive and overall schizophrenia symptoms. Effect sizes included post-treatment as well as follow-up measures (< 1 year and > 1 year follow-up) and were presented in Hedges' *g* to control for small sample bias. The authors reported effect sizes when data of a minimum of five studies were available for meta-analysis. Furthermore, when individual studies

reported effect sizes using multiple measures, the authors converted and pooled results into mean weighted effect sizes. Moreover, composite scores were calculated when multiple measures for the assessment of one outcome parameter were used, providing a single effect size per comparison and outcome parameter to be included in the meta-analysis. Potential threats to within- and between-study bias were identified on the following criteria: randomization, masking, publication bias, study quality, and missing data. These validity threats were evaluated using the Cochrane's Risk of Bias Tool, following the recommended protocol by Higgins et al. (2011), as well as funnel plots, Egger's test (Egger et al., 1997), Duval and Tweedie's trim and fill analysis (Duval & Tweedie, 2000b), and Rosenthal's fail-safe *N* test (Rosenthal, 1979). Meta-analysis was done separately for outcome parameter and time. A random-effects model was used. Heterogeneity was assessed using I^2 and Q statistics.

Subgroup analysis for MCT found no evidence of a significant effect on positive symptoms ($n = 6$, $g = 0.24$, 95% CI [-0.12, 0.61], $p = .194$) and schizophrenia outcomes ($n = 6$, $g = 0.16$, 95% CI [-0.17, 0.48], $p = .35$). Moreover, further analysis revealed no level of heterogeneity for the findings on positive symptoms ($I^2 = 0\%$; $Q = 4.42$, $p = .491$) and for schizophrenia outcomes ($I^2 = 0\%$; $Q = 1.35$, $p = .93$).

Burlingame et al. (2020) concluded that, based on their findings, MCT should not be implemented into routine care for the treatment of schizophrenia. The authors also stated that the APA and NICE did not recommend MCT, as well. Nonetheless, the authors discuss several of this study's limitations, such as the comparison between intervention and TAU/WLC control groups, which may have led to a reduced ability to replicate the findings of previous meta-analyses on MCT. It is also stated that no within-study comparisons were conducted to investigate more than two active treatment groups. Furthermore, included studies used the PANSS and BPRS as

assessment methods for clinical symptoms, however, the authors suggested that no more than 10% of eligible studies were excluded by these measures. For studies that included total scores of the PANSS and BPRS, these were used to assess schizophrenia outcomes (*i.e*., positive and negative), both of which included items of general psychopathology. Moreover, overestimation of effect sizes and psychopharmacological treatment for patients were also listed as limitations to this meta-analysis. The authors neither reported whether they received funding for this study, nor did they report information on possible conflicts of interest.

Following the publication of Burlingame et al.'s (2020) meta-analysis, a letter to the authors was issued by Moritz et al. (2022) addressing concerns of misclassification, inclusion and exclusion of a variety of studies from Burlingame et al.'s meta-analysis. Burlingame et al. (2022) issued a response in which they discussed the claims made by Moritz et al. (2022). In the corresponding statement, the authors pointed out that some of the concerns that were raised in regards to their meta-analysis have been addressed in the study's limitations (*i.e.*, inclusion criteria and limited study overlap, data extraction). In regard to further methodological concerns regarding PROSPERO protocol and guidelines, Burlingame et al. (2022) noted that, while their meta-analysis was part of an international project published by Rosendahl et al. (2021) which had been registered with PROSPERO (CRD42013004419), their study had differed from this protocol in some aspects, which had not been clarified or stated in their meta-analysis.

In their letter to the authors, Moritz et al. pointed that some analyses were conducted on interventions including less than five participants, contradicting the published PROSPERO protocol, which stated that meta-analysis would not be conducted for samples with less than five participants. Burlingame et al. explained that limited resources (e.g., number of computers needed in CR treatments) and accommodations for patients with specialized needs affected the

PROSPERO methods. Moreover, they suggested that the definition of small group treatment is considerably variable, for which the authors reference Burlingame and Strauss (2021).

In their statement, Moritz et al. (2022) provided a list of studies that were misclassified or should have been included in or excluded from Burlingame et al.'s (2020) study. In regard to the meta-analyses on MCT, Moritz et al. (2022) claimed that a study by Lecardeur et al. (2009) was falsely allocated to the CR condition, whereas it should have been classified as part of the MCT condition, due to its use of MSAT, which heavily incorporates MCT materials as part of the intervention. The main author of this study, Laurent Lecardeur, substantiated this claim. Furthermore, in regards to the meta-analyses on MCT, Moritz et al. (2022) suggested that one study by Inchausti et al. (2017) did not fulfill the inclusion criteria, as it was falsely classified as part of the MCT condition albeit employing metacognition-oriented social skills training (MOSST), a psychological intervention not addressing cognitive biases, which is an integral part of MCT. This statement was further supported by the main author of this study, Felix Inchausti Gomez.

In regard to potentially eligible studies which were not included in Burlingame et al.'s (2020) meta-analysis, Moritz et al. (2022) suggested the inclusion of two studies (*i.e.*, Moritz, Veckenstedt et al., 2011; Wardwell et al., 2017), which fulfilled the initial criteria. Additionally, the inclusion and exclusion of four studies (*i.e.*, Briki, Monnin et al, 2014; Moritz, Veckenstedt et al., 2011; Moritz et al., 2013; Ochoa et al., 2017) were discussed on potential criteria inconsistencies, such as use of studies with two or more active treatments (*i.e.*, Briki, Monnin et al., 2014; Ochoa et al., 2017), use of a control group employing an intervention included in Burlingame et al.'s (2022) meta-analysis (CR; Moritz et al., 2013), and use of individualized MCT (Moritz, Veckenstedt et al., 2011). In response, Burlingame et al. (2022) described that coding for

treatment allocation relied on the study text. Thus, treatments that were the same or related could be grouped together (*e.g.*, hybrid CBT and individual CBT), some active control groups (*i.e.*, TAU) could be similar to schizophrenia treatment, or studies could vary in describing support groups as either a treatment or control condition, making coding considerably difficult. Additionally, Burlingame et al. (2022) conducted a re-analysis of the data for MCT, including six additional studies in their sample (*i.e.*, Briki, Monnin et al., 2014; Gawęda et al., 2015; Kuokkanen et al., 2014; Moritz, Kerstan et al., 2011; van Oosterhout et al., 2014; Wardwell et al., 2017) and excluding two of the original studies (*i.e.*, Moritz, Veckenstedt et al., 2011; Inchausti et al., 2017). While Burlingame et al. (2022) stated that a total of 12 studies were included in the re-analysis, *Table 1* in the online supplementary material accounts for 11 included studies. A sensitivity analysis was conducted to investigate whether the reformed inclusion and exclusion of studies influenced the original findings in Burlingame et al. (2020). The authors found no evidence of a significant effect for the findings on overall schizophrenia outcomes. However, evidence of a significant but small effect was found for positive symptoms (n = 8, g = 0.22, 95% CI [0.04, 0.4], p = .017) with no heterogeneity (I^2 = 0%) and treatment-specific outcomes (n = 11, g = 0.23, 95% CI [0.02, 0.44], p = .031) with moderate levels of heterogeneity (I^2 = 41%). Neither negative symptoms, nor general functioning were assessed, due to the study sample for these outcome parameters being fewer than five.

Thirdly, the case of potential reporting bias is also discussed in Moritz et al.'s (2022) letter to the authors. While Burlingame et al. (2020) reported on the non-significant findings of van Oosterhout et al.'s (2015) meta-analysis, other studies reporting significant findings were disregarded (*i.e.*, Eichner & Berna, 2016; Liu et al., 2018; Philipp et al., 2018). Moreover, Burlingame et al. (2020) found evidence of a significant effect for MCT effectiveness for

treatment-specific outcomes ($n = 5$, $g = 0.52$, 95% CI [0.12, 0.92], $p = 0.01$), which was not further discussed in the meta-analysis. It should be noted that these findings were heterogeneous (I^2 = 54%; Q = 8.70, p = .70). Lastly, Moritz et al. (2022) pointed out that in their meta-analysis, Burlingame et al. (2020) stated that the APA and NICE guidelines did not recommend MCT, however, these guidelines were published in 2004, three years before publication of the first study on MCT in 2007. At the time of this publication, the APA and NICE did not explicitly examine MCT. Due to the aforementioned concerns raised, specifically the inclusion of ineligible studies in Burlingame et al.'s (2020) meta-analysis, any resulting findings from this study regarding the effectiveness of MCT should be considered with caution. However, Burlingame et al.'s (2022) re-analysis and its findings may be more reliable in this regard.

Penney et al. (2022)

The last meta-analysis included in this review was conducted by Penney et al. (2022). The authors examined MCT effectiveness and its immediate and maintained effects on schizophrenia symptoms, particularly proximal outcomes (*i.e.*, positive symptoms, delusions, hallucinations, and cognitive biases) which are directly targeted by MCT and distal outcomes (*i.e.*, negative symptoms, global and social functioning, self-esteem, QoL, and well-being) that may indirectly benefit from MCT. Moreover, a broad set of moderators were investigated to assess potential additional heterogeneity in the results. These moderators were either based on study characteristics (*i.e.*, year of publication, type of study design, type of analyses, and risk of bias), treatment-related (*i.e.*, number of MCT sessions, delivery format, credentials and training of facilitators, and adherence to MCT manual) or participant-related (i.e., diagnosis and duration of illness, age, gender, and medication). The study was registered with PROSPERO (CRD 42021259291) and

followed PRISMA guidelines. See *Table A1* in the Appendix for a detailed description of the characteristics of this meta-analysis.

The authors administered a small set of criteria to be met for study inclusion and exclusion. While study design, follow-up measures and language of publication were unrestricted, only peer-reviewed studies addressing MCT effectiveness for proximal and distal outcomes were eligible for inclusion. The psychological intervention had to employ group or individualized MCT. Eligible control groups included TAU, waitlist, and active control groups. Moreover, study samples had to include participants diagnosed with a schizophrenia spectrum disorder or psychotic disorder according to the DSM or ICD criteria. No restrictions for the number of MCT sessions or participants' age, sex, gender, and ethnicity were applied. The initial data search yielded 1,045 results, of which a total of 40 studies with a sample size of 1,816 participants were included in the final meta-analysis. Six additional reports were discussed in a narrative review. Meta-analyzable data was synthesized for studies that reported sample size, means, standard deviations, and effect sizes/percentages with variance measures (*i.e.*, confidence intervals) for pre- and post-treatment scores for the outcome parameters. Effect sizes were pooled for measured outcomes of the same type and time points of follow-up (< 1 year and > 1 year follow-up), respectively, and presented in Hedges' *g* to control for small sample bias. Subgroup analyses were performed for the aforementioned moderators using the *Q* statistic. A random-effects model was used. The authors assessed risk of bias using the Mixed Methods Appraisal Tool (MMAT; Hong et al., 2018). Publication bias was evaluated using funnel plots, Egger's test (Egger et al., 1997), and Rosenthal's safe-fail *N* test (Rosenthal, 1979). Moreover, heterogeneity was assessed using I^2 and *Q* statistics.

In the main analysis, Penney et al. (2022) found evidence of a significant small to medium-sized effect for the effectiveness of MCT at post-treatment for proximal (n = 38, g = 0.39, 95% CI [0.25, 0.53], p < .001) and distal (n = 26, g = 0.31, 95% CI [0.19, 0.44], p < .001) outcomes in schizophrenia. Nonetheless, levels of heterogeneity were found to be high regarding proximal (I^2 = 63.83%; Q = 101.03, p < 0.01), as well as moderate for distal (I^2 = 41.63%; Q = 42.83, p = .01) outcomes. Additionally, results at follow-up (< 1 year and > 1 year) were assessed. However, the authors found no evidence of significant effects for neither proximal nor distal outcomes when compared to post-treatment results. However, when results were analyzed for pre-treatment and at < 1 year follow-up, evidence of a significant small to medium-sized effect for proximal (n = 14, g = 0.39, 95% CI [0.16, 0.61], p < .01) with high levels of heterogeneity (I^2 = 65.52%; Q = 37.71, p < .01) and distal outcomes (n = 11, g = 0.3, 95% CI [0.14, 0.46, p < .01) with low levels of heterogeneity (I^2 = 12.34%; Q = 11.41, p = .33) was found.

Moreover, subgroup analyses for MCT effectiveness at post-treatment were also conducted. Evidence of a significant, medium-sized effect was found for positive symptoms (n = 36, g = 0.50, 95% CI [0.34, 0.67], p < .001), as well as evidence of a large effect for delusions (n = 9, g = 0.26; 95% CI [0.11, 0.40], p < .001). Considerably high levels of heterogeneity were found for both studies assessing positive symptoms (I^2 = 75.76%; Q = 144.37, p < .01) and delusions (I^2 = 81.84%; Q = 121.13, p < .01). Evidence for a small effect size was detected for hallucinations (n = 9, g = 0.26, 95% CI [0.11, 0.40], p < .001), for which levels of heterogeneity were found to be very low (I^2 = 0.00%; Q = 7.84, p = 0.45). A subgroup analysis for negative symptoms found evidence of a significant, but small effect (n = 37, g = 0.23, 95% CI [0.10, 0.37], p < .001) with a low-to-moderate level of heterogeneity (I^2 = 29.72%; Q = 22.77, p = .12). Meta-analysis for results at follow-up (< 1 year and > 1 year) found no evidence of a significant effect for any of the

subgroups when compared to post-treatment results. Nonetheless, when results were assessed for pre-treatment and at < 1 year follow-up, evidence of a significant medium-to-large effect size for positive symptoms (n = 14, g = 0.49, 95% CI [0.22, 0.76], p < .01; I^2 = 77.56%; Q = 57.93, p < .01) and delusions (n = 10, g = 0.61, 95% CI [0.16, 1.06], p = .01; I^2 = 88.82; Q = 80.50, p < .01), both of which showed high levels of heterogeneity. Moreover, evidence of a significant, but small effect was found for negative symptoms (n = 6, g = 0.27, 95% CI [0.05, 0.50], p = .02) with low levels of heterogeneity (I^2 = 12.42%; Q = 5.71, p = .34).

Additionally, a meta-analysis for pre- and post-treatment results with RCTs only was conducted. The authors reported evidence of a significant small to medium-sized effect for proximal (n = 26, g = 0.37, 95% CI [0.20, 0.53], p < .001) and distal (n = 19, g = 0.25, 95% CI [0.11, 0.39], p < .001) outcomes. Moreover, evidence of a medium-to-large effect size for positive symptoms (n = 24, g = 0.47, 95% CI [0.25, 0.69], p = .001) and delusions (n = 15, g = 0.64, 95% CI [0.32, 0.96], p < .001) was found. Evidence of a significant, but small effect for hallucinations (n = 6, g = 0.26, 95% CI [0.04, 0.48], p = .02) and negative symptoms (n = 13, g = 0.25, 95% CI [0.10, 0.40], p = .001) was also found. However, no data for levels of heterogeneity were provided.

Regarding moderator analyses, Penney et al. (2022) reported evidence of a significant moderating effect for year of publication for hallucinations (β = 0.04, 95% CI [0.00, 0.07], p = .03), which should be interpreted with caution due to small sample size (n = 9). The authors note that all other analyses yielded non-significant or non-interpretable results due to small sample size or unreported data. Assessment of study quality revealed that low-quality studies were more likely to report lower effect sizes for distal outcomes (Q_4 = 9.33, p = .05), but not for proximal outcomes, positive symptoms, delusions, hallucinations, and negative symptoms. Presence of publication bias

was indicated for outcomes of hallucinations (N = 20) and negative symptoms (N = 59). The authors noted that sensitivity analyses yielded similar results.

In their conclusion, Penney et al. (2022) stated that the results of their meta-analysis suggest that MCT improved not only proximal and distal outcomes overall, but also positive symptoms, delusions, hallucinations, and negative symptoms, specifically. Additionally, effectiveness of MCT was maintained for up to one year post-treatment for all outcome parameters that yielded significant effect sizes. While a moderator effect was found for year of publication and hallucinations, no other variables showed significant moderating effects. The authors describe several strengths of their study, such as large sample size of included studies and assessment of a broad set of outcome parameters (*i.e.*, distal outcomes) and robustness of findings. Considerable limitations of this analysis are significant heterogeneity levels, which were detected for a number of outcome parameters, as well as publication bias for hallucinations and negative symptoms. The authors also note that lower-quality studies were found to report lower effect sizes for distal outcomes. An analysis of RCTs at follow-up could not be conducted due to small sample size, which would have led to unreliable results. Nonetheless, Penney et al. (2022) stated that MCT, while being cost-effective and readily available for administering, also shows significant effectiveness and durability in psychotic symptom reduction. The authors note that the main developer of MCT, Steffen Moritz, was considered during the search of articles for this meta-analysis, however he was not involved in study selection, data extraction, or meta-analysis. Moreover, the authors reported receiving financial support in terms of grants/fees (from the Roche Canada and Otsuka Lundbeck Alliance) and funding/fellowships (from the Canada First Research Excellence Fund, awarded through the Healthy Brains, Healthy Lives (HBHL) initiative at McGill University (grant HBHL 3c-KM-56); James McGill Professorship from McGill University;

Canadian Institutes of Health Research (171198)) for this meta-analysis. All in all, datedness and study overlap can be regarded as considerable factors when interpreting meta-analyses' results, as well as the assessment of the study's findings and subsequent reliability (Hennessey & Johnson, 2019). Thus, as Penney et al.'s (2022) meta-analysis addressed the effectiveness of MCT for schizophrenia symptoms in terms of a broad set of included studies and settings, as well as multiple outcome parameters of interest, it can be considered the most comprehensive examination of the effectiveness of MCT for schizophrenia symptoms to date.

Study Overlap

The overlap of primary studies used in the meta-analyses was calculated using the corrected covered area (*CCA*; Pieper et al., 2014). Study overlap was assessed across all outcome parameters, as well as for each outcome parameter (*i.e.*, overall symptoms, positive symptoms, delusions, hallucinations, negative symptoms) separately (see *Table 1*). The total study overlap, calculated for all included meta-analyses and re-analyses, as well as for all included primary studies assessing the effectiveness of MCT, was very high (*CCA* = 0.217). Study overlap for overall schizophrenia symptoms was slight (*CCA* = 0.033). While study overlap for positive symptoms (*CCA* = 0.173) and delusions (*CCA* = 0.164) was very high, the calculated covered area for hallucinations (*CCA* = 0.00) and negative symptoms (*CCA* = 0.00) is none.

Table 1. *Corrected Covered Area (CCA) for Assessment of Study Overlap.*

	k	*r*	*c*	*CCA*	Classification of Study Overlap
Overall symptoms	52	39	11	0.033	slight
Positive symptoms	123	45	11	0.173	very high
Delusions	65	25	11	0.164	very high
Hallucinations	9	9	11	0.000	none
Negative symptoms	17	17	11	0.000	none
Total	172	55	11	0.217	very high

Note. k = number of included primary studies, r = number of index primary studies, c = number of meta-analyses/re-analyses, *CCA* = Corrected Covered Area.

Methodological Quality

The methodological study quality of the included meta-analyses was assessed using the AMSTAR-2 checklist (Shea et al., 2017), which is scored on seven critical domains (*i.e.*, a protocol was registered before conducting the meta-analysis, adequacy of literature search items, justification for study exclusion, assessment of risk of bias for individual studies, appropriateness for statistical methods, discussion of risk of bias, assessment and discussion of publication bias) and nine non-critical domains (*i.e.*, research questions and inclusion criteria included population, intervention, comparator group, and outcome (PICO), justification for study design inclusion, study selection was performed in duplicate, data extraction was performed in duplicate, adequate and detailed description of included studies, report of sources of funding for primary studies, assessment of impact of risk of bias, explanation for and discussion of heterogeneity, report of conflict of interest). *Table 2* and *Table 3* depict the AMSTAR-2 scores for all nine meta-analyses. Two re-analyses (*i.e.*, van Oosterhout et al. (2016) and Burlingame et al. (2020)) were not included in the assessment, as the provided information for methodological quality in these two articles were not sufficient to be conclusively scored on the relevant items of the AMSTAR-2 checklist.

Three meta-analyses (33%) pre-registered a comprehensive protocol, two meta-analyses (22%) employed a comprehensive search strategy, four meta-analyses (44%) provided a list of and justifications for excluded studies, one meta-analysis (11%) comprehensively assessed risk of bias for the included primary studies, three meta-analyses (33%) employed appropriate statistical methods for combining results, seven meta-analyses (77%) discussed risk of bias for the included primary studies when interpreting their results, and seven meta-analyses (77%) assessed publication bias (see *Table 2*).

All nine meta-analyses described PICO in their research questions or inclusion criteria, two meta-analyses (22%) provided an explanation for inclusion of study design, six meta-analyses (66%) performed study selection in duplicate, eight meta-analyses (88%) performed data extraction in duplicate, none of the meta-analyses provided a detailed description of the included studies' populations, none of the meta-analyses reported funding for the included primary studies', seven meta-analyses (77%) assessed impact of included primary studies' risk of bias on the results, seven meta-analyses (77%) comprehensively discussed and explained heterogeneity in their results, six meta-analyses (66%) appropriately reported conflict of interests or funding for their study (see *Table 3*).

None of the meta-analyses were rated high or moderate on methodological quality. Two meta-analyses (Penney et al., 2022; Philipp et al., 2018) scored low, whereas the remaining seven meta-analyses scored critically low on methodological quality.

Table 2. *Assessment of Methodological Quality of the Included Meta-Analyses Regarding Critical Domains of the AMSTAR-2 Checklist.*

Meta-Analysis	Protocol	Search	Exclusion	Bias	Statistics	Discussion of RoB	Publication bias
Jiang2015	partial yes	partial yes	no	partial yes	yes	yes	no
vanOosterhout 2015	no	partial yes	yes	no	no	yes	yes
EichnerBerna 2016	no	partial yes	no	no	no	yes	yes
Liu2018	no	partial yes	no	no	no	no	yes
Philipp2018	yes	yes	yes	yes	no	yes	yes
Barnicot2020	no	partial yes	no	partial yes	yes	yes	yes
Sauvé2020	yes	partial yes	yes	partial yes	no	no	yes
Burlingame2020	partial yes	partial yes	no	no	yes	yes	no
Penney2022	yes	yes	yes	partial yes	no	yes	yes

Note. AMSTAR-2 = A MeaSurement Tool to Assess Systematic Reviews; RoB = Risk of Bias.

Table 3. *Assessment of Methodological Quality of the Included Meta-Analyses Regarding Non-Critical Domains of the AMSTAR-2 Checklist.*

Meta-Analysis	PICO	Design	Screening	Extraction	Inclusion	Funding	Impact of RoB	Heterogeneity	Conflict of interest
Jiang2015	yes	no	yes	yes	partial yes	no	yes	yes	yes
vanOosterhout 2015	yes	no	no	no	no	no	yes	yes	yes
EichnerBerna 2016	yes	no	no	yes	no	no	yes	yes	yes
Liu2018	yes	no	yes	yes	partial yes	no	no	no	no
Philipp2018	yes	no	yes	yes	partial yes	no	yes	yes	yes
Barnicot2020	yes	no	yes	yes	partial yes	no	yes	no	no
Sauvé2020	yes	no	yes	yes	partial yes	no	yes	yes	yes
Burlingame2020	yes	yes	no	yes	partial yes	no	yes	yes	no
Penney2022	yes	yes	yes	yes	partial yes	no	yes	yes	yes

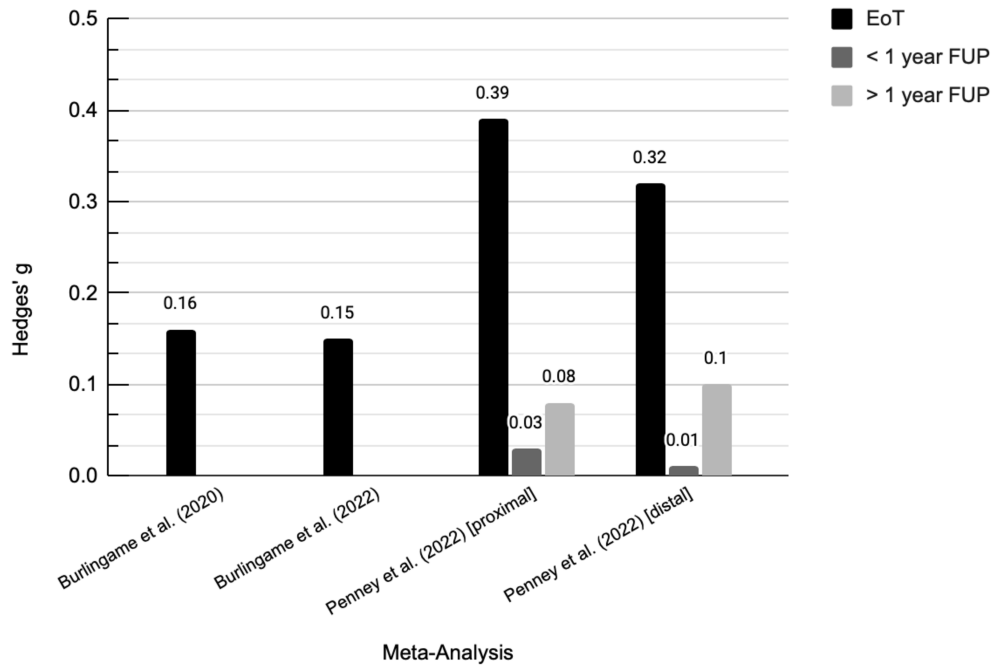
Note. AMSTAR-2 = A MeaSurement Tool to Assess Systematic Reviews; PICO = Population, Intervention, Comparator group, Outcome; RoB = Risk of bias.

Data Analysis

All analyzable data was entered into metaumnbrella.org (Gosling et al., 2023) for evidence classification (see *Table 4*). Additional data for van Oosterhout et al. (2016) and follow-up time points for Penney et al. (2022) were not received in time to conduct further data extraction, stratification, and analysis and could not be considered for this meta-review. As mentioned before, data analysis could not be conducted for Barnicot et al. (2020). Thus, a full classification of evidence is not available for these meta-analyses. Effect sizes for each meta-analysis and outcome of interest are additionally presented by means of histograms (see *Figures 4-8*). In terms of classifying the evidence based on methodological aspects, none of the meta-analyses' data were categorized as convincing (Class I), highly suggestive (Class II) or suggestive (Class III) for the effectiveness of MCT for schizophrenia symptoms.

Overall Symptoms

One out of two meta-analysis (50%) reported significant, small-to-medium-sized effects for overall schizophrenia symptoms, specifically for proximal and distal symptoms. Nonetheless, the evidence was classed as weak (Class IV). Effects measures at follow-up time points were non-significant. The second meta-analysis and its re-analysis (50%) comprised non-significant effect sizes for the effectiveness of MCT for overall symptoms of schizophrenia. Heterogeneity was considerate (> 45%) for both significant effect sizes. None of the meta-analyses showed excess significance bias, nor were any small study effects detected. All of the largest primary studies included were significant.

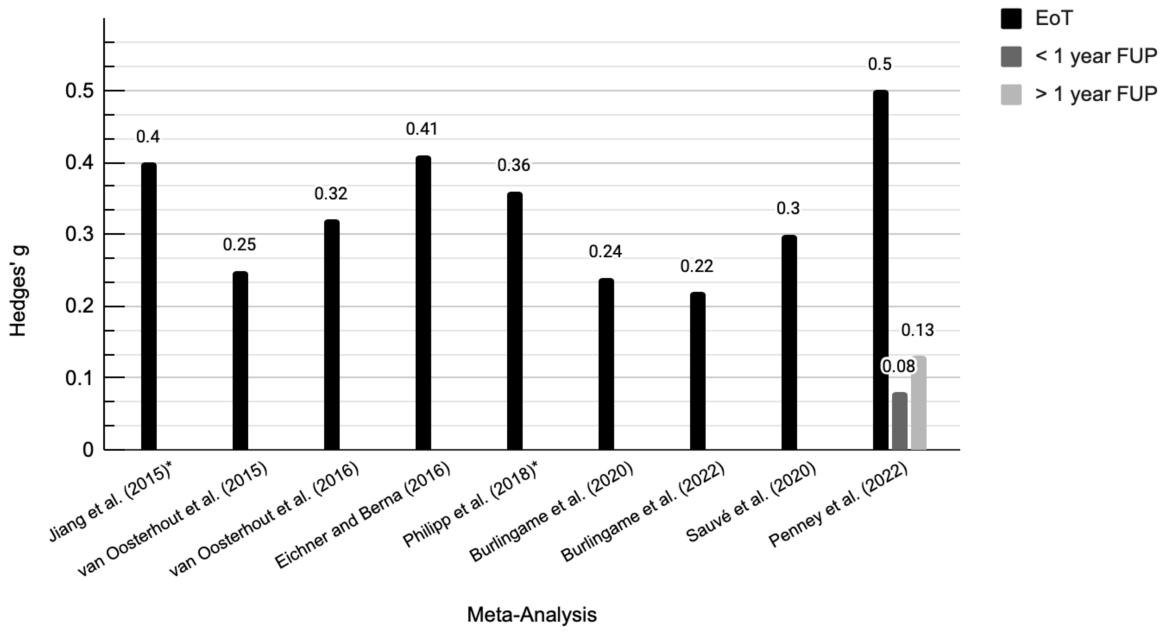


Note. Proximal outcomes included positive symptoms, delusions, hallucinations, and cognitive biases. Distal outcomes included negative symptoms, self-esteem, quality of life, and functioning.

Figure 4. *Effect Sizes for the Effectiveness of Metacognitive Training for Overall Symptoms.*

Positive Symptoms

Five out of nine meta-analyses (55%) comprised significant, small-to-medium sized effects speaking for the effectiveness of MCT for positive symptoms. Nonetheless, all of these were ranked as weak evidence (Class IV). Four meta-analyses (45%) comprised non-significant effect sizes for the effectiveness of MCT for positive symptoms in schizophrenia. Small study effects were detected for one meta-analysis (11%). No excess significance bias was detected for any of the meta-analyses. All of the largest primary studies were significant. Small study effects and excess significance bias were not calculated for one meta-analysis (11%).



Note. *Data was calculated using metaumbrella.org (Gosling et al., 2023).

Figure 5. *Effect Sizes for the Effectiveness of Metacognitive Training for Positive Symptoms.*

Delusions. Five out of six meta-analyses (83.33%) comprised significant small, medium-sized, and large effect sizes for the effectiveness of MCT for delusions, two meta-analyses tested at follow-up, of which one remained significant at six months follow-up (Liu et al., 2018). Nonetheless, all evidence was ranked as weak (Class IV). One meta-analysis (16.66%) comprised non-significant results. Neither small study effects nor excess significance bias were detected for any of the meta-analyses. The largest primary studies of four meta-analyses (66.66%) were significant. Small study effects and excess significance bias were not calculated for one meta-analysis (11%).

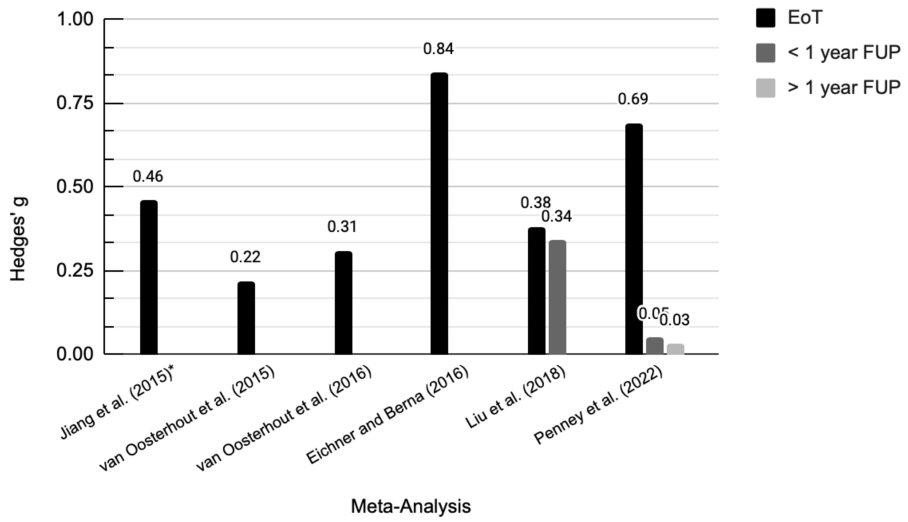


Figure 6. *Effect Sizes for the Effectiveness of Metacognitive Training for Delusions.*

Hallucinations. One meta-analysis (Penney et al., 2022) investigated the effectiveness of MCT for hallucinations, showing a significant, small-to-medium-sized effect in favor of MCT. The evidence was classified as weak (Class IV). Neither small study effects nor excess significance bias was detected. The meta-analysis' largest primary study was not significant (van Oosterhout et al., 2014).

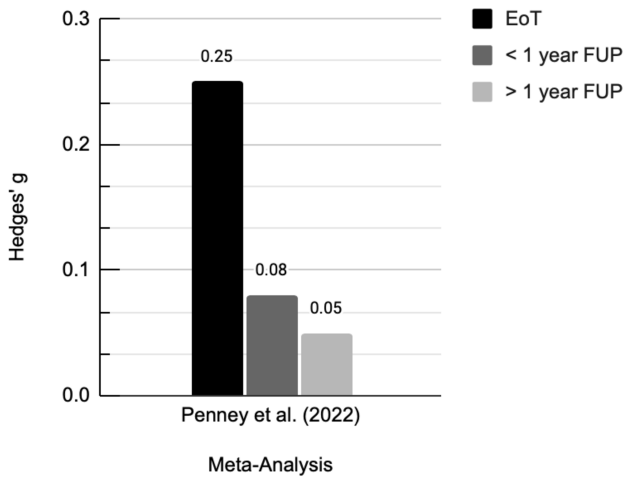


Figure 7. *Effect Sizes for the Effectiveness of MCT for Hallucinations.*

Negative Symptoms

One meta-analysis investigated the effectiveness of MCT for negative symptoms. The results showed a significant, but small effect in favor of MCT. The evidence was classed as weak (IV). Neither small study effects nor excess significance bias were detected. The meta-analysis' largest primary study was significant (Chen et al., 2021).

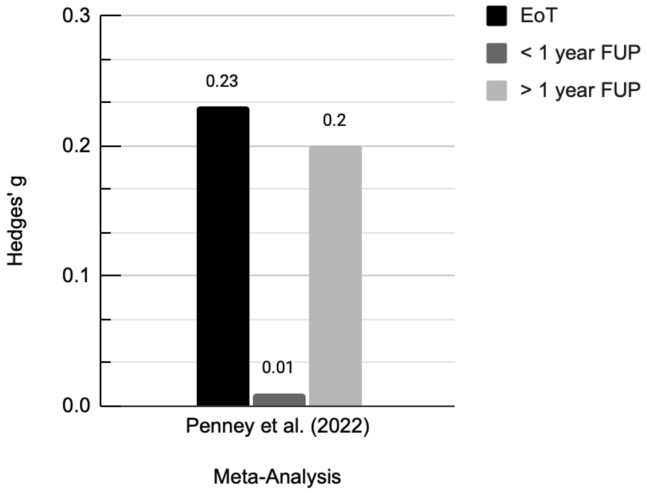


Figure 8. *Effect Sizes for the Effectiveness of MCT for Negative Symptoms.*

Table 4. *Evidence Classification for Outcomes of Interest.*

Outcome	Author/Year	Intervention[a]/Control	RCT; nRCT	FUP	*N* cases	Hedges' g [95% CI]	*p*-value	*p*-value sig.	I^2 (%)	PI 95% CI	SSE/ESB/LS	CE
Overall symptoms	*Burlingame 2020*	MCT vs AttCG (16.66%); MCT vs TAU (33.33%); MCT vs AC (50%)	6; 0	EoT	204	0.141 [-0.058, 0.34]	0.166	no	0	[-0.141, 0.423]	no/no/yes	ns
	Burlingame 2022	MCT vs ND (20%); MCT vs TAU (20%); MCT vs CogPack (20%); MCT vs WL (20%); MCT vs PE (20%)	5; 0	EoT	162	0.142 [-0.08, 0.363]	0.209	no	0	[-0.218, 0.501]	no/no/yes	ns
	Penney2022 [proximal]	MCT vs TAU (42.1%); MCT vs CR (10.5%); MCT vs AC (21.05%); MCT vs CBR (2.63%); MCT alone (13.15%); MCT vs WL (5.26%); MCT vs RA (2.63%)	26; 12	EoT	932	0.392 [0.245, 0.538]	< .01	yes	65.73	[-0.368, 1.151]	no/no/yes	IV
	Penney2022 [distal]	MCT vs TAU (38.46%); MCT vs CR (11.53%); MCT vs ST (3.84%); MCT vs CBR (3.84%); MCT alone (15.38%); MCT vs PE (7.69%); MCT vs WL (3.84%); MCT vs AC (11.53%); MCT vs RA (3.84%)	19; 7	EoT	645	0.313 [0.197, 0.43]	< .01	yes	46.72	[-0.081, 0.707]	no/no/yes	IV
Positive symptoms	*Jiang2015*	MCT vs TAU (50%); MCT vs CogPack (25%); MCT vs ST (25%)	4; 0	EoT	129	-0.406 [-0.757, -0.054]	0.023	yes	34.30	[-1.619, 0.807]	yes/no/yes	IV
	vanOosterhout 2015	MCT vs TAU (66.66%); MCT vs ST (11.11%); MCT vs CogPack (22.22%)	6; 3	EoT	209	0.26 [-0.003, 0.522]	0.052	no	41.03	[-0.412, 0.931]	no/no/yes	ns
	EichnerBerna 2016	MCT vs ND (9.09%); MCT vs TAU (45.45%); MCT vs ST (9.09%); MCT vs CogPack (18.18%); MCT vs WL (18.18%)	9; 2	EoT	245	-0.361 [-0.565, -0.157]	< .01	yes	7.12	[-0.746, 0.023]	no/no/yes	IV

	Philipp2018	MCT vs ND (10.05%); MCT vs CogPack (15.78%); MCT vs TAU (47.36%); MCT vs CR (5.26%); MCT vs ST (5.26%); MCT vs WL (10.05%); MCT vs PE (5.26%)	15; 4	EoT	531	-0.302 [-0.486, -0.117]	0.001	yes	49.24	[-0.92, 0.317]	no/no/yes	IV
	Sauvé2020	MCT vs ND (5.88%); MCT vs CogPack (17.64%); MCT vs TAU (41.17%); MCT vs CR (5.88%); MCT vs ST (5.88%); MCT alone (5.88%); MCT vs MCT and control (5.88%); MCT+CR vs AC and WL (5.88%); MCT vs WL (5.88%)	9; 8	EoT	480	0.273 [0.099, 0.446]	0.002	yes	47.31	[-0.275, 0.821]	no/no/yes	IV
	Burlingame 2020	MCT vs AttCG (16.66%); MCT vs TAU (33.33%); MCT vs AC (50%)	6; 0	EoT	204	0.208 [0.01, 0.406]	0.039	yes	0	[-0.072, 0.489]	no/no/yes	IV
	Burlingame 2022	MCT vs ND (12.5%); MCT vs TAU (37.5%); MCT vs SS (12.5%); MCT vs CogPack (12.5%); MCT vs PE (12.5%); MCT vs group-based therapy (12.5%)	8; 0	EoT	241	0.179 [0, 0.357]	0.050	no	0	[-0.045, 0.402]	no/no/yes	ns
	Penney2022	MCT vs TAU (41.66%); MCT vs CR (11.11%); MCT vs AC (2.77%); MCT vs CBR (2.77%); MCT alone (13.88%); MCT vs MCT (2.77%); MCT vs AC (16.66%); MCT vs WL (5.55%); MCT vs RA (2.77%)	23; 13	EoT	894	0.473 [0.295, 0.651]	< .01	yes	74.65	[-0.483, 1.43]	-/-/yes	IV
Delusions	*Jiang2015*	MCT vs TAU (50%); MCT vs CogPack (25%); MCT vs ST (25%)	4; 0	EoT	196	-0.127 [-0.464, 0.21]	0.459	no	60.96	[-1.476, 1.222]	no/no/yes	ns
	vanOosterhout 2015	MCT vs SC (14.28%); MCT vs TAU (57.14%); MCT vs CogPack (28.57%)	7; 0	EoT	224	0.234 [-0.035, 0.502]	0.088	no	49.86	[-0.489, 0.956]	no/no/yes	IV

	EichnerBerna 2016	MCT vs TAU (72.72%); MCT vs ST (9.09%); MCT vs CogPack (18.18%); MCT vs WL (9.09%)	9; 2	EoT	334	-0.407 [-0.748, -0.066]	0.019	yes	75.93	[-1.59, 0.776]	no/no/yes	IV
	Liu2018	MCT vs CogPack (27.27%); MCT vs ST (9.09%); MCT vs TAU (54.54%); MCT vs WL (9.09%)	11; 0	EoT	334	-0.38 [-0.635, -0.125]	0.003	yes	64.84	[-1.183, 0.422]	no/no/yes	IV
	Liu2018	MCT vs Cogpack (50%); MCT vs TAU (50%)	4; 0	6 m.	144	-0.35 [-0.607, -0.094]	0.007	yes	1.67	[-1.08, 0.38]	no/no/no	IV
	Penney2022	MCT vs CR (17.39%); MCT vs TAU (47.82%); MCT alone (21.73%); MCT vs CBR (4.34%); MCT vs MCT (8.69%); MCT vs AC (4.34%); MCT vs WL (4.34%)	15; 8	EoT	621	0.638 [0.388, 0.888]	< .01	yes	80	[-0.504, 1.781]	-/-/no	IV
Hallucinations	*Penney2022*	MCT vs AC (11.11%); MCT vs CBR (11.11%); MCT vs TAU (33.33%); MCT alone (22.22%); MCT vs CR (22.22%);	6; 3	EoT	271	0.265 [0.098, 0.432]	0.001	yes	6.1	[-0.095, 0.625]	no/no/no	IV
Negative symptoms	*Penney2022*	MCT vs TAU (5.88%); MCT vs CR (11.76%); MCT vs CBR (5.88%); MCT vs TAU (29.41%); MCT vs AC (23.52%); MCT vs WL (5.88%); MCT alone (11.76%); MCT vs RA (5.88%)	13; 4	EoT	415	0.233 [0.1, 0.366]	< .01	yes	34.77	[-0.125, 0.591]	no/no/yes	IV

Note. [a]Metacognitive training (MCT) and all its adaptations are listed under the umbrella term MCT; RCT = Randomized controlled trial; nRCT = non-RCT; FUP = Follow-up; CI = Confidence interval; PI = Prediction interval; SSE = Small study effect; ESB = Excess significance bias; LS = Largest study; AttCG = Attention control group; TAU = Treatment as usual; AC = Active control; ND = Newspaper discussion; WL = Waitlist; PE = Psycho-education; ST = Supportive therapy; CR = Cognitive remediation therapy; CBR = Community-based rehabilitation; RA = Recreational activity; EoT = End of trial.

CHAPTER FOUR

Discussion and Final Conclusions

This meta-review aimed to provide an overview of the meta-analyses investigating the effectiveness of MCT for schizophrenia symptoms between the years 2007 and 2023. It took a specific focus on overall symptoms, positive symptoms, including delusions and hallucinations, as well as negative symptoms in schizophrenia. Nine meta-analyses and two re-analyses were included in this meta-review. Two letters to the authors and the responses were discussed, as well. Study overlap and methodological quality were investigated, moreover, a classification of the evidence was performed. A detailed review of the meta-analyses was provided to discuss the methodological robustness, the statistical analysis, as well as the limitations of the provided evidence.

The data and findings were favorable for the effectiveness of MCT for positive symptoms and delusions, with significant effects ranging from small-to-medium in size, as well as a large effect being found for delusions, and showed no excess significance bias or small study effects. As only one study examined effects for hallucinations and negative symptoms no firm conclusions can be drawn, albeit both outcomes being significant and in favor of MCT.

Study overlap was calculated using the CCA (Pieper et al., 2014) demonstrating a high overlap of primary studies for the assessment of positive symptoms and delusions. The total overlap of all primary studies for all meta-analyses was also very high. Nonetheless, the results for delusions as well as – to a lesser degree – for positive symptoms were quite inconsistent across meta-analyses in terms of significance and effect size (see *Figure 5, 6*). Possible reasons for these inconsistencies could be a growing body of primary literature to be included in meta-analyses, as well as methodological differences in data stratification or synthesis. The largest meta-analysis

(Penney et al., 2022) included a total of 43 primary studies, which addressed all outcomes of interest for the analysis and was the only study to assess the effectiveness of MCT for hallucinations and negative symptoms. Additionally, this study was the only one to incorporate analyses for end of trial data, as well as for two follow-up points (< 1 year, > 1 year), making it the most extensive meta-analysis on this topic to date.

Methodological quality was assessed using the AMSTAR-2 (Shea et al., 2017). The authors (Shea et al., 2017) state that the critical domains for assessment of methodological quality may be recognized as non-critical if the review author has substantial reasoning for doing so. Nonetheless, the evaluation as part of this meta-review followed the proposed guidelines of the AMSTAR-2. Results showed that none of the meta-analyses were considered to have high or moderate methodological quality according to these strict criteria. The critical domains which were least likely to be fulfilled were pre-registration of a protocol, a listing of excluded studies and the justification for exclusion, and using the appropriate statistical methods for combining results in a meta-analysis. Additionally, several unfulfilled non-critical domains (*e.g.*, reporting sources of funding for all included primary studies) were also included in the overall score for methodological quality. Nonetheless, two studies (Penney et al., 2022; Philipp et al., 2018) scored low, whereas all remaining meta-analyses scored critically low.

A total of four authors (*i.e.*, Burlingame et al. (2022), Penney et al. (2022), Sauvé et al. (2020), van Oosterhout et al. (2016)) were contacted for additional information regarding the data of their meta-analyses. Van Oosterhout et al. (2016) did not provide additional datasets regarding their re-analysis. Additional data by Penney et al. (2022) was not received in time with respect to the present dissertation to conduct further data analysis and evidence classification. Nonetheless, authors Burlingame et al. (2022) and Sauvé et al. (2020) provided additional datasets that had not

been presented in the meta-analyses, which were stratified for statistical analysis. A classification of the evidence was conducted using metaumbrella.org (Gosling et al., 2023). Results showed that none of the evidence was classified above Class IV (weak evidence). The most likely reason for this is the small number of cases included in each meta-analysis, as a number of > 1,000 cases is required for a ranking of Class I (convincing evidence), Class II (highly suggestive evidence) or Class III (suggestive evidence). The largest number of cases was included in Penney et al.'s (2022) assessment for proximal outcomes (n = 932), followed by the same authors' assessment for positive symptoms (n = 894). Neither small study effects nor excess significance bias was detected for seven of the eight analyzable meta-analyses. However, most of the resulting findings were subject to considerable levels of heterogeneity (> 50%). All prediction intervals included the null.

Limitations

This meta-review is subject to several limitations. First, a comprehensive statistical analysis and classification of evidence could not be conducted for three of the meta-analyses (Barnicot et al., 2020; Penney et al., 2022; van Oosterhout et al., 2016), due to missing data. Second, several limitations apply to the use of the AMSTAR-2 (Shea et al., 2017) guidelines (*e.g.*, the critical and non-critical domains may not be reflective of methodological quality of the study), as well as to the use of metaumbrella.org (Gosling et al., 2023) leading to potential bias (*e.g.*, through the use of a random-effects model). Third, the meta-analyses in this review were not large enough in numbers or sample size to generalize findings.

Conclusion

This meta-review comprised a total of nine meta-analyses and two re-analyses. Following strict guidelines and statistical assessments, none of the meta-analyses were considered of sufficient methodological quality or having produced convincing evidence for the effectiveness of

MCT for the reduction of schizophrenia symptoms. These findings mirror the inconsistent results that have been produced regarding the effectiveness of MCT for schizophrenia symptoms over the past decade. None of the meta-analyses were eligible to be ranked Class III or higher, as none included more than 1,000 cases in their sample. Moreover, the AMSTAR-2 guidelines, when used as provided by the authors (Shea et al., 2017), proved strict and may not be representative of the most critical features of methodological quality for meta-analyses. The most recent meta-analysis (Penney et al., 2022) which is the largest one on this topic to date, ranked the highest in methodological quality, and provided the most promising evidence for the immediate and delayed effectiveness of MCT for schizophrenia symptoms.

When considering MCT as a subsidiary tool for therapeutic treatment, the provided findings point toward beneficial results for the reduction of psychotic symptoms in schizophrenia. Future research should corroborate the robustness of Penney et al.'s (2022) findings, the to date largest, and most extensive meta-analysis regarding the effectiveness of MCT for schizophrenia symptoms as of to date.

Conflict of Interest

This dissertation was written under the supervision of the main developer of MCT, Steffen Moritz. No financial support was received for the writing of this dissertation.

Author Note

I would like to acknowledge my first and second supervisors, Prof. Dr. Chiara Spironelli and Prof. Dr. Steffen Moritz, who have provided me with advice and guidance throughout the stages of the writing of this dissertation. Furthermore, I would also like to acknowledge Christine & Aldo Colo, Sabine Kirchner-Spiess and Melwin Meyer, who have greatly supported me throughout the working and writing process.

References

Acuña, V., Otto, A., Cavieres, A., & Villalobos, H. (2022). Efficacy of metacognitive training in a Chilean sample of people with schizophrenia. *Revista Colombiana de Psiquiatría (English Ed.)*, *51*(4), 301–308. https://doi.org/10.1016/j.rcpeng.2020.12.002

Aghotor, J., Pfueller, U., Moritz, S., Weisbrod, M., & Roesch-Ely, D. (2010). Metacognitive training for patients with schizophrenia (MCT): Feasibility and preliminary evidence for its efficacy. *Journal of Behavior Therapy and Experimental Psychiatry*, *41*(3), 207–211. https://doi.org/10.1016/j.jbtep.2010.01.004

American Psychological Association. (2013). Recognition of psychotherapy effectiveness. *Psychotherapy, 50*(1), 102–109. https://doi.org/10.1037/a0030276

Andreou, C., Wittekind, C. E., Fieker, M., Heitz, U., Veckenstedt, R., Bohn, F., & Moritz, S. (2017). Individualized metacognitive therapy for delusions: A randomized controlled rater-blind study. *Journal of Behavior Therapy and Experimental Psychiatry*, *56*, 144–151. https://doi.org/10.1016/j.jbtep.2016.11.013

Baker, S. C., Konova, A. B., Daw, N. D., & Horga, G. (2019). A distinct inferential mechanism for delusions in schizophrenia. *Brain*, *142*(6), 1797–1812. https://doi.org/10.1093/brain/awz051

Balzan, R. P., Delfabbro, P. H., Galletly, C. A., & Woodward, T. S. (2013). Metacognitive training for patients with schizophrenia: Preliminary evidence for a targeted, single-module programme. *Australian & New Zealand Journal of Psychiatry*, *48*(12), 1126–1136. https://doi.org/10.1177/0004867413508451

Balzan, R. P., Mattiske, J. K., Delfabbro, P., Liu, D., & Galletly, C. (2018). Individualized metacognitive training (MCT+) reduces delusional symptoms in psychosis: A randomized clinical trial. *Schizophrenia Bulletin*, *45*(1), 27–36. https://doi.org/10.1093/schbul/sby152

Barnicot, K., Michael, C., Trione, E., Lang, S., Saunders, T., Sharp, M., & Crawford, M. J. (2020). Psychological interventions for acute psychiatric inpatients with schizophrenia-spectrum disorders: A systematic review and meta-analysis. *Clinical Psychology Review*, *82*, 101929. https://doi.org/10.1016/j.cpr.2020.101929

Begg, C. B., & Mazumdar, M. (1994). Operating characteristics of a rank correlation test for publication bias. *Biometrics*, *50*(4), 1088. https://doi.org/10.2307/2533446

Bowie, C. R., Bell, M. D., Fiszdon, J. M., Johannesen, J. K., Lindenmayer, J.-P., McGurk, S. R., Medalia, A. A., Penadés, R., Saperstein, A. M., Twamley, E. W., Ueland, T., & Wykes, T. (2020). Cognitive remediation for schizophrenia: An expert working group white paper on core techniques. *Schizophrenia Research*, *215*, 49–53. https://doi.org/10.1016/j.schres.2019.10.047

Briki, M., Monnin, J., Haffen, E., Sechter, D., Favrod, J. Ô., Netillard, C., Cheraitia, E., Marin, K., Govyadovskaya, S., Tio, G., Bonin, B., Chauvet-Gelinier, J. C., Leclerc, S., Hodé, Y., Vidailhet, P., Berna, F., Bertschy, A. Z., & Vandel, P. (2014). Metacognitive training for schizophrenia: A multicentre randomised controlled trial. *Schizophrenia Research*, *157*(1–3), 99–106. https://doi.org/10.1016/j.schres.2014.06.005

Briki, M., Vandel, P., Haffen, E., & Sechter, D. (2014). Metacognition training for schizophrenia: A French pilot study. *The Journal of Neuropsychiatry and Clinical Neurosciences*, *26*(2). https://doi.org/10.1176/appi.neuropsych.13040090

Bruno, N., Sachs, N., Demily, C., Franck, N., & Pacherie, E. (2012). Delusions and metacognition in patients with schizophrenia. *Cognitive Neuropsychiatry*, *17*(1), 1–18. https://doi.org/10.1080/13546805.2011.562071

Buonocore, M., Bosia, M., Riccaboni, R., Bechi, M., Spangaro, M., Piantanida, M., Cocchi, F., Guglielmino, C., Bianchi, L., Smeraldi, E., & Cavallaro, R. (2015). Combined neurocognitive and metacognitive rehabilitation in schizophrenia: Effects on bias against disconfirmatory evidence. *European Psychiatry*, *30*(5), 615–621. https://doi.org/10.1016/j.eurpsy.2015.02.006

Burlingame, G. M., & Rosendahl, J. (2022). A scientific response to Moritz et al. (2022). *Psychotherapy*, *59*(2), 136–139. https://doi.org/10.1037/pst0000433

Burlingame, G. M., & Strauss, B. (2021). Efficacy of small group treatments: Foundation for evidence-based practice. In M. Barkham, W. Lutz, & L. G. Castonguay (Eds.), *Bergin and Garfield's handbook of psychotherapy and behavior change: 50th anniversary edition* (pp. 583–624). John Wiley & Sons, Inc.

Burlingame, G. M., Svien, H., Hoppe, L., Hunt, I., & Rosendahl, J. (2020). Group therapy for schizophrenia: A meta-analysis. *Psychotherapy*, *57*(2), 219–236. https://doi.org/10.1037/pst0000293

Chen, Q., Sang, Y., Ren, L., Wu, J., Chen, Y., Zheng, M., Bian, G., & Sun, H. (2021). Metacognitive training: A useful complement to community-based rehabilitation for schizophrenia patients in China. *BMC Psychiatry*, *21*(1). https://doi.org/10.1186/s12888-021-03039-y

Correll, C. U., & Schooler, N. R. (2020). Negative symptoms in schizophrenia: A review and clinical guide for recognition, assessment, and treatment. *Neuropsychiatric Disease and Treatment*, *Volume 16*, 519–534. https://doi.org/10.2147/ndt.s225643

Deeks, J. J., Higgins, J. P. T., & Altman, D. G. (2011). Chapter 9: Analysing data and undertaking meta-analyses. *Cochrane handbook for systematic reviews of interventions* Version 5.1.0 (updated March 2011). The Cochrane Collaboration.

de Pinho, L., Sequeira, C., Sampaio, F., Rocha, N., Ozaslan, Z., & Ferre-Grau, C. (2020). Assessing the efficacy and feasibility of providing metacognitive training for patients with

schizophrenia by mental health nurses: A randomized controlled trial. *Journal of Advanced Nursing*, *77*(2), 999–1012. https://doi.org/10.1111/jan.14627

Dudley, R., Taylor, P., Wickham, S., & Hutton, P. (2015). Psychosis, delusions and the "jumping to conclusions" reasoning bias: A systematic review and meta-analysis. *Schizophrenia Bulletin*, *42*(3), 652–665. https://doi.org/10.1093/schbul/sbv150

Duval, S., & Tweedie, R. (2000a). A nonparametric "trim and fill" method of accounting for publication bias in meta-analysis. *Journal of the American Statistical Association*, *95*(449), 89. https://doi.org/10.2307/2669529

Duval, S., & Tweedie, R. (2000b). Trim and fill: A simple funnel-plot-based method of testing and adjusting for publication bias in meta-analysis. *Biometrics*, *56*(2), 455–463. https://doi.org/10.1111/j.0006-341x.2000.00455.x

Egger, M., Smith, G. D., Schneider, M., & Minder, C. (1997). Bias in meta-analysis detected by a simple, graphical test. *BMJ*, *315*(7109), 629–634. https://doi.org/10.1136/bmj.315.7109.629

Eichner, C. (2015). *Can Metacognitive Training (MCT) Reduce Positive Symptoms and Delusions in Patients with Schizophrenia? A Meta-Analysis Taking into Account Important Moderators*. [Master's thesis, University of Hamburg]. ResearchGate. https://www.researchgate.net/publication/282804732_Can_metacognitive_training_MCT_reduce_positive_symptoms_and_delusions_in_patients_with_schizophrenia_A_meta-analysis_taking_into_account_important_moderators

Eichner, C., & Berna, F. (2016). 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*, *42*(4), 952–962. https://doi.org/10.1093/schbul/sbv225

Erawati, E., Keliat, B. A., Helena, N., & Hamid, A. (2014). The influence of metacognitive training on delusion severity and metacognitive ability in schizophrenia. *Journal of Psychiatric and Mental Health Nursing*, *21*(9), 841–847. https://doi.org/10.1111/jpm.12130

Faden, J., & Citrome, L. (2018). Resistance is not futile: Treatment-refractory schizophrenia – overview, evaluation and treatment. *Expert Opinion on Pharmacotherapy*, *20*(1), 11–24. https://doi.org/10.1080/14656566.2018.1543409

Favrod, J., Maire, A., Bardy, S., Pernier, S., & Bonsack, C. (2010). Improving insight into delusions: A pilot study of metacognitive training for patients with schizophrenia. *Journal of Advanced Nursing*, *67*(2), 401–407. https://doi.org/10.1111/j.1365-2648.2010.05470.x

Favrod, J., Rexhaj, S., Bardy, S., Ferrari, P., Hayoz, C., Moritz, S., Conus, P., & Bonsack, C. (2014). Sustained antipsychotic effect of metacognitive training in psychosis: A randomized-controlled study. *European Psychiatry*, *29*(5), 275–281. https://doi.org/10.1016/j.eurpsy.2013.08.003

Fekete, Z., Vass, E., Balajthy, R., Tana, Ü., Nagy, A. C., Oláh, B., Domján, N., & Kuritárné, I. S. (2022). Efficacy of metacognitive training on symptom severity, neurocognition and social cognition in patients with schizophrenia: A single-blind randomized controlled trial. *Scandinavian Journal of Psychology*, *63*(4), 321–333. https://doi.org/10.1111/sjop.12811

Ferwerda, J., de Boer, K., & van der Gaag, M. (2010). Metacognitieve training voor patiënten met een psychotische kwetsbaarheid. *Directieve Therapie*, *30*(4), 263–279. https://doi.org/10.1007/s12433-010-0240-y

Feyaerts, J., Henriksen, M. G., Vanheule, S., Myin-Germeys, I., & Sass, L. A. (2021). Delusions beyond beliefs: A critical overview of diagnostic, aetiological, and therapeutic schizophrenia research from a clinical-phenomenological perspective. *The Lancet Psychiatry*, *8*(3), 237–249. https://doi.org/10.1016/s2215-0366(20)30460-0

Fischer, R., Scheunemann, J., Bohlender, A., Duletzki, P., Nagel, M., & Moritz, S. (2022). 'You are trying to teach us to think more slowly!': Adapting metacognitive training for the acute care setting – a case report. *Clinical Psychology & Psychotherapy*, *29*(6), 1877–1885. https://doi.org/10.1002/cpp.2755

Flavell, J. H. (1979). Metacognition and cognitive monitoring: A new area of cognitive-developmental inquiry. *American Psychologist*, *34*(10), 906–911. https://doi.org/10.1037/0003-066x.34.10.906

Fujii, K., Kobayashi, M., Funasaka, K., Kurokawa, S., & Hamagami, K. (2021). Effectiveness of metacognitive training for long-term hospitalized patients with schizophrenia: A pilot study with a crossover design. *Asian Journal of Occupational Therapy*, *17*(1), 45–52. https://doi.org/10.11596/asiajot.17.45

Galderisi, S., Mucci, A., Buchanan, R. W., & Arango, C. (2018). Negative symptoms of schizophrenia: New developments and unanswered research questions. *The Lancet Psychiatry*, *5*(8), 664–677. https://doi.org/10.1016/s2215-0366(18)30050-6

Gawęda, Ł., Krężołek, M., Olbryś, J., Turska, A., & Kokoszka, A. (2015). Decreasing self-reported cognitive biases and increasing clinical insight through meta-cognitive training in patients with chronic schizophrenia. *Journal of Behavior Therapy and Experimental Psychiatry*, *48*, 98–104. https://doi.org/10.1016/j.jbtep.2015.02.002

Gosling, C. J., Solanes, A., Fusar-Poli, P., & Radua, J. (2023, February 1). *Metaumbrella: The first comprehensive suite to perform data analysis in umbrella reviews with stratification of the evidence*. BMJ Mental Health. https://doi.org/10.1136/bmjment-2022-300534

Green, M. F., Horan, W. P., & Lee, J. (2019). Nonsocial and social cognition in schizophrenia: Current evidence and future directions. *World Psychiatry*, *18*(2), 146–161. https://doi.org/10.1002/wps.20624

Haddock, G., McCarron, J., Tarrier, N., & Faragher, E. B. (1999). Scales to measure dimensions of hallucinations and delusions: The psychotic symptom rating scales (PSYRATS). *Psychological Medicine*, *29*(4), 879–889. https://doi.org/10.1017/s0033291799008661

Hedges, L. V. (1981). Distribution theory for Glass's estimator of effect size and related estimators. *Journal of Educational Statistics*, *6*(2), 107. https://doi.org/10.2307/1164588

Hennessy, E. A., Johnson, B. T., & Keenan, C. (2019). Best practice guidelines and essential methodological steps to conduct rigorous and systematic meta-reviews. *Applied Psychology: Health and Well-Being*, *11*(3), 353–381. https://doi.org/10.1111/aphw.12169

Higgins, J. P. T., Altman, D. G., & Sterne, J. A. C. (2011). Assessing risk of bias in included studies. In J. P. T. Higgins & S. Green (Eds.), *Cochrane handbook for systematic reviews of interventions* Version 5.1.0 (pp. 187–242). Chichester, United Kingdom: John Wiley & Sons.

Higgins, J. P. T., & Green, S. (Eds.). (2008). *Cochrane Handbook for Systematic Reviews of interventions* Version 5.0.2 (updated 2009). The Cochrane Collaboration.

Higgins, J. P. T., Altman, D. G., Deeks, J. J., & Thompson, S. G. (2003). Measuring inconsistency in meta-analyses. *BMJ*, *327*(7414), 557–560. https://doi.org/10.1136/bmj.327.7414.557

Hong, Q. N., Fàbregues, S., Bartlett, G., Boardman, F., Cargo, M., Dagenais, P., Gagnon, M.-P., Griffiths, F., Nicolau, B., O'Cathain, A., Rousseau, M.-C., Vedel, I., & Pluye, P. (2018). The mixed methods appraisal tool (MMAT) version 2018 for information professionals and researchers. *Education for Information*, *34*(4), 285–291. https://doi.org/10.3233/efi-180221

Howes, O. D., Cummings, C., Chapman, G. E., & Shatalina, E. (2022). Neuroimaging in schizophrenia: An overview of findings and their implications for synaptic changes. *Neuropsychopharmacology*, *48*(1), 151–167. https://doi.org/10.1038/s41386-022-01426-x

Ho-wai So, S., Hoi-kei Chan, G., Kit-wa Wong, C., Wing-ka Ching, E., Sze-wai Lee, S., Chi-Wing Wong, B., Zhu, C., Sun, X., Kin-hei Chung, L., Hung, A. Y., Oi-yin Wong, J., & Sau-man Chan, S. (2021). A randomised controlled trial of metacognitive training for psychosis, depression, and belief flexibility. *Journal of Affective Disorders*, *279*, 388–397. https://doi.org/10.1016/j.jad.2020.09.126

Inchausti, F., García-Poveda, N. V., Ballesteros-Prados, A., Ortuño-Sierra, J., Sánchez-Reales, S., Prado-Abril, J., Aldaz-Armendáriz, J. A., Mole, J., Dimaggio, G., Ottavi, P., & Fonseca-Pedrero, E. (2017). The effects of metacognition-oriented social skills training on psychosocial outcome in schizophrenia-spectrum disorders: A randomized controlled trial. *Schizophrenia Bulletin*, *44*(6), 1235–1244. https://doi.org/10.1093/schbul/sbx168

Ishikawa, R., Ishigaki, T., Shimada, T., Tanoue, H., Yoshinaga, N., Oribe, N., Morimoto, T., Matsumoto, T., & Hosono, M. (2020). The efficacy of extended metacognitive training for

psychosis: A randomized controlled trial. *Schizophrenia Research*, *215*, 399–407. https://doi.org/10.1016/j.schres.2019.08.006

Jackson, D., & Turner, R. (2017). Power analysis for random-effects meta-analysis. *Research Synthesis Methods*, *8*(3), 290–302. https://doi.org/10.1002/jrsm.1240

Jiang, J., Zhang, L., Zhu, Z., Li, W., & Li, C. (2015). Metacognitive training for schizophrenia: A systematic review. *Shanghai Archives of Psychiatry, 27*(3), 149–157. https://doi.org/10.11919/j.issn.1002-0829.215065

Jones, C., Hacker, D., Xia, J., Meaden, A., Irving, C. B., Zhao, S., Chen, J., & Shi, C. (2018). Cognitive behavioural therapy plus standard care versus standard care for people with schizophrenia. *Cochrane Database of Systematic Reviews*, *2018*(12). https://doi.org/10.1002/14651858.cd007964.pub2

Kay, S. R., Fiszbein, A., & Opler, L. A. (1987). The positive and negative syndrome scale (PANSS) for schizophrenia. *Schizophrenia Bulletin*, *13*(2), 261–276. https://doi.org/10.1093/schbul/13.2.261

Keepers, G. A., Fochtmann, L. J., Anzia, J. M., Benjamin, S., Lyness, J. M., Mojtabai, R., Servis, M., Walaszek, A., Buckley, P., Lenzenweger, M. F., Young, A. S., Degenhardt, A., Hong, S.-H. (2020). The American psychiatric association practice guideline for the treatment of patients with schizophrenia. *American Journal of Psychiatry, 177*(9), 868–872.doi:10.1176/appi.ajp.2020.177901

Kendler, K. S. (2020a). Eugen Bleuler's views on the genetics of schizophrenia in 1917. *Schizophrenia Bulletin*, *46*(4), 758–764. https://doi.org/10.1093/schbul/sbz131

Kendler, K. S. (2020b). Kraepelin's final views on dementia praecox. *Schizophrenia Bulletin*, *47*(3), 635–643. https://doi.org/10.1093/schbul/sbaa177

Kowalski, J., Pankowski, D., Lew-Starowicz, M., & Gawęda, Ł. (2017). Do specific metacognitive training modules lead to specific cognitive changes among patients diagnosed with schizophrenia? A single module effectiveness pilot study. *Psychosis*, *9*(3), 254–259. https://doi.org/10.1080/17522439.2017.1300186

Köther, U., Vettorazzi, E., Veckenstedt, R., Hottenrott, B., Bohn, F., Scheu, F., Pfueller, U., Roesch-Ely, D., & Moritz, S. (2017). Bayesian analyses of the effect of metacognitive training on social cognition deficits and overconfidence in errors. *Journal of Experimental Psychopathology*, *8*(2), 158–174. https://doi.org/10.5127/jep.054516

Kumar, D., Zia Ul Haq, M., Dubey, I., Dotivala, K. N., Veqar Siddiqui, S., Prakash, R., Abhishek, P., & Nizamie, S. H. (2010). Effect of meta-cognitive training in the reduction of positive symptoms in schizophrenia. *European Journal of Psychotherapy & Counselling*, *12*(2), 149–158. https://doi.org/10.1080/13642537.2010.488875

Kumar, D., Rao, M. G., Raveendranathan, D., Venkatasubramanian, G., Varambally, S., & Gangadhar, B. N. (2015). Metacognitive training for delusion in treatment-resistant schizophrenia. *Clinical Schizophrenia & Related Psychoses*, *9*(1), 40–43. https://doi.org/10.3371/csrp.kura.031513

Kuokkanen, R., Lappalainen, R., Repo-Tiihonen, E., & Tiihonen, J. (2014). Metacognitive group training for forensic and dangerous non-forensic patients with schizophrenia: A randomised controlled feasibility trial. *Criminal Behaviour and Mental Health*, *24*(5), 345–357. https://doi.org/10.1002/cbm.1905

Kuokkanen, R., Aho-Mustonen, K., Muotka, J., Lappalainen, R., & Tiihonen, J. (2015). A pilot study of group administered metacognitive training (MCT) for schizophrenia patients in a high-security forensic setting: Subjective training success and health-related quality of life. *Journal of Forensic Psychology Practice*, *15*(4), 344–362. https://doi.org/10.1080/15228932.2015.1053546

Lam, K. C. K., Ho, C. P. S., Wa, J. C., Chan, S. M. Y., Yam, K. K. N., Yeung, O. S. F., Wong, W. C. H., & Balzan, R. P. (2015). Metacognitive Training (MCT) for schizophrenia improves cognitive insight: A randomized controlled trial in a Chinese sample with schizophrenia spectrum disorders. *Behaviour Research and Therapy*, *64*, 38–42. https://doi.org/10.1016/j.brat.2014.11.008

Laws, K. R., Darlington, N., Kondel, T. K., McKenna, P. J., & Jauhar, S. (2018). Cognitive behavioural therapy for schizophrenia – outcomes for functioning, distress and quality of life: A meta-analysis. *BMC Psychology*, *6*(1). https://doi.org/10.1186/s40359-018-0243-2

Lecardeur, L., Stip, E., Giguere, M., Blouin, G., Rodriguez, J.-P., & Champagne-Lavau, M. (2009). Effects of cognitive remediation therapies on psychotic symptoms and cognitive complaints in patients with schizophrenia and related disorders: A randomized study. *Schizophrenia Research*, *111*(1–3), 153–158. https://doi.org/10.1016/j.schres.2009.03.029

Lemmers-Jansen, I. L. J., & Moritz, S. (2021). A practice-oriented review on effectiveness of metacognitive training (MCT) for psychosis. *BPA Applied Psychology Bulletin, 69*(290), 24-34. https://doi.org/10.26387/bpa.290.3

Liberati, A., Altman, D. G., Tetzlaff, J., Mulrow, C., Gøtzsche, P. C., Ioannidis, J. P., Clarke, M., Devereaux, P. J., Kleijnen, J., & Moher, D. (2009). The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: Explanation and elaboration. *PLoS Medicine*, *6*(7). https://doi.org/10.1371/journal.pmed.1000100

Lim, A., Hoek, H. W., Deen, M. L., Blom, J. D., Bruggeman, R., Cahn, W., de Haan, L., Kahn, R. S., Meijer, C. J., Myin-Germeys, I., van Os, J., & Wiersma, D. (2016). Prevalence and classification of hallucinations in multiple sensory modalities in schizophrenia spectrum

disorders. *Schizophrenia Research*, *176*(2–3), 493–499. https://doi.org/10.1016/j.schres.2016.06.010

Lipsey, M. W., & Wilson, D. B. (2000). *Practical Meta-Analysis* (1st ed.). SAGE Publications, Inc.

Liu, Y., Tang, C., Hung, T., Tsai, P., & Lin, M. (2018). The efficacy of metacognitive training for delusions in patients with schizophrenia: A meta-analysis of Randomized Controlled Trials informs evidence-based practice. *Worldviews on Evidence-Based Nursing*, *15*(2), 130–139. https://doi.org/10.1111/wvn.12282

Lopez-Morinigo, J.-D., Ajnakina, O., Martínez, A. S.-E., Escobedo-Aedo, P.-J., Ruiz-Ruano, V. G., Sánchez-Alonso, S., Mata-Iturralde, L., Muñoz-Lorenzo, L., Ochoa, S., Baca-García, E., & David, A. S. (2020). Can metacognitive interventions improve insight in schizophrenia spectrum disorders? A systematic review and meta-analysis. *Psychological Medicine*, *50*(14), 2289–2301. https://doi.org/10.1017/s0033291720003384

Marcellusi, A., Fabiano, G., Viti, R., Francesa Morel, P. C., Nicolò, G., Siracusano, A., & Mennini, F. S. (2018). Economic burden of schizophrenia in Italy: A probabilistic cost of illness analysis. *BMJ Open*, *8*(2). https://doi.org/10.1136/bmjopen-2017-018359

McCutcheon, R. A., Reis Marques, T., & Howes, O. D. (2020). Schizophrenia – an overview. *JAMA Psychiatry*, *77*(2), 201. https://doi.org/10.1001/jamapsychiatry.2019.3360

McLean, B. F., Mattiske, J. K., & Balzan, R. P. (2016). Association of the jumping to conclusions and evidence integration biases with delusions in psychosis: A detailed meta-analysis. *Schizophrenia Bulletin*. https://doi.org/10.1093/schbul/sbw056

Merriam-Webster. (n.d.-a). Cognition. In Merriam-Webster.com dictionary. Retrieved October 6, 2023, from https://www.merriam-webster.com/dictionary/cognition

Merriam-Webster. (n.d.-b). Meta. In Merriam-Webster.com dictionary. Retrieved October 6, 2023, from https://www.merriam-webster.com/dictionary/meta

Merriam-Webster. (n.d.-c). Schizophrenia. In Merriam-Webster.com dictionary. Retrieved October 6, 2023, from https://www.merriam-webster.com/dictionary/schizophrenia

Moher, D., Liberati, A., Tetzlaff, J., & Altman, D. G. (2009). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *PLoS Medicine*, *6*(7). https://doi.org/10.1371/journal.pmed.1000097

Moritz, S., Andreou, C., Schneider, B. C., Wittekind, C. E., Menon, M., Balzan, R. P., & Woodward, T. S. (2014). Sowing the seeds of doubt: A narrative review on metacognitive training in Schizophrenia. *Clinical Psychology Review*, *34*(4), 358–366. https://doi.org/10.1016/j.cpr.2014.04.004

Moritz, S., Kerstan, A., Veckenstedt, R., Randjbar, S., Vitzthum, F., Schmidt, C., Heise, M., & Woodward, T. S. (2011). Further evidence for the efficacy of a metacognitive group

training in schizophrenia. *Behaviour Research and Therapy*, *49*(3), 151–157. https://doi.org/10.1016/j.brat.2010.11.010

Moritz, S., Menon, M., Andersen, D., Woodward, T. S., & Gallinat, J. (2017). Moderators of symptomatic outcome in metacognitive training for psychosis (MCT). Who benefits and who does not? *Cognitive Therapy and Research*, *42*(1), 80–91. https://doi.org/10.1007/s10608-017-9868-3

Moritz, S., Menon, M., Balzan, R., & Woodward, T. S. (2022). Metacognitive training for psychosis (MCT): Past, present, and future. *European Archives of Psychiatry and Clinical Neuroscience*, *273*(4), 811–817. https://doi.org/10.1007/s00406-022-01394-9

Moritz, S., Thoering, T., Kühn, S., Willenborg, B., Westermann, S., & Nagel, M. (2015). Metacognition-augmented cognitive remediation training reduces jumping to conclusions and overconfidence but not neurocognitive deficits in psychosis. *Frontiers in Psychology*, *6*. https://doi.org/10.3389/fpsyg.2015.01048

Moritz, S., Turner, D., Bechdolf, A., Mueller, D. R., Woodward, T. S., Penney, D., & Mehl, S. (2022). Group therapy for schizophrenia: Why Burlingame et al. (2020) should redo their meta-analysis. *Psychotherapy*, *59*(2), 133–135. https://doi.org/10.1037/pst0000401

Moritz, S., Veckenstedt, R., Randjbar, S., Vitzthum, F., & Woodward, T. S. (2011). Antipsychotic treatment beyond antipsychotics: Metacognitive intervention for schizophrenia patients improves delusional symptoms. *Psychological Medicine*, *41*(9), 1823–1832. https://doi.org/10.1017/S0033291710002618

Moritz, S., Veckenstedt, R., Andreou, C., Bohn, F., Hottenrott, B., Leighton, L., Köther, U., Woodward, T. S., Treszl, A., Menon, M., Schneider, B. C., Pfueller, U., & Roesch-Ely, D. (2014). Sustained and "sleeper" effects of group metacognitive training for schizophrenia. *JAMA Psychiatry*, *71*(10), 1103. https://doi.org/10.1001/jamapsychiatry.2014.1038

Moritz, S., Veckenstedt, R., Bohn, F., Hottenrott, B., Scheu, F., Randjbar, S., Aghotor, J., Köther, U., Woodward, T. S., Treszl, A., Andreou, C., Pfueller, U., & Roesch-Ely, D. (2013). Complementary group metacognitive training (MCT) reduces delusional ideation in schizophrenia. *Schizophrenia Research*, *151*(1–3), 61–69. https://doi.org/10.1016/j.schres.2013.10.007

Moritz, S., Werner, D., Menon, M., Balzan, R. P., & Woodward, T. S. (2015). Jumping to negative conclusions – a case of study-gathering bias? *Psychological Medicine*, *46*(1), 59–61. https://doi.org/10.1017/s0033291715002068

Moritz, S., & Woodward, T. S. (2007a). Metacognitive training for schizophrenia patients (MCT): A pilot study on feasibility, treatment adherence, and subjective efficacy. *German Journal of Psychiatry, 10*(3), 69–78.

Moritz, S., & Woodward, T. S. (2007b). Metacognitive training in schizophrenia: From basic research to knowledge translation and intervention. *Current Opinion in Psychiatry*, *20*(6), 619–625. https://doi.org/10.1097/yco.0b013e3282f0b8ed

Nakamura, T., & Takata, A. (2023). The molecular pathology of schizophrenia: An overview of existing knowledge and new directions for future research. *Molecular Psychiatry*. https://doi.org/10.1038/s41380-023-02005-2

Nathou, C., Etard, O., & Dollfus, S. (2019). Auditory verbal hallucinations in schizophrenia: Current perspectives in brain stimulation treatments. *Neuropsychiatric Disease and Treatment*, *Volume 15*, 2105–2117. https://doi.org/10.2147/ndt.s168801

Naughton, M., Nulty, A., Abidin, Z., Davoren, M., O'Dwyer, S., & Kennedy, H. G. (2012). Effects of group Metacognitive Training (MCT) on mental capacity and functioning in patients with psychosis in a secure forensic psychiatric hospital: A prospective-cohort waiting list controlled study. *BMC Research Notes*, *5*(1). https://doi.org/10.1186/1756-0500-5-302

Ochoa, S., López-Carrilero, R., Barrigón, M. L., Pousa, E., Barajas, A., Lorente-Rovira, E., González-Higueras, F., Grasa, E., Ruiz-Delgado, I., Cid, J., Birulés, I., Esteban-Pinos, I., Casañas, R., Luengo, A., Torres-Hernández, P., Corripio, I., Montes-Gámez, M., Beltran, M., De Apraiz, A., … Moritz, S. (2017). Randomized control trial to assess the efficacy of metacognitive training compared with a psycho-educational group in people with a recent-onset psychosis. *Psychological Medicine*, *47*(9), 1573–1584. https://doi.org/10.1017/s0033291716003421

Ochoa, S., Lopez-Carrilero, R., Luisa Barrigon, M., Pousa, E., Grasa, E., González, F., Monserrat, C., Gutierrez-Zotes, alfonso, Lorente, E., Barajas, A., Ruiz-Delgado, I., Cid, J., Birules, I., Pélaez, T., García-Mieres, H., Vila-Badia, R., & Moritz, S. (2020). S34. Effectiveness of individual metacognitive training (MCT+) in first-episode psychosis. *Schizophrenia Bulletin*, *46*(Supplement_1). https://doi.org/10.1093/schbul/sbaa031.100

Ouzzani, M., Hammady, H., Fedorowicz, Z., & Elmagarmid, A. (2016). Rayyan – a web and mobile app for systematic reviews. *Systematic Reviews*, *5*(1). https://doi.org/10.1186/s13643-016-0384-4

Overall, J. E., & Gorham, D. R. (1962). Brief psychiatric rating scale. *PsycTESTS Dataset*. https://doi.org/10.1037/t01554-000

Owen, M. J., Sawa, A., & Mortensen, P. B. (2016). Schizophrenia. *The Lancet*, *388*(10039), 86–97. https://doi.org/10.1016/s0140-6736(15)01121-6

Park, S., Lee, H. K., & Kim, H. (2019). Effects of a Korean version of the metacognitive training program for outpatients with schizophrenia on theory of mind, positive symptoms, and interpersonal relationships. *Behavioural and Cognitive Psychotherapy*, *48*(1), 14–24. https://doi.org/10.1017/s1352465819000560

Penney, D., Sauvé, G., Mendelson, D., Thibaudeau, É., Moritz, S., & Lepage, M. (2022). Immediate and sustained outcomes and moderators associated with metacognitive training for psychosis. *JAMA Psychiatry*, *79*(5), 417. https://doi.org/10.1001/jamapsychiatry.2022.0277

Philipp, R., Kriston, L., Lanio, J., Kühne, F., Härter, M., Moritz, S., & Meister, R. (2018). Effectiveness of metacognitive interventions for mental disorders in adults—a systematic review and meta-analysis (METACOG). *Clinical Psychology & Psychotherapy*, *26*(2), 227–240. https://doi.org/10.1002/cpp.2345

Pieper, D., Antoine, S.-L., Mathes, T., Neugebauer, E. A. M., & Eikermann, M. (2014). Systematic review finds overlapping reviews were not mentioned in every other overview. *Journal of Clinical Epidemiology*, *67*(4), 368–375. https://doi.org/10.1016/j.jclinepi.2013.11.007

Pos, K., Meijer, C. J., Verkerk, O., Ackema, O., Krabbendam, L., & de Haan, L. (2017). Metacognitive training in patients recovering from a first psychosis: An experience sampling study testing treatment effects. *European Archives of Psychiatry and Clinical Neuroscience*, *268*(1), 57–64. https://doi.org/10.1007/s00406-017-0833-7

Premack, D., & Woodruff, G. (1978). Does the chimpanzee have a theory of mind? *Behavioral and Brain Sciences*, *1*(4), 515–526. https://doi.org/10.1017/s0140525x00076512

Raucher-Chéné, D. M., Daniel, Thibaudeau, É., & Lepage, M. (unpublished). *Virtual metacognitive training for psychosis: Preliminary findings from a Canadian cohort study*.

Reeves, B. C., Deeks, J. J., Higgins, J. P., & Wells, G. A. (2008). Including non-randomized studies. *Cochrane Handbook for Systematic Reviews of Interventions*, 389–432. https://doi.org/10.1002/9780470712184.ch13

Rocha, N. B. F., & Queirós, C. (2013). Metacognitive and social cognition training (MSCT) in schizophrenia: A preliminary efficacy study. *Schizophrenia Research*, *150*(1), 64–68. https://doi.org/10.1016/j.schres.2013.07.057

Rosendahl, J., Alldredge, C. T., Burlingame, G. M., & Strauss, B. (2021). Recent developments in group psychotherapy research. *American Journal of Psychotherapy*, *74*(2), 52–59. https://doi.org/10.1176/appi.psychotherapy.20200031

Rosenthal, R. (1991). *Meta-Analytic Procedures for Social Research*. https://doi.org/10.4135/9781412984997

Rosenthal, R. (1979). The file drawer problem and tolerance for null results. *Psychological Bulletin*, *86*(3), 638–641. https://doi.org/10.1037/0033-2909.86.3.638

Rosenthal, R., & DiMatteo, M. R. (2001). Meta-analysis: Recent developments in quantitative methods for literature reviews. *Annual Review of Psychology*, *52*(1), 59–82. https://doi.org/10.1146/annurev.psych.52.1.59

Ross, K., Freeman, D., Dunn, G., & Garety, P. (2009). A randomized experimental investigation of reasoning training for people with delusions. *Schizophrenia Bulletin*, *37*(2), 324–333. https://doi.org/10.1093/schbul/sbn165

Salas-Sender, M., López-Carrilero, R., Barajas, A., Lorente-Rovira, E., Pousa, E., Barrigón, M. L., Grasa, E., Ruiz-Delgado, I., González-Higueras, F., Cid, J., Aznar, A., Pélaez, T., Birulés, I., Moritz, S., The Spanish Metacognition Study Group, & Ochoa, S. (2020). Gender differences in response to metacognitive training in people with first-episode psychosis. *Journal of Consulting and Clinical Psychology*, *88*(6), 516–525. https://doi.org/10.1037/ccp0000468

Sauvé, G., Lavigne, K. M., Pochiet, G., Brodeur, M. B., & Lepage, M. (2020). Efficacy of psychological interventions targeting cognitive biases in schizophrenia: A systematic review and meta-analysis. *Clinical Psychology Review*, *78*, 101854. https://doi.org/10.1016/j.cpr.2020.101854

Schneider, B. C., Cludius, B., Lutz, W., Moritz, S., & Rubel, J. A. (2018). An investigation of module-specific effects of metacognitive training for psychosis. *Zeitschrift Für Psychologie*, *226*(3), 164–173. https://doi.org/10.1027/2151-2604/a000336

Shadish, W. R. (2011). Randomized controlled studies and alternative designs in outcome studies. *Research on Social Work Practice*, *21*(6), 636–643. https://doi.org/10.1177/1049731511403324

Shan, X., Liao, R., Ou, Y., Pan, P., Ding, Y., Liu, F., Chen, J., Zhao, J., Guo, W., & He, Y. (2020). Increased regional homogeneity modulated by metacognitive training predicts therapeutic efficacy in patients with schizophrenia. *European Archives of Psychiatry and Clinical Neuroscience*, *271*(4), 783–798. https://doi.org/10.1007/s00406-020-01119-w

Shea, B. J., Grimshaw, J. M., Wells, G. A., Boers, M., Andersson, N., Hamel, C., Porter, A. C., Tugwell, P., Moher, D., & Bouter, L. M. (2007). Development of AMSTAR: A measurement tool to assess the methodological quality of systematic reviews. *BMC Medical Research Methodology*, *7*(1). https://doi.org/10.1186/1471-2288-7-10

Shea, B. J., Reeves, B. C., Wells, G., Thuku, M., Hamel, C., Moran, J., Moher, D., Tugwell, P., Welch, V., Kristjansson, E., & Henry, D. A. (2017). AMSTAR 2: A critical appraisal tool for systematic reviews that include randomised or non-randomised studies of healthcare interventions, or both. *BMJ*. https://doi.org/10.1136/bmj.j4008

Sher, L., & Kahn, R. S. (2019). Suicide in schizophrenia: An educational overview. *Medicina*, *55*(7), 361. https://doi.org/10.3390/medicina55070361

Simón-Expósito, M., & Felipe-Castaño, E. (2019). Effects of metacognitive training on cognitive insight in a sample of patients with schizophrenia. *International Journal of Environmental Research and Public Health*, *16*(22), 4541. https://doi.org/10.3390/ijerph16224541

So, S. H.-W., Chan, A. P., Chong, C. S.-Y., Wong, M. H.-M., Lo, W. T.-L., Chung, D. W.-S., & Chan, S. S. (2015). Metacognitive training for delusions (MCTd): Effectiveness on data-gathering and belief flexibility in a Chinese sample. *Frontiers in Psychology*, *6*. https://doi.org/10.3389/fpsyg.2015.00730

Steinmann, S., Leicht, G., & Mulert, C. (2019). The interhemispheric miscommunication theory of auditory verbal hallucinations in schizophrenia. *International Journal of Psychophysiology*, *145*, 83–90. https://doi.org/10.1016/j.ijpsycho.2019.02.002

Stępnicki, P., Kondej, M., & Kaczor, A. A. (2018). Current concepts and treatments of schizophrenia. *Molecules*, *23*(8), 2087. https://doi.org/10.3390/molecules23082087

Sterne, J. A., Hernán, M. A., Reeves, B. C., Savović, J., Berkman, N. D., Viswanathan, M., Henry, D., Altman, D. G., Ansari, M. T., Boutron, I., Carpenter, J. R., Chan, A.-W., Churchill, R., Deeks, J. J., Hróbjartsson, A., Kirkham, J., Jüni, P., Loke, Y. K., Pigott, T. D., … Higgins, J. P. (2016). Robins-I: A tool for assessing risk of bias in non-randomised studies of interventions. *BMJ*, i4919. https://doi.org/10.1136/bmj.i4919

Takeda, T., Nakataki, M., Ohta, M., Hamatani, S., Matsuura, K., & Ohmori, T. (2018). Effect of cognitive function on jumping to conclusion in patients with schizophrenia. *Schizophrenia Research: Cognition*, *12*, 50–55. https://doi.org/10.1016/j.scog.2018.04.002

Tanoue, H., Yoshinaga, N., Hayashi, Y., Ishikawa, R., Ishigaki, T., & Ishida, Y. (2020). Clinical effectiveness of metacognitive training as a transdiagnostic program in routine clinical settings: A prospective, multicenter, single-group study. *Japan Journal of Nursing Science*, *18*(2). https://doi.org/10.1111/jjns.12389

Tarrier, N., & Wykes, T. (2004). Is there evidence that cognitive behaviour therapy is an effective treatment for schizophrenia? A cautious or cautionary tale? *Behaviour Research and Therapy*, *42*(12), 1377–1401. https://doi.org/10.1016/j.brat.2004.06.020

Thibaudeau, É., Achim, A. M., Parent, C., Turcotte, M., & Cellard, C. (2020). A meta-analysis of the associations between theory of mind and neurocognition in Schizophrenia. *Schizophrenia Research*, *216*, 118–128. https://doi.org/10.1016/j.schres.2019.12.017

Turner, D. T., Burger, S., Smit, F., Valmaggia, L. R., & van der Gaag, M. (2020). What constitutes sufficient evidence for case formulation–driven CBT for psychosis? cumulative meta-analysis of the effect on hallucinations and delusions. *Schizophrenia Bulletin*, *46*(5), 1072–1085. https://doi.org/10.1093/schbul/sbaa045

Turner, D. T., MacBeth, A., Larkin, A., Moritz, S., Livingstone, K., Campbell, A., & Hutton, P. (2018). The effect of reducing the "jumping to conclusions" bias on treatment decision-making capacity in psychosis: A randomized controlled trial with mediation analysis. *Schizophrenia Bulletin*, *45*(4), 784–793. https://doi.org/10.1093/schbul/sby136

Ussorio, D., Giusti, L., Wittekind, C. E., Bianchini, V., Malavolta, M., Pollice, R., Casacchia, M., & Roncone, R. (2015). Metacognitive training for young subjects (MCT young version) in

the early stages of psychosis: Is the duration of untreated psychosis a limiting factor? *Psychology and Psychotherapy: Theory, Research and Practice*, *89*(1), 50–65. https://doi.org/10.1111/papt.12059

Valle, R. (2020). Schizophrenia in ICD-11: Comparison of ICD-10 and DSM-5. *Revista de Psiquiatría y Salud Mental (English Edition)*, *13*(2), 95–104. https://doi.org/10.1016/j.rpsmen.2020.01.002

van Oosterhout, B., Krabbendam, L., de Boer, K., Ferwerda, J., van der Helm, M., Stant, A. D., & van der Gaag, M. (2014). Metacognitive group training for schizophrenia spectrum patients with delusions: A randomized controlled trial. *Psychological Medicine*, *44*(14), 3025–3035. https://doi.org/10.1017/s0033291714000555

van Oosterhout, B., Smit, F., Krabbendam, L., Castelein, S., Staring, A. B., & van der Gaag, M. (2015). Metacognitive training for schizophrenia spectrum patients: A meta-analysis on outcome studies. *Psychological Medicine*, *46*(1), 47–57. https://doi.org/10.1017/s0033291715001105

van Oosterhout, B., Smit, F., Krabbendam, L., Castelein, S., Staring, A. B., & van der Gaag, M. (2016). Letter to the editor: Should we focus on quality or quantity in meta-analyses? *Psychological Medicine*, *46*(9), 2003–2005. https://doi.org/10.1017/s003329171600009x

Vitzthum, F., Veckenstedt, R., & Moritz, S. (2014). Individualized metacognitive therapy program for patients with psychosis (MCT+): Introduction of a novel approach for psychotic symptoms. *Behavioural and Cognitive Psychotherapy, 42*(1), 105-110. doi:10.1017/S1352465813000246

Vos, T., Lim, S. S., Abbafati, C., Abbas, K. M., Abbasi, M., Abbasifard, M., Abbasi-Kangevari, M., Abbastabar, H., Abd-Allah, F., Abdelalim, A., Abdollahi, M., Abdollahpour, I., Abolhassani, H., Aboyans, V., Abrams, E. M., Abreu, L. G., Abrigo, M. R., Abu-Raddad, L. J., Abushouk, A. I., … Murray, C. J. (2020). Global burden of 369 diseases and injuries in 204 countries and territories, 1990–2019: A systematic analysis for the global burden of disease study 2019. *The Lancet*, *396*(10258), 1204–1222. https://doi.org/10.1016/s0140-6736(20)30925-9

Wander, C. (2020). Schizophrenia: Opportunities to improve outcomes and reduce economic burden through managed care. *The American Journal of Managed Care*, *26*(Supplement_3). https://doi.org/10.37765/ajmc.2020.43013

Wardwell, P., Petrik, T., Mathews, L., Thime, W., Haber, L., Bracken, D., & Choi, J. (2017). SA123. Metacognitive training to improve insight and work outcome in schizophrenia. *Schizophrenia Bulletin*, *43*(Supplement_1). https://doi.org/10.1093/schbul/sbx023.119

Weilnhammer, V., Röd, L., Eckert, A.-L., Stuke, H., Heinz, A., & Sterzer, P. (2020). Psychotic experiences in schizophrenia and sensitivity to sensory evidence. *Schizophrenia Bulletin*, *46*(4), 927–936. https://doi.org/10.1093/schbul/sbaa003

World Health Organization (2018). *ICD-11 for Mortality and Morbidity Statistics*. From https://icd.who.int/browse11/l-m/en

Wykes, T., Steel, C., Everitt, B., & Tarrier, N. (2007). Cognitive behavior therapy for schizophrenia: Effect sizes, clinical models, and methodological rigor. *Schizophrenia Bulletin*, *34*(3), 523–537. https://doi.org/10.1093/schbul/sbm114

Yang, A., & Tsai, S.-J. (2017). New targets for schizophrenia treatment beyond the dopamine hypothesis. *International Journal of Molecular Sciences*, *18*(8), 1689. https://doi.org/10.3390/ijms18081689

Yildiz, M., Ozaslan, Z., Incedere, A., Kircali, A., Kiras, F., & Ipci, K. (2018). The effect of psychosocial skills training and metacognitive training on social and cognitive functioning in schizophrenia. *Archives of Neuropsychiatry*. https://doi.org/10.29399/npa.23095

Zalzala, A., Wardwell, P., Petrik, T., Mathews, L., Moritz, S., Fiszdon, J., Haber, L. C., Shagan, D., Bracken, D., & Choi, J. (2019). F121. Metacognitive Training (MCT) to improve insight and work outcome in schizophrenia. *Schizophrenia Bulletin*, *45*(Supplement_2). https://doi.org/10.1093/schbul/sbz018.533

Appendix

Tables and Figures

Table A1. *Study Characteristics for Included Meta-Analyses Regarding Outcomes of Schizophrenia Symptoms.*

Meta-Analysis	Search Strategy		Intervention; Control	Outcome Parameters	*N* Studies (*N* Intervention; *N* Control)
	Databases	Search Terms[a]			
Jiang2015	CENTRAL, Current Contents, EMBASE, MEDLINE, PsycINFO, Web of Science	[‘randomized controlled trial’/exp OR ‘randomized controlled trial’ AND (metacogniti*:ab,ti OR (‘meta’ NEAR/2 (‘cognitive’ OR ‘cognition’)):ab,ti) AND schizophreni*:ab,ti]	MCT; CogPack, ND, ST, TAU	Positive symptoms, delusions, global state, mental state, engagement with service, QoL, general functioning, adverse effects, dropout rate, satisfaction with treatment	11 (324; 322)
vanOosterhout 2015	CENTRAL, Cochrane Database of Systematic Reviews, EMBASE, MEDLINE, PsycINFO	‘metacognitive training’ OR ‘MCT’) AND outcome research (search terms included ‘randomised controlled trial’, ‘randomized controlled trial’ OR ‘RCT’	MCT, MCT+CBT, MSCT, MCT-JTC, MCT-T; CogPack, ST, TAU	Positive symptoms, delusions, data-gathering bias	11 (316; 617)
EichnerBerna 2016	CENTRAL, EMBASE, PsycINFO, PubMed	(delusion* or psychosis or psychotic or schizophren*) and (metacogn* or reason* or cognitive bias*) and (training or therap* or intervention)	MCT; CogPack, ND, TAU, WL	Positive symptoms, delusions, subjective acceptance of the intervention	15 (408; 399)
Liu2018	CINAHL, Cochrane Library, Joanna Briggs Institute Library, MEDLINE, PsycINFO	delusion (psychosis or psychotic or schizophrenia) and metacognitive (training or therapy or intervention)	MCT; CR+, ST, TAU, WL	Delusions	11 (352; 350)

Philipp2018	BIOSIS, CINAHL, ClinicalTrials.gov, GoogleScholar, ICRTP, ISI Web of Science, MEDLINE, Open Grey, ProQuest Dissertations, PsycINFO	(metacogniti* or "meta cogniti*" or "MCT"); metacognition AND (randomized OR effectiveness) AND (disorder OR illness) AND (therapy OR treatment) +MCT +mental -child -adolescent	MCT; CogPack, HappyNeuron, health training, ND, ST, TAU, PE, PMR, WL	Positive symptoms	19 (597; 522)
Barnicot2020	EMBASE, MEDLINE, PsycInfo	("inpatient" or "hosp*"), ("psychiatr*" or "mental"), ("psycho*" or "therap*" or "train*" or "group*" or "interven*")	MCT; CR, ND, TAU	General psychopathology, positive symptoms, relapse/re-hospitalization, social functioning, treatment compliance, JCT, delusions belief strength	3 (48; 46)
Sauvé2020	EMBASE, MEDLINE, PsycINFO	(schizophreni* OR psychosis OR psychoses OR psychotic*) AND (cogniti* OR think* OR reason*) AND (bias* OR error* OR distort* OR style)	MCT, MCT+, MCTd, MCT-T, MCT+CACR, MCT+CR, MCT-JTC; CogPack, CR, ND, ST, TAU, WL	Positive symptoms, cognitive biases, insight	25 (606; 598)
Burlingame 2020	CENTRAL, MEDLINE, PsycINFO, PsycARTICLES, PSYNDEX, Web of Science	TI (schiz* OR psychotic* OR psychos?s*) OR AB (schiz* OR psychotic* OR psychos?s* OR "negative symptom*" OR "positive symptom*") KW (schiz* OR psychotic* OR "psychos?s*" OR "negative symptom*" OR "positive symptom*"); (group next (treatment or intervention or setting or strategy or session) or group near/3 (therap* or psychotherap* or psychoanaly* or cognitive behav* therap* or CBT or training or format or exposure or program or counseling or approach or support* or "cognitive restructuring" or "cognitive technique*" or "guided imagery") or "group based" or "group focused" or "group centered" or "group	MCT; TAU, AttCG, AC	Schizophrenia outcomes, group treatment-specific outcomes, general outcomes	7 (245; 230)

		delivered" or CBGT or "group vs individual" or "group versus individual"):ti,ab,kw; (((control* or compar* or clinic*) adj3 (studies or study)) or ((treatment or intervention or studi* or study) adj2 (effectiveness or efficacy)) or random* or placebo* or assign* or allocat* or "experimental design" or trial* or dismantling or "control group$1").ti,ab,kf.			
Penney2022	CINAHL (EBSCO), Cochrane Central Register of Controlled Trials, EMBASE (Ovid), MEDLINE (Ovid), OpenGrey, ProQuest Dissertations, PsycINFO (Ovid), PubMed, Social Science Research Network eLibrary, Social Work Abstracts (Ovid), Web of Science	(schizo* or delusion* or psychosis or psychoses or psychotic* or first episode* or first-episode* or fep*) TX All Text AND (metacognitive train* or meta-cognitive train*) TI Title OR (metacognitive train* or meta-cognitive train*) AB Abstract OR (metacognitive train* or meta-cognitive train*) TX All Text; (("Schizophrenia Spectrum and Other Psychotic Disorders"[Mesh]) OR (schizo* or delusion* or psychosis or psychoses or psychotic* or first episode* or first-episode* or fep)) AND ((("metacognitive" train*) OR ("meta-cognitive" train*) OR (MCT)) AND ("2007"[Date - Publication] : "3000"[Date - Publication]))	MCT, MCT+, MCT-JTC, MCT-ToM, MCT (virtual); community-based rehabilitation, current events discussion, CR, CR+, healthy living group, ND, PE, recreational activities, SS, ST, TAU, WL	Proximal outcomes (global positive symptoms, delusions, hallucinations, cognitive biases), distal outcomes (self-esteem, negative symptoms, QOL, well-being, social and global functioning)	43 (1,272; 840)

Note. [a]The provided search strategy and search terms are similar for each of the databases of each meta-analysis, respectively; MCT(+) = Meta-cognitive training (individualized); ND = Newspaper discussion; ST = Supportive therapy; TAU = Treatment as usual; QoL = Quality of life; MCT+CBT = MCT plus cognitive behavioral therapy; MSCT = MCT plus social cognition training; MCT-JTC = MCT (target: jumping to conclusions); MCT-T = MCT (targeted); WL = Waitlist; CR(+) = Cognitive remediation therapy (individualized); PE = Psycho-education; PMR = Progressive muscle relaxation; MCTd = MCT for delusions; MCT+CACR = MCT plus computer-assisted cognitive remediation; AttCG = Attention control group; AC = Active control; MCT-ToM = MCT (target: theory of mind); SS = Social skills training.