NON-PHARMACOLOGICAL INTERVENTIONS FOR SCHIZOPHRENIA: HOW MUCH CAN BE ACHIEVED AND HOW?

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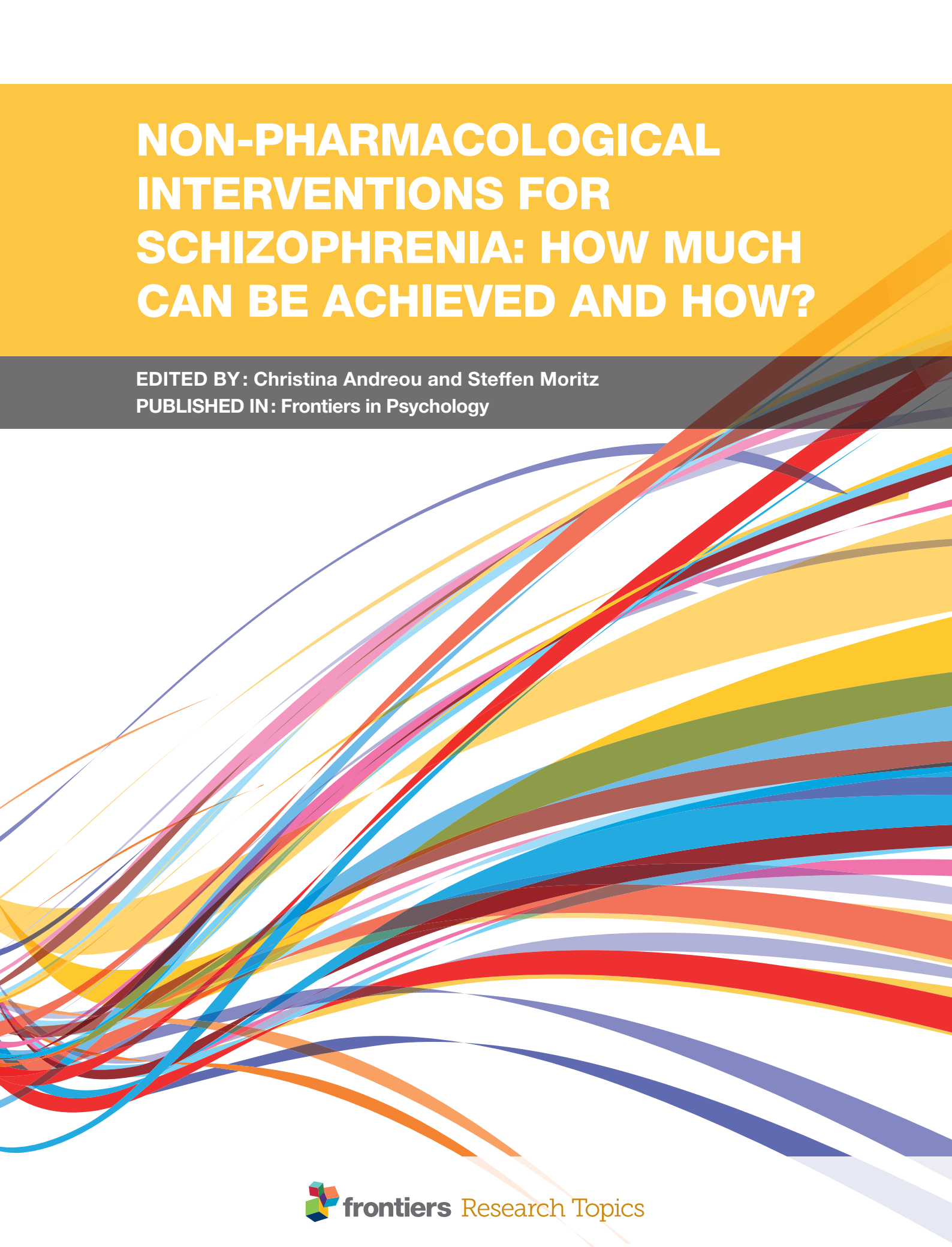

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NON-PHARMACOLOGICAL INTERVENTIONS FOR SCHIZOPHRENIA: HOW MUCH CAN BE ACHIEVED AND HOW?

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The introduction of antipsychotic agents in the 1950's substantially improved the treatment of schizophrenia and other psychotic disorders. However, clinical and functional outcomes are still far less than optimal for patients, and have not improved in recent years despite the development of several new antipsychotics. Efficacy rates are further compromised by medication non-adherence, which has been reported to affect more than half of patients. In response to these issues, several non-pharmacological interventions have been developed for the treatment of schizophrenia, such as cognitive behavioral therapy, cognitive remediation, social cognition training and metacognitive approaches.

Although these interventions have produced promising results, there is still much controversy regarding their usefulness and applicability in clinical practice. A major impeding factor for their dissemination is possibly a lack of sufficient evidence regarding their specific indications, mechanisms of action, adverse effects, but also practical issues concerning the interpretability of respective clinical studies, such as the choice of outcome variables and control of confounding factors. The present Research Topic includes original research articles and reviews addressing these issues.

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EDITORIAL
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Editorial: Non-pharmacological Interventions for Schizophrenia: How Much Can Be Achieved and How?

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The Editorial on the Research Topic

Non-pharmacological Interventions for Schizophrenia: How Much Can Be Achieved and How?

For the greatest part of the twentieth century, symptoms of schizophrenia such as delusional beliefs were considered to be "non-understandable," and attempts to explain and treat these symptoms were predominantly influenced by biological conceptualizations (Mander and Kingdon, 2015). However, insights from behavioral, cognitive and social research as well as societal influences (Mueser et al., 2013; Mander and Kingdon, 2015) have contributed to an increasing appreciation of the importance of cognitive and psychological factors in understanding and treating psychotic symptoms. At the same time, there has been growing discontent with the outcomes achieved through antipsychotic medication alone, especially in terms of functional recovery (Leucht et al., 2009; Jääskeläinen et al., 2013). This, combined with the high reported rates of medication non-adherence (Lieberman et al., 2005), has led to a major boost in the development of non-pharmacological interventions for schizophrenia.

Despite promising results, there is still much controversy regarding the usefulness and applicability of psychological interventions in clinical practice, and there is still little evidence regarding their mechanisms of action. The present Research Topic addresses these issues.

Naturally, an issue dealing with psychological interventions in schizophrenia could not do without the "heavy artillery," cognitive behavioral therapy. CBT has been one of the first non-pharmacological interventions to be included in treatment guidelines. However, there is still an ongoing debate about its efficacy (McKenna and Kingdon, 2014). Two articles in the present Research Topic contribute to this debate. Peters et al. provide evidence in favor of CBT effectiveness under routine service delivery conditions in a large sample of patients from a challenging catchment area—a very relevant finding for clinical purposes, since everyday clinical practice may differ from clinical studies in many aspects (e.g., patients with comorbidities, variability in therapist availability and/or experience). On the other hand, Mehl et al. deal with the efficacy of clinical studies on CBT for psychosis. The results of their meta-analysis indicate that CBT has a long-lasting positive effect on delusions compared to standard care, but that this effect might be significantly reduced when CBT is compared to other "active" psychological treatments. However, the authors also provide tentative evidence that theory-driven interventions according to an interventionist-causal approach may lead to improved outcomes compared to standard CBT. Thus, treatment outcomes may be improved using more focused interventions based on knowledge of the factors contributing to psychotic symptoms.

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Other papers in this issue take up this latter point as well. Three papers focus on variations of metacognitive training (MCT), one of the first interventions to address not delusions *per se*, but rather reasoning biases associated with their emergence and maintenance. Moritz et al. show that an online metacognitive intervention in the context of a cognitive training program can lead to significant changes of the most prominent biases associated with delusions. So et al. provide evidence that an very brief course of metacognitive training can have beneficial effects in patients with psychosis, and that changes in belief flexibility mediate improvement in delusions. Finally, Balzan and Galletly report on two patients refusing antipsychotic medication, in whom individualized metacognitive therapy led to symptom improvement, confirming that psychological interventions may be a viable option in this patient population (cf. Morrison et al., 2014). An interesting aspect of all three above studies is that they describe short, low-cost interventions that are well suited to address problems such as limited resources and cost considerations, which may hamper the dissemination of psychotherapy interventions (Shafran et al., 2009).

Two papers address the processes of improvement rather than determinants of symptoms: Westermann et al. deal with the therapy process and propose that a structured focus on patient motives can improve outcomes of both psychological and pharmacological interventions in patients with psychosis. Menon et al. discuss factors that may affect outcome in group CBT for psychosis and identify an important issue: Despite the wealth of clinical efficacy studies, there is still very little evidence regarding individual factors that may affect treatment success. The authors acknowledge sample size limitations as a cause for this problem and suggest possible solutions.

In reading the above articles, one could think that the factors implicated in symptoms and their improvement act independently and/or in an additive manner. However, the reader should keep in mind that different factors may dynamically interact with one another, leading to complex associations with symptoms. In a very interesting analysis, Hesse et al. confirm that self-concept is important for the development of paranoid delusions, but also show that self-concept in itself may be affected by neurocognitive deficits. Hence, cognitive remediation training might contribute to the stability of long-term symptom outcome, even though it is not thought to have a direct effect on delusions (Wykes et al., 2011). However, cognitive remediation programs themselves are being influenced by the above dynamic interaction concept, moving away from the simple 'drill-and-practice' approach: In their opinion paper, Cella et al. summarize evidence suggesting that a metacognitive focus, i.e., promoting awareness of cognitive strengths and weaknesses, boosts the efficacy of cognitive remediation by helping patients develop strategies to overcome neurocognitive deficits. Interestingly, metacognitive awareness itself may be affected by high self-esteem (Cella et al., 2014). This stresses the importance of keeping account of multiple patient characteristics during therapy, however "simple" its actual focus may be.

Several issues remain open: Many authors in this issue highlight the need to consider outcomes other than psychotic symptoms such as depression or well-being. The reader is also reminded that this Research Topic represents only a small snapshot of a fertile research field that includes a number of alternative approaches (to name but a few, see Kurtz and Richardson, 2012 for social cognitive training, Khoury et al., 2013 for mindfulness interventions, and Grácio et al., 2016 for family interventions). The optimistic take-home message is that, although there is still much work to be done in terms of achieving mainstream status, psychological interventions are not only gradually establishing themselves as effective treatments for psychotic symptoms, but are also furthering our understanding of how these symptoms occur.

AUTHOR CONTRIBUTIONS

CA, SM carried out literature reviews. CA wrote the first draft of this manuscript. SM critically reviewed the manuscript. Both authors have read and approved the final version of the manuscript.

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ORIGINAL RESEARCH
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Does Cognitive Behavior Therapy for psychosis (CBTp) show a sustainable effect on delusions? A meta-analysis

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Cognitive Behavior Therapy for psychosis (CBTp) is an effective treatment resulting in small to medium effect sizes with regard to changes in positive symptoms and psychopathology. As a consequence, CBTp is recommended by national guidelines for all patients with schizophrenia. However, although CBTp was originally developed as a means to improve delusions, meta-analyses have generally integrated effects for positive symptoms rather than for delusions. Thus, it is still an open question whether CBTp is more effective with regard to change in delusions compared to treatment as usual (TAU) and to other interventions, and whether this effect remains stable over a follow-up period. Moreover, it would be interesting to explore whether newer studies that focus on specific factors involved in the formation and maintenance of delusions (causal-interventionist approach) are more effective than the first generation of CBTp studies. A systematic search of the trial literature identified 19 RCTs that compared CBTp with TAU and/or other interventions and reported delusions as an outcome measure. Meta-analytic integration resulted in a significant small to medium effect size for CBTp in comparison to TAU at end-of-therapy ($k = 13$; $\overline{d} = 0.27$) and after an average follow-up period of 47 weeks ($k = 12$; $\overline{d} = 0.25$). When compared with other interventions, there was no significant effect of CBTp at end-of-therapy ($k = 8$; $\overline{d} = 0.16$) and after a follow-up period ($k = 5$; $\overline{d} = -0.04$). Comparison between newer studies taking a causal-interventionist approach ($k = 4$) and first-generation studies showed a difference of 0.33 in mean effect sizes in favor of newer studies at end-of-therapy. The findings suggest that CBTp is superior to TAU, but is not superior to other interventions, in bringing about a change in delusions, and that this superiority is maintained over the follow-up period. Moreover, interventions that focus on causal factors of delusions seem to be a promising approach to improving interventions for delusions.

Keywords: CBT, CBTp, delusions, paranoia, follow-up

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Introduction

Before Cognitive Behavior Therapy for psychosis (CBTp) was introduced in the early 1990s, there was much concern that targeting delusions directly was likely to make matters worse. At the root of this concern was the assumption that psychotic symptoms such as delusions are qualitatively different from normal experiences and are therefore not amenable to reason or normal mechanisms

of learning (Jaspers, 1913). Meanwhile, this view has been questioned by epidemiological studies that point to a continuum between normal and psychotic experiences (McGovern and Turkington, 2001; van Os et al., 2009) which indicates that normal reasoning could be involved in the formation and maintenance of delusional beliefs. This view, along with research on cognitive and emotional correlates of psychotic symptoms (Garety et al., 2001) has been one of the main suppositions upon which the systematic development of CBTp is based. CBTp was adapted from cognitive therapy, which was originally developed by A. T. Beck to treat depression (Beck, 2005). A characteristic aspect of CBTp compared to other psychological interventions for psychosis (e.g., psychoeducation, skill trainings etc.) is that the therapist works directly with delusional beliefs, not only by challenging the beliefs suspected of triggering and maintaining them (e.g., beliefs about the self and others) but also by questioning the delusional beliefs *per se*.

In the last 20 years, about 50 randomized controlled therapy studies (identified in a recent short review: Naeem et al., 2014) have demonstrated that CBTp is an effective adjunct to standard care. CBTp generally reduces positive symptoms, negative symptoms, general functioning and symptoms of depression (Gould et al., 2001; Rector and Beck, 2001; Zimmermann et al., 2005; Wykes et al., 2008; Sarin et al., 2011). Several national guidelines thus recommend CBTp for patients with schizophrenia in all phases of the disorder (DGPPN, 2006; NICE, 2014).

Despite the plentiful research on CBTp, the degree to which CBTp affects delusions as such has remained unclear. This is because the intervention studies generally used broader outcome measures of positive symptoms or general psychopathology as the primary outcome measure rather than delusions. Somewhat surprisingly, it was not until recently that researchers first attempted to address the question of how effective CBTp is in changing delusions as such. Van der Gaag et al. (2014) did this by analysing effects from secondary outcome measures of RCTs on CBTp. They included nine RCTs (from a total of 50 RCTs of CBTp) that had reported on change in delusions and found a significant, but small to medium effect of CBTp on delusions ($\bar{d} = 0.36$, 95%-CI: 0.08, 0.63). However, due to the fairly narrow definition of individually tailored formulation-based CBTp, several RCTs evaluating CBTp were excluded (Cather et al., 2005; Turkington et al., 2006; Garety et al., 2008; Foster et al., 2010). Moreover, follow-up data were not analyzed. Thus, it would be interesting to see whether the effect remains significant if broader inclusion criteria are used. Also, it remains open whether change in delusions is sustainable over a follow-up period.

Finally, van der Gaag et al. (2014) excluded some of the more recent studies (Foster et al., 2010) that used a quite interesting approach with regard to change in delusions: an interventionist-causal model approach (Kendler and Campbell, 2009). This approach selects one of several cognitive and emotional factors that are hypothesized to be involved in the formation and maintenance of delusions (Freeman, 2007; Garety et al., 2007; Freeman and Garety, 2014) and aims to change this factor by means of cognitive-behavioral interventions that target this factor but do not challenge the delusion itself. For example, Freeman and colleagues targeted worrying by employing several interventions: (1) psychoeducation on worry, (2) identification and reviewing of positive and negative beliefs about worry, (3) increasing awareness of individual triggers of worry, (4) planning activity at times of worry, and learning to let go of worry (Freeman et al., 2015).

Thus, this meta-analysis tests whether CBTp has any benefits in comparison to (1) standard care and (2) other psychological treatments such as supportive therapy, problem solving, and family interventions and (3) whether its effects are still present after a follow-up period. (4) Finally, it explores whether newer cognitive-behavioral interventions that take a causal-interventionist approach by focusing solely on specific factors involved in the formation and maintenance of delusions are more effective in changing delusions than the first generation of CBTp studies.

Methods

Eligibility Criteria

To be included, studies had to be: (1) randomized controlled trials assessing (2) individualized CBTp for psychosis compared to (3) treatment as usual (TAU) or other psychological interventions (such as family interventions, supportive therapy, problem solving) in (4) patients with a psychotic disorder (at least 75% of the sample), be (5) published in peer-reviewed journals and report (6) on change in delusions using a reliable scale. (7) We excluded studies focusing on a specific subgroup of patients such as those with a comorbid substance disorder. CBTp was defined according to the criteria of the National Institute of Health and Clinical Excellence (NICE, 2014): (1) links are established between patients thoughts, feelings or actions and their current or past symptoms and functioning, (2) patient perceptions, beliefs or reasoning are reevaluated in relation to target symptoms. TAU or standard care included regular outpatient appointments with psychiatrists and prescription of medication. In contrast, supportive therapy included weekly sessions with a therapist who used basic therapeutic skills such as listening, reflecting, empathizing, and summarizing.

Information Sources and Search

Relevant studies were identified by an electronic literature search using five databases: MEDLINE, EMBASE, Cochrane Central Register of Controlled Trials, PsycINFO, and PsycLIT from 1987 to 21st January 2015 in the English or German languages. Published meta-analyses and reviews were also searched.

We conducted three different searches that were combined later. First, we searched the databases on the terms "CBT" OR "cognitive therapy" OR "cognitive behavioural therapy" OR "cognitive behavior therapy" OR "cognitive behaviour therapy" OR "cognitive behavior therapy." Second, we searched the databases on "psychosis" OR "psychotic symptoms" OR "schizophreni*" OR "paranoi*." Third, we investigated the terms "RCT" OR "randomized controlled trial" OR "randomised controlled trial." Then, we combined all three searches, using the operator AND, which yielded 1598 studies. Removing duplicates

resulted in 816 studies (see flow chart depicted on **Figure 1**). Of these, 774 could be excluded beyond doubt after reading the title, leaving 42 studies. The search of existing meta-analyses identified three further studies. The remaining 45 studies were read by the first author and a Master's student of clinical psychology. Of these, 19 studies fulfilled our inclusion criteria and were ultimately included.

Statistical Analysis

Study characteristics and the appropriate statistics to calculate effect sizes were independently coded by the first and second authors. Statistical analyses were carried out in *R* (Version 3.1.2) using the meta-analysis package metafor (Version 1.9-5). We calculated the bias-corrected standardized mean difference *(d)* on all delusion-related outcomes for every treatment-control group comparison using the pooled standard deviation as the standardizer (Hedges and Olkin, 1985). A positive sign for *d* indicates that the CBTp group was better off after treatment compared to the control condition. If a study reported results for subscales or for more than one delusion-related outcome, we calculated a single composite effect size for each study to be able to analyze stochastically independent effect size estimates. Effect sizes were calculated on the basis of pretest data, posttest data, and at follow-up if appropriate statistics were available. We used end-of-treatment statistics (controlled for the smaller number of patients at follow-up) for one study that reported that there were "no significant differences" between end-of-treatment and follow-up scores but did not report the scores (Pinninti et al., 2010). Whenever a study reported more than one follow-up measurement, we calculated the effect size for the final measurement in order to estimate the long-term effects of treatment.

We did not assume that all included studies share a common effect size, because the studies obviously differ in various ways (e.g., duration of treatment, format of therapy, experience of therapists, patient population). To allow for variation in true effect sizes (δ_i) we fitted a random-effects model to the data and estimated the amount of heterogeneity with restricted maximum-likelihood estimation (Raudenbush, 2009).

We conducted two meta-analyses: one of all available comparisons of CBTp vs. TAU and one of all available comparisons of CBTp vs. other psychological interventions. For each analysis we report the estimated mean population effect size ($\widehat{\mu}_\delta$ subsequently denoted as $\overline{d}$), the *p*-value for the test H0: $\mu\delta = 0$, the estimated variance of the true effect sizes ($\widehat{\tau}^2$), the results for the Q-test for heterogeneity with a *p*-value for the test H0: $\tau^2 = 0$. As the number of included studies might be quite small and the Q-test might have low statistical power in order to test for heterogeneity, we also reported an I^2-statistic to estimate the percentage of observed variation in effect sizes that is due to hetereogeneity, as recommended by Deeks et al. (2008). In order to compare newer studies that used a causal-interventionist approach with first-generation CBTp studies, we performed a subgroup analysis and calculated the mean effect size at end-of-treatment for (a) the studies that used the causal-interventionist approach and (b) for all other studies. Then we calculated the difference between both mean effect sizes. In addition, 95% confidence intervals were calculated for all above-mentioned statistics.

We investigated the possibility of publication bias with funnel-plots and regression-tests (Sterne and Egger, 2005). We used a trim-and-fill analysis (Duval, 2005) to investigate the impact of missing studies on the overall results.

Results

Descriptive Information on Included Studies

Fourteen studies were identified that compared CBTp with TAU (see flow-chart on **Figure 1** and **Table 1** for more information on the studies) and eight studies that compared CBTp with other psychological interventions. Three studies (Lewis et al., 2002; Durham et al., 2003; Garety et al., 2008) reported results for one CBTp and two control conditions and were included in both meta-analyses.

Most studies ($n = 18$) used observer-rated assessments of delusions such as the Psychotic Symptom Rating Scale ($k = 17$; PSYRATS: Haddock et al., 1999a) or the Maudsley Assessment of Delusions Scale ($k = 1$; MADS: Wessely et al., 1993). Only one of these studies did not use single-blind assessment (Foster et al., 2010) and only one study (Lincoln et al., 2012) used a self-report measure (Peters et al. Delusions Inventory: Peters et al., 1999). Most studies ($k = 12$) selectively included patients with delusions (Tarrier et al., 1993; Lewis et al., 2002; Durham et al., 2003; Valmaggia et al., 2005; O'Connor et al., 2007; Haddock et al., 2009; Foster et al., 2010; Kråkvik et al., 2013; Freeman et al., 2014, 2015; Morrison et al., 2014; Waller et al., 2015), but only one of these studies predefined change in delusions as the primary outcome (Waller et al., 2015).

Of the 14 studies that compared CBTp and TAU, most studies (Tarrier et al., 1993; Lewis et al., 2002; Durham et al., 2003; Garety et al., 2008; Haddock et al., 2009; Pinninti et al., 2010; Lincoln et al., 2012; Kråkvik et al., 2013; Morrison et al., 2014) used traditional CBTp based on established manuals (Kingdon and Turkington, 1994; Fowler et al., 1995; Chadwick et al., 1996; Lincoln, 2006). One study used a brief and more "technical" version of CBTp administered by trained nurses (Turkington et al., 2006), another used a culturally-adapted version of CBTp in a population of migrants (Rathod et al., 2013). Two studies assessed the effectiveness of CBTp in other specific populations, namely patients who refused to take antipsychotic medication (Morrison et al., 2014) and patients who reported suicide attempts or current suicidal ideation (Tarrier et al., 2014). Four studies used an interventionist causal model approach and focused on cognitive or emotional factors involved in the formation and maintenance of persecutory delusions: negative self-evaluations (Freeman et al., 2014), worrying (Foster et al., 2010; Freeman et al., 2015), and reasoning biases (Waller et al., 2015).

Patients received between 4 and 29 therapy sessions, the mean number of sessions was 14.8 ($SD = 8.3$ sessions) and the duration of treatment varied between 4 and 39 weeks with a mean duration of 19.9 weeks ($SD = 14.7$ weeks). Most of the studies ($k = 13$) reported results at *end-of-therapy*. One study was only included

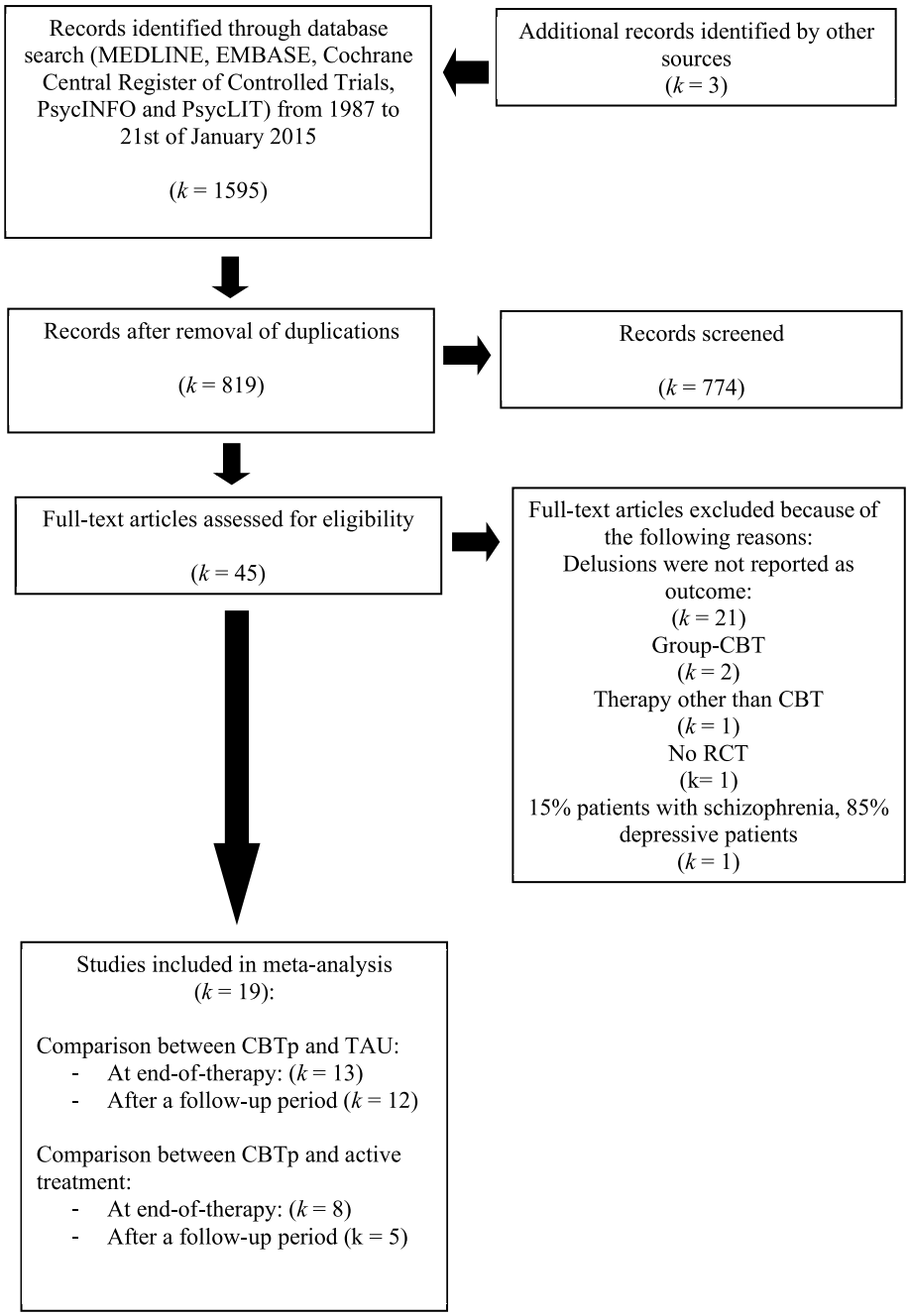

FIGURE 1 | Flow chart of selected studies.

in comparisons after a *follow-up* period, as findings at *end-of-therapy* were not reported (Turkington et al., 2006). Two studies used a wait-list group that later received CBTp (Lincoln et al., 2012; Kråkvik et al., 2013). As they did no longer use a controlled design at *follow-up*, their results were not included in *follow-up* analysis. In sum, 12 studies were included in the comparison between CBTp and TAU after an average *follow-up* period of 46.8 weeks ($SD = 58.5$ weeks).

All studies that were included in comparisons between CBTp and other psychological interventions ($k = 8$) used traditional CBTp (Tarrier et al., 1993; Lewis et al., 2002; Durham et al., 2003; Cather et al., 2005; Valmaggia et al., 2005; O'Connor et al., 2007; Garety et al., 2008; Haddock et al., 2009) based on established manuals (Kingdon and Turkington, 1994; Fowler et al., 1995; Chadwick et al., 1996; Nelson, 1997; Haddock et al., 2004; Morrison et al., 2004) (see **Table 1** and **Figure 1**

TABLE 1 | Studies included in the comparison of CBTp vs. TAU and CBTp vs. other psychological interventions: description of the intervention, patient characteristics and outcome measure.

Author and Year	Subject characteristics: Experimental Condition (EC), Control Condition I (C 1) Control Condition II (CC II)	Experimental condition (EC) CBT format patients	Control condition I (CC I) format patients	Control condition II (CC II)	Duration of intervention EC/CC I/ CC II	Total no. of sessions, Mean number of sessions, EC/CC I/CC II	Selected outcome measure	Blind assess-ment?	ITT-data?	Follow-up
Cather et al., 2005	Number of randomized patients: $n = 28$, Diagnoses: 17 SZ; 11 SA, Age: EC: $M = 45.8$ ($SD = 10.2$) CCI: $M = 33.1$ ($SD = 10.3$), Medication: EC: 100%/CCI: 100%	Functional CBT, Based on established manuals (Kingdon and Turkington, 1994; Fowler et al., 1995; Chadwick et al., 1996; Nelson, 1997), Number of randomized patients: $n = 15$	Psychoeducation, Number of randomized patients: ($n = 15$)		16/16 weeks	Total number of sessions: 16/16[6]	PSYRATS del.	Yes	No	–
Durham et al., 2003	Number of randomized patients $n = 66$, Diagnoses: 59 SZ; 5 SA; 2 DD, Age: EC: $M = 36$ ($SD = 10.0$)/CCI: $M = 36$ ($SD = 10.2$)/CC II: $M = 37$ ($SD = 11.2$), Medication: EC: 100%/CC I: 86%	CBT, Best practice based on established manuals (Tarrier, 1992; Kingdon and Turkington, 1994), Number of randomized patients: $n = 22$	TAU, Number of randomized patients: $n = 21$	Supportive therapy, Number of randomized patients: $n = 23$	39 weeks/–/22 weeks	Total number of sessions: EC: 20/–/CC II: 20, Mean number of sessions: EC: 14.8, /–/CC II: 16.8, $D_{sessions} = -2.0$	PSYRATS del.	Yes	No	52 weeks
Foster et al., 2010	Number of randomized patients $n = 24$, Diagnoses: SZ, SA, and DD[1], Age: EC: 40.0 (10.5)/CC I: 39.1 (9.2), Medication: EC: 92%/CCI: 83%	Worry-CBT, Fixed sessions based on a manual (Wells, 1997), Number of randomized patients: $n = 12$	TAU, Number of randomized patients: $n = 12$		4 weeks/–	Total number of sessions: 4/–	PSYRATS del.	No	No	9 weeks
Freeman et al., 2015	Number of randomized patients: $n = 150$, Diagnoses: 111 SZ; 11 SA; 10 DD; 18 POS, Age: EC: 40.9 (10.5)/CC I: 42.1 (13.1), Medication: 94%[3]	Worry-CBT, Based on self-help manual, (Freeman and Freeman, 2013), Number of randomized patients: $n = 73$	TAU, Number of randomized patients: $n = 77$	–	8 weeks/–	Total number of sessions: 6/–, Mean number of sessions: EC: 5.5	PSYRATS del.	Yes	No	24 weeks
Freeman et al., 2014	Number of randomized patients: $n = 30$, Diagnoses: 22 SZ; 6 SA; 1 DD; 1 POS, Age: EC: 41.9 (11.5)/CC I: 41.5 (13.1), Medication: EC: 100%/CC I: 100%	Brief CBT, Based on self-help manual (Freeman and Freeman, 2012), Number of randomized patients: $n = 15$	TAU, Number of randomized patients: $n = 15$		8 weeks/–	Total number of sessions: 6/–, Mean number of session: EC: 6.67/–	PSYRATS del.	Yes	No	12 weeks

(Continued)

TABLE 1 | Continued

Author and Year	Subject characteristics: Experimental Condition (EC), Control Condition I (C 1) Control Condition II (CC II)	Experimental condition (EC) CBT format patients	Control condition I (CC I) format patients	Control condition II (CC II)	Duration of intervention EC/CC I/ CC II	Total no. of sessions, Mean number of sessions, EC/CC I/CC II	Selected outcome measure	Blind assess-ment?	ITT-data?	Follow-up
Garety et al., 2008	Number of randomized patients: $n = 328$, Diagnoses: 258 SZ; 38 SA; 5 DD, Age: n.r., Medication: n.r.	CBT (carer + no-carer), Based on an established manual (Fowler et al., 1995), Number of randomized patients: $n = 133$	TAU, Number of randomized patients (carer + no-carer): $n = 140$	Family intervention, Number of randomized patients: $n = 28$	39 weeks	Total number of sessions: 20/–, Mean number of sessions: EC: 14.3/–/CC II: 13.9, $D_{sessions} = 0.4$	PSYRATS del., conviction and delusion distress	Yes	No	52 weeks
Haddock et al., 2009	Number of randomized patients: $n = 77$, Diagnoses: 69 SZ; 7 SA; 1 POS, Age: EC: 35.7 (12.5)/CC I: 33.9 (9.7), Medication: EC: 100%/CC I: 100%	CBT, Based on an established manual (Haddock et al., 2004), Number of randomized patients: $n = 38$	Social activity therapy, Number of randomized patients: $n = 38$		26 weeks	Total number of sessions: 25, Mean number of sessions: EC: 13.13/CC I: 14.9, $D_{sessions} = -1.77$	PSYRATS del.	Yes	No	24 weeks
Kråkvik et al., 2013	Number of randomized patients: $n = 55$, Diagnoses: 34 SZ/2 SA/9 DD, Age: EC: 37.5 (11.2)/CC I: 35.3 (8.9), Medication: EC: 100%/CC I: 100%	CBT, Simplified version of an established manual (Chadwick et al., 1996), Number of randomized patients: $n = 23$	TAU[2],Number of randomized patients: $n = 22$	–	26 weeks	Total number of sessions: 20	PSYRATS cognitive and emotional	Yes	Yes	52 weeks[2]
Lewis et al., 2002	Number of randomized patients: $n = 309$, Diagnoses: 123 SZ; 109 SFD; 39 SA; 25 DD; 13 POS, Age: EC: 29.1/CC I: 27.0/CC II: 27.2[4], Medication: EC: 100%/CC I: 100%/CC II: 100%	CBT, Based on an established manual (Haddock et al., 1999b), Number of randomized patients: $n = 101$	TAU, Number of randomized patients: $n = 102$	Supportive counseling Number of randomized patients: $n = 106$	5 weeks	Total number of sessions: 20, Mean number of sessions: EC: 16.1/–/CC II: 15.7, $D_{sessions} = -0.4$	PSYRATS del.	Yes	No	67 weeks
Lincoln et al., 2012	Number of randomized patients: $n = 80$, Diagnoses: 58 SZ; 13 SA; 5 DD; 4 APD, Age: EC: 33.2 (10.4)/CC I: 33.1 (10.9), Medication: EC: 100%/CC I: 97%	CBTp, Based on an established German manual (Lincoln, 2006), Number of randomized patients: $n = 40$	TAU[2], Number of randomized patients: $n = 40$	–	38 weeks	No fixed number of sessions. Mean number of sessions EC: 29/–	PDI distress, preoccupation, conviction	Yes	Yes	52 weeks[2]

(Continued)

TABLE 1 | Continued

Author and Year	Subject characteristics: Experimental Condition (EC), Control Condition I (C 1) Control Condition II (CC II)	Experimental condition (EC) CBT format patients	Control condition I (CC I) format patients	Control condition II (CC II)	Duration of intervention EC/CC I/ CC II	Total no. of sessions, Mean number of sessions, EC/CC I/CC II	Selected outcome measure	Blind assess-ment?	ITT-data?	Follow-up
Morrison et al., 2014	Number of randomized patients: $n = 74$, Diagnoses: SZ, SA, and DD[1], Age: EC: 33.0 (13.1)/CC I: 29.7 (11.9), Medication: EC: 0%/CC I: 0%	CBTp, Based on established manuals (Morrison et al., 2004; Kingdon and Turkington, 2005), Number of randomized patients: $n = 37$	TAU, Number of randomized patients: $n = 37$	–	39 weeks	Total number of sessions: 26, Mean number of sessions: EC: 13.3/–	PSYRATS cognitive and emotional	Yes	No	19 weeks
O'Connor et al., 2007	Number of randomized patients: $n = 24$, Diagnoses: 24 DD, Age: EC: 40.0 (9.4)/CC I: 36.8 (13.5), Medication: EC: 100%/CC I: 100%	CBTp, Based on established manuals (Fowler et al., 1995; Chadwick et al., 1996), Number of randomized patients: $n = 12$	Attention placebo control, Number of randomized patients: $n = 12$	–	24 weeks	Total number of sessions: 24	MADS	No	No	–
Pinninti et al., 2010	Number of randomized patients: $n = 33$, Diagnoses: 11 SZ; 22 SA, Age: 40.0 (11.0)[3], Medication: EC: 100%/CC I: 100%	CBTp, Not manualized, Number of randomized patients: $n = 18$	TAU, Number of randomized patients: $n = 15$	–	12 weeks	Total number of sessions: 12, Mean number of sessions EC: 11.9/–	PSYRATS del.	Yes	No	24 weeks
Rathod et al., 2013	Number of randomized patients $n = 35$, Diagnoses: SZ, SA, and DD[1], Age: EC: 31.4 (12.3)/CC I: 35.6 (10.7), Medication: EC: 100%/CC I: 100%	Culturally adapted CBTp Based on a study protocol (Rathod et al., 2010), Number of randomized patients: $n = 17$	TAU, Number of randomized patients: $n = 18$	–	18 weeks	Total number of sessions: 16, Mean number of sessions: EC: 13.6/–	CPRS del.	Yes	Yes	26 weeks
Tarrier et al., 1993	Number of randomized patients: $n = 27$, Diagnoses: 307 SZ, Age: EC: 42.8 (12.3)/CC I: 42.8 (12.3), Medication: EC: 100%/CC I: 100%	Coping strategy enhancement, Based on an established manual (Tarrier, 1992), Number of randomized patients: $n = 15$	Problem solving, Number of randomized patients: $n = 12$	–	5 weeks	Total number of sessions: 10	PAS delusions	No	No	31 weeks
Tarrier et al., 2014	Number of randomized patients $n = 49$, Diagnoses: SZ, SA, DD, POS[1], Age: EC: 32.6 (11.7)/CC I: 37.3 (14.2), Medication: EC: 100%/CC I: 100%	CBT for suicidal patients, Based on a manual (Tarrier et al., 2013), Number of randomized patients: $n = 25$	TAU, Number of randomized patients: $n = 24$	–	12 weeks	Total number of sessions: 24	PSYRATS del.	Yes	No	17 weeks

(Continued)

TABLE 1 | Continued

Author and Year	Subject characteristics: Experimental Condition (EC), Control Condition I (C 1) Control Condition II (CC II)	Experimental condition (EC) CBT format patients	Control condition I (CC I) format patients	Control condition II (CC II)	Duration of intervention EC/CC I/ CC II	Total no. of sessions, Mean number of sessions, EC/CC I/CC II	Selected outcome measure	Blind assess-ment?	ITT-data?	Follow-up
Turkington et al., 2006	Number of randomized patients: $n = 422$, Diagnoses: 422 SZ, Age: n. r., Medication: EC: 100%/CC I: 100%	CBTp, Based on established manuals (Kingdon and Turkington, 1994, 2005), Number of randomized patients: $n = 281$	TAU[2], Number of randomized patients: $n = 141$	–	10.5 weeks	Total number of sessions: Mean number of sessions: EC: 6 /–	PSYRATS del.	Yes	No	52 weeks
Valmaggia et al., 2005	Number of randomized patients: $n = 62$, Diagnoses: 62 SZ, Age: EC: 35.4 (10.5)/CC I: 35.5 (11.4), Medication: EC: 100%/CC I: 100%	CBTp, Based on an established manual (Kingdon and Turkington, 1994), Number of randomized patients: $n = 36$	Supportive counseling, Number of randomized patients: $n = 26$	–	22 weeks	Total number of sessions: 16	PSYRATS cognitive and emotional scale	Yes	Yes	48 weeks
Waller et al., 2015	Number of randomized patients: $n = 31$, Diagnoses: 27 SZ, 2 SA, 2 DD, Age: EC: 39.1 (10.5)/CC I: 43.0 (10.7), Medication: EC: 90%/CC I: 91%	Focused CBT, Sessions described in the study, Number of randomized patients: $n = 20$	TAU, Number of randomized patients: $n = 11$	–	6 weeks	Total number of sessions: 4	PSYRATS del.	Yes	Yes	8 weeks

M, Mean; SD, Standard deviation; TAU, Treatment as Usual; EC, Experimental condition; CCI, Control condition I; CCII, Control condition II; SZ, Schizophrenia; SA, Schizoaffective Disorder; DD, Delusional disorder; APD, Acute psychotic disorder; POS, Psychosis not otherwise specified; SFD, Schizophreniform disorder; Medication, percentage of patients treated with antipsychotic medication. PSYRATS del., PSYRATS delusions score; CPRS, Comprehensive Psychopathology Rating Scale; PAS, Psychiatric Assessment Scale; n.r., not reported; $D_{sessions}$, Mean number of CBT sessions—Mean number of other therapy sessions; [1]no information on diagnosis ratio; [2]study was not included in follow-up comparison betweeen CBTp and TAU, as the study used a wait-list design and comparisons between CBTp and TAU are not possible at follow-up assessment; [3]variable was only reported for all patients [4]SD was not reported.

for more information on the studies). One study assessed the effectiveness of CBTp in patients with a history of violence (Haddock et al., 2009). Four of the studies compared CBTp with a therapy placebo such as supportive counseling/therapy (Lewis et al., 2002; Durham et al., 2003; Valmaggia et al., 2005) or attention placebo (O'Connor et al., 2007). Other studies used psychoeducation (Cather et al., 2005), problem solving (Tarrier et al., 1993), family intervention (Garety et al., 2008) and social activity therapy (Haddock et al., 2009). Patients received between 10 and 25 sessions of treatment. Average number of sessions was 16.81 ($SD = 5.5$). The average duration of treatment was 22 weeks ($SD = 13.2$ weeks). Only five studies (Lewis et al., 2002; Durham et al., 2003; Valmaggia et al., 2005; Garety et al., 2008; Haddock et al., 2009) reported comparisons between CBTp and other psychological interventions after a follow-up period with the average follow-up period being 34.4 weeks ($SD = 23.0$ weeks).

Comparisons of CBTp and Treatment as Usual (TAU)

Results of the comparisons between CBTp vs. TAU ($k = 13$ studies) at *end-of-therapy* are depicted in **Figure 2** in form of a forest plot. The estimated mean effect size of CBTp was small to medium ($\overline{d} = 0.27$, $SE = 0.10$, $p = 0.005$) with a 95% confidence interval ranging from 0.08 to 0.47. The estimator of the between-study variance revealed an estimate of $\widehat{\tau}^2 = 0.05$ (95% CI: 0.00 to 0.32), the Q-statistic was non-significant ($Q = 20.46$, $df = 12$, $p = 0.059$). The small to medium value of $I^2 = 42.1\%$ indicates that approximately 42% of the observed variance in effect sizes might be due to heterogeneity. However, one study (Kråkvik et al., 2013) had an especially large influence on the amount of observed heterogeneity. If we exclude this study, the proportion of observed variance due to real differences in effect sizes drops to approximately 12% ($I^2 = 11{,}7\%$).

An inspection of the funnel plot (see **Figure 3**) gives the impression of a tendency toward higher effect sizes for studies with a smaller sample size. The regression test for funnel plot asymmetry at *end-of-therapy* was significant ($p = 0.017$). Results of a trim and fill analysis suggest that there may be four unpublished studies on the left side of the funnel plot (see **Figure 3**). Including these studies in a meta-analysis would reduce the mean effect size to $\overline{d} = 0.14$ ($SE = 0.12$).

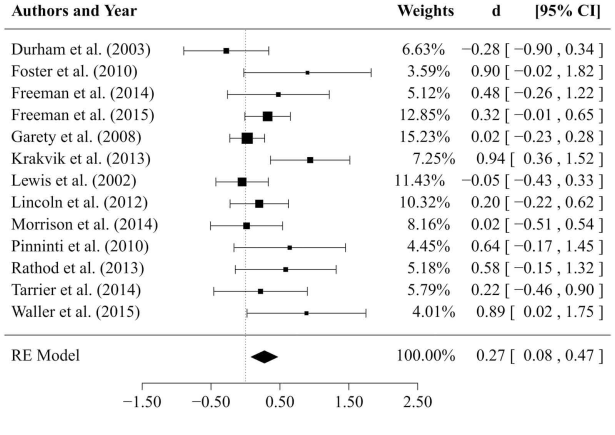

FIGURE 2 | Forest plot of effect sizes for the comparison between CBTp and treatment as usual (TAU) at end-of-therapy.

Results of comparisons of CBTp vs. TAU ($k = 12$ studies) after an average *follow-up period* of 47 weeks are depicted in **Figure 4**. The estimate for the mean effect size of CBTp compared to TAU was small to medium ($\overline{d} = 0.25$, $SE = 0.09$, $p = 0.006$, 95%-CI: 0.07, 0.43). The between-study variance was $\widehat{\tau}^2 = 0.03$ (95%-CI: 0.00, 0.17), and the Q-statistic ($Q = 17.49$, $df = 11$, $p = 0.094$) was non-significant. The value of $I^2 = 36.7\%$ indicated a small to medium level of heterogeneity. The regression test for funnel plot assymetry revealed a statistically non-significant result ($p = 0.80$), thus, there was no indication of a bias. Finally, we tested whether the results of both comparisions would change if we exclude two studies that assessed specific subpopulations: patients who did not use medication (Morrison et al., 2014) and suicidal patients (Tarrier et al., 2014). However, exclusion of these studies revealed comparable mean effect sizes (CBTp vs TAU at end-of-treatment: $\overline{d} = 0.32$; CBTp vs. TAU at follow-up: $\overline{d} = 0.22$).

Comparisons of CBTp and Other Psychological Interventions

The comparisons between CBTp and other psychological interventions at *end-of-therapy* ($k = 8$ studies, depicted in **Figure 5**) revealed an estimated mean effect size that is small and non-significant ($\overline{d} = 0.16$, $SE = 0.14$, $p = 0.28$: 95%-CI:–0.13, 0.44). The estimator of the between-study variance was $\widehat{\tau}^2 = 0.07$ (95%-CI: 0.00, 0.54). The Q-statistic was non-significant ($Q = 11.69$, $df = 7$, $p = 0.111$). The value of $I^2 = 42.1\%$ indicated a small to medium degree of heterogeneity.

Results of comparisons of CBTp vs. psychological interventions ($k = 5$) after an average *follow-up* period of 34.3 weeks are depicted in **Figure 6**. The estimate for the mean effect size was non-significant ($\overline{d} = -0.04$, $SE = 0.11$, $p = 0.687$, 95%-CI:–0.26; 0.17). The estimated between-study variance was zero ($\widehat{\tau}^2 = 0.00$, 95%-CI: 0.00, 0.15) as was the I^2-statistic.

Comparison of Studies that used a Causal-interventionist Approach and First-generation CBTp Studies at End-of-therapy

In order to select newer CBTp studies, the first and the last author independently selected studies that stated in their introduction that they "used a causal-interventionist approach" or that they focused on "factors that are causally involved in the formation and maintenance of delusions." Both consistently selected four studies, two of which focused on worrying (Foster et al., 2010; Freeman et al., 2015), one of which focused on self-esteem (Freeman et al., 2014) and one of which focused on reasoning biases (Waller et al., 2015). These studies were compared with all other studies that compared CBTp with standard treatment at *end-of-therapy* ($k = 9$: Lewis et al., 2002; Durham et al., 2003; Garety et al., 2008; Pinninti et al., 2010; Lincoln et al., 2012; Kråkvik et al., 2013; Rathod et al., 2013; Morrison et al., 2014; Tarrier et al., 2014). Results suggest a difference of 0.33 in mean effect sizes (95%-CI for the difference: −0.10, 0.75) in favor of the four studies focusing on causal factors ($\overline{d} = 0.51$, $SE = 0.19$,

$p = 0.006$), compared to all other studies ($\overline{d} = 0.18$, $SE = 0.11$, $p = 0.090$), using an estimated between-study variance $\widehat{\tau}^2 = 0.04$ within each group.

Discussion

First, our results suggest that CBTp is more beneficial in changing delusions than standard treatment and that this effect remains stable after an average follow-up period of more than half a year. Compared to other psychological interventions, CBTp did not prove to be better at changing delusions, neither at end-of-treatment, nor after a follow-up period. However, more recent studies that focused on factors that are hypothetically involved in the formation and maintenance of delusions rather than on the delusions *per se*, produced a numerically larger effect size of moderate magnitude compared to first-generation CBTp studies.

With regard to comparisons between CBTp and standard treatment at end-of-therapy, our results are consistent with the large body of meta-analytic research which finds small to medium effect sizes for positive symptoms (Lincoln et al., 2008; Wykes et al., 2008; Sarin et al., 2011; Jauhar et al., 2014). Moreover, our results are comparable with the recent meta-analysis by van der Gaag et al. (2014) that focused on change in delusions in individually-tailored formulation-based CBTp. However, they reported a slightly higher estimated effect size (k=9; ; $\overline{d} = 0.36$, 95%-CI: 0.08, 0.63) which seems to be the result of using a smaller pool of studies. The broader selection of studies in our meta-analysis produced a slightly smaller effect size; this effect size had a smaller confidence interval ($\overline{d} = 0.27$, 95%-CI: 0.08, 0.47). Thus, the broader inclusion criteria we used lead to a slightly smaller, but also to a more precise estimation of the mean effect size of change in delusions at *end-of-therapy*. Moreover, we also investigated the stability of the effects and are the first to report a small to medium effect of CBTp on delusions after a follow-up period of 45 weeks.

It is important to note that we found a small to medium amount of variance that is due to heterogeneity between the studies (about 42%). This variance is largely due to the study by Kråkvik et al. (2013). This study included patients with both auditory hallucinations and delusions and produced a quite large effect size ($\overline{d} = 0.94$), which might also have been influenced by difficulties in maintaining the blinding procedure.

Our results seem to suggest a slightly higher effect size in smaller studies (see **Figure 3**). This could be due to higher motivation, engagement and team-work of therapists, more intense training, more available supervision, and fewer communication problems between researchers in smaller studies. However, a publication/reporting bias could not be ruled out. Indeed, it seems unlikely that only 19 RCTs (included in our meta-analyses) from the pool of 50 RCTs on CBTp assessed change in delusions as a secondary outcome. When having to select findings from a complex study for a publication with limited space, statistically non-significant results will probably not have the highest priority. However, in general it is difficult to distinguish bias from genuine heterogeneity in meta-analyses (Ioannidis, 2005).

It is also important to take into account that the analyses are based on mostly secondary outcome measures and effect size estimates are based on small samples resulting in low statistical power for most analyses. Further methodically rigorous studies are necessary to achieve reliable effect-size estimates.

As in the former meta-analysis by van der Gaag et al. (2014), we did not find a significant effect of CBTp compared to other psychological interventions. Consequently, we found no evidence of an advantage of CBTp compared to other interventions after an average follow-up period of 35 weeks. This could be interpreted as meaning that CBTp is not superior to other therapies such as supportive therapy, social activity therapy, problem solving or family interventions. Another explanation is that the general effect of CBTp on delusions is relatively small, making it difficult to detect an advantage of CBTp over other effective treatments, especially ones that also involve cognitive behavioral elements, such as family interventions, problem solving or social activity therapy. We may possibly have detected

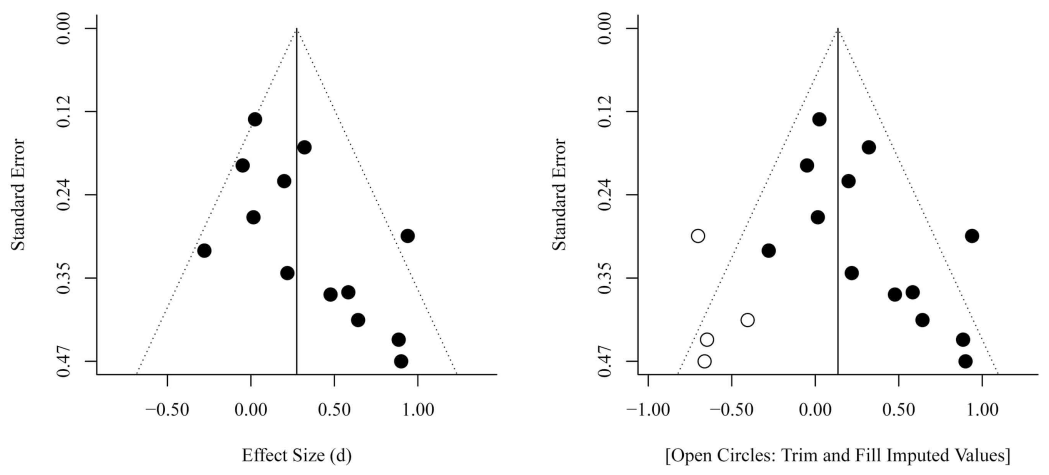

FIGURE 3 | Funnel Plots for the comparison between CBTp and treatment as usual (TAU) at end-of-therapy.

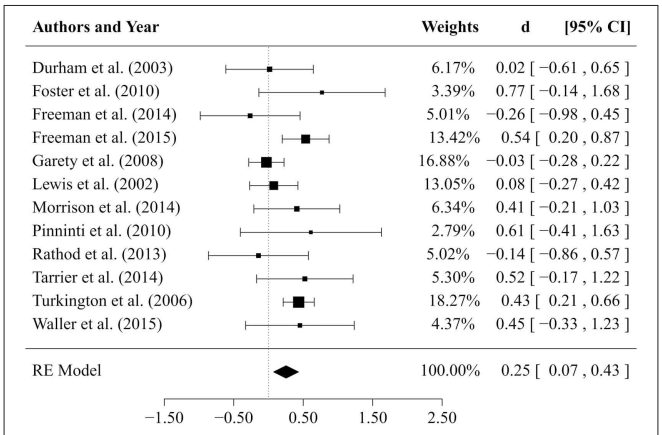

FIGURE 4 | Results of comparison between CBTp and treatment as usual (TAU) after a follow-up period of 47 weeks.

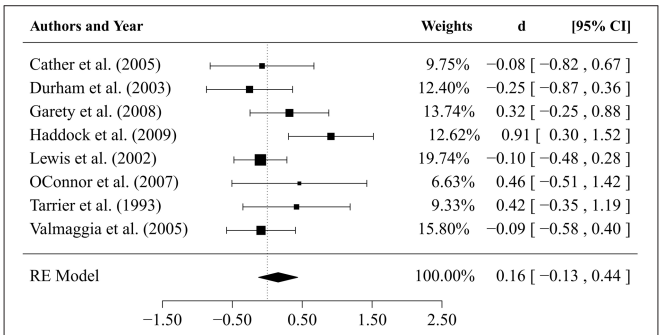

FIGURE 5 | Results of comparisons between CBTp and other psychological interventions at end-of therapy.

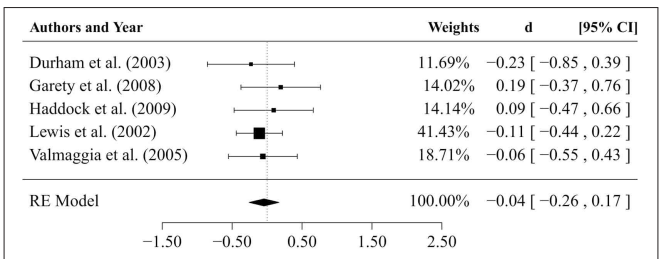

FIGURE 6 | Results of the comparison between CBTp and other psychological interventions after a follow-up period of 35 weeks.

a slightly larger effect size if we had analyzed a larger number of studies that compared CBTp solely with placebo therapies such as supportive therapy/counseling (Lewis et al., 2002; Durham et al., 2003; Valmaggia et al., 2005) or attention placebo control (O'Connor et al., 2007). However, this was not possible given the small number of studies.

As stated above, our preliminary findings suggest a trend toward a small advantage of recent RCTs that tested a causal-interventionist approach. These studies targeted delusions specifically by focusing on factors that are hypothetically involved in the formation and maintenance of delusions compared to the first-generation CBTp approach that focuses on delusions in a more direct manner. This comparison is based on a small number of studies and the effect difference in favor of the causal-interventionist approach should be interpreted with caution. However, it is interesting to note that the causal-interventionist studies were also much shorter (requiring an average number of five sessions) than the first-generation CBTp studies, that required an average of 25 sessions. It is possible, on the one hand, that the focus on causal factors of delusions might be more beneficial than working on the delusions *per se*. On the other hand, it is also likely that shorter and more focused interventions have a positive effect because both the therapist and the patient have only a short amount of time to achieve an improvement and are thus particularly motivated and focused on the aims of the therapy. Nevertheless, it is important to note that these interventions focused specifically on delusions, whereas the first-generation CBTp studies took a broader approach, which explains why their effect sizes for the broader outcome measures such as positive symptoms or psychopathology in general tend to be numerically higher (Turner et al., 2013) than those we found for delusions in this analysis. Again, more methodologically rigorous RCTs are needed that can help us to answer these questions.

Strengths of the present study are the broader inclusion criteria resulting in inclusion of more studies and smaller confidence intervals, the focus of the study on sustainability of CBTp over a follow-up period, and the use of several statistical techniques to assess the possible influence of publication bias. Limitations are the still small number of studies that reported results on change in delusions (19 studies compared to 50 RCTs assessing the effectiveness of CBTp in schizophrenia) and the small number of studies assessing effectiveness of CBTp compared to other psychological interventions (eight studies) that resulted in low statistical power (Hedges and Pigott, 2001). In addition, one has to be aware that some comparisons in the primary studies differed in the mean number of sessions that the CBTp group received compared to the control group. However, on average, patients were offered more sessions in the comparison interventions and treatment intensity did not affect the considered outcome measures, as clarified by an explorative meta-regression.

With respect to the small number of available RCTs addressing delusions, one therefore has to be aware that the estimated mean effect size might change in a future meta-analysis after the inclusion of a small number of new studies. Moreover, it is still unknown whether patients with severe delusions are not able to participate in CBTp, as suggested by a more severe drop-out rate among them (Lincoln et al., 2012). In future studies it would be interesting to compare drop-out samples with patients who completed therapy and to ask patients who refused the treatment for their personal reasons.

To sum up, our results suggest that CBTp is superior to TAU in regard to changing delusions and that this superiority is maintained over the course of the follow-up period. Moreover, at present, CBTp is not superior to other effective interventions, neither at end-of-therapy nor after a follow-up period. Finally, interventions that focus specifically on cognitive and emotional

factors that are hypothetically involved in the formation and maintenance of delusions seem to be slightly more effective and thus are a promising approach to improving interventions for delusions.

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The long-term effectiveness of cognitive behavior therapy for psychosis within a routine psychological therapies service

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Randomised controlled trials (RCTs) have shown the efficacy of CBTp, however, few studies have considered its long-term effectiveness in routine services. This study reports the outcomes of clients seen in a psychological therapies clinic, set up following positive results obtained from an RCT (Peters et al., 2010). The aims were to evaluate the effectiveness of CBTp, using data from the service's routine assessments for consecutive referrals over a 12 years period, and assess whether gains were maintained at a 6+ months' follow-up. Of the 476 consenting referrals, all clients ($N = 358$) who received ≥5 therapy sessions were offered an assessment at four time points (baseline, pre-, mid-, and end of therapy) on measures assessing current psychosis symptoms, emotional problems, general well-being and life satisfaction. A sub-set ($N = 113$) was assessed at a median of 12 months after finishing therapy. Following the waiting list (median of 3 months) clients received individualized, formulation-based CBTp for a median number of 19 sessions from 121 therapists with a range of experience receiving regular supervision. Clients showed no meaningful change on any measure while on the waiting list (Cohen's $d <= 0.23$). In contrast, highly significant improvements following therapy, all of which were significantly greater than changes during the waiting list, were found on all domains assessed (Cohen's d: 0.44–0.75). All gains were maintained at follow-up (Cohen's d: 0.29–0.82), with little change between end of therapy and follow-up (Cohen's $d <= 0.18$). Drop-out rate from therapy was low (13%). These results demonstrate the positive and potentially enduring impact of psychological therapy on a range of meaningful outcomes for clients with psychosis. The follow-up assessments were conducted on only a sub-set, which may not generalize to the full sample. Nevertheless this study is the largest of its kind in psychosis, and has important implications for the practice of CBTp in clinical services.

Keywords: cognitive behaviour therapy, psychosis, schizophrenia, effectiveness, randomised controlled trials

INTRODUCTION

Cognitive behavior therapy (CBT) for psychosis (CBTp) is an adaptation of CBT for emotional disorders, tailored to the specific needs of people with psychosis. The heterogeneity of presentation in psychosis means that therapy approaches are diverse, with up to 30 books and manuals currently available [see (Johns et al., 2014) for a full list]. Broadly, the aims of CBTp are to work collaboratively with the person to help them gain a better understanding of their psychotic experiences and potential contributing factors; enhance coping and improve functioning; learn adaptive strategies to manage emotional distress; break vicious cycles by identifying cognitive processes and behaviors that are maintaining the problem; and consider alternative, less distressing ways of appraising their experiences. The main instrument of change in CBTp involves making changes in appraisals and behavior to reduce distress, in the context of a good therapeutic relationship.

There is now a robust evidence base demonstrating that CBTp can produce improvements in a variety of outcomes in patients who continue to have residual psychosis symptoms and emotional difficulties despite optimal medication. This body of work has led to its current status as a recommended treatment within the UK National Institute for Health and Clinical Excellence (NICE, 2014), American Patient Outcomes Research Team (PORT; (Kreyenbuhl et al., 2010), and international (Gaebel et al., 2011) guidelines for psychosis and schizophrenia. To date, there have been 12 meta-analyses reviewing up to 50 randomised controlled trials (RCTs), including five within the last year (Burns et al., 2014; Jauhar et al., 2014; Turner et al., 2014; van der Gaag et al., 2014; Velthorst et al., 2015). The effect sizes across the different meta-analyses are small to moderate, ranging from 0.09 to 0.49, depending on trials included and outcomes examined. Two of the larger meta-analyses reported an inverse relationship between effect size and methodological rigor, especially blinding (Wykes et al., 2008; Jauhar et al., 2014), suggesting caution in interpreting previous positive outcomes of CBTp. However, the value of combining highly heterogeneous trials with different foci has been questioned (Byrne, 2014; Peters, 2014), since such analyses reflect an over-simplification of the complexities of psychosis presentations and of the range of psychological interventions encompassed within a broad CBTp framework. Other recent meta-analyses, which focus on treatment-resistant patients [effect size: 0.47; (Burns et al., 2014)], or on individually tailored, formulation-based CBT for hallucinations (effect size: 0.44) and delusions [effect size: 0.36; (van der Gaag et al., 2014)] are more informative about the specific effects of CBTp.

The focus on symptom severity as a primary outcome has also been criticized, since CBTp targets symptom distress and impact on functioning, as well as psychological recovery, rather than symptom reduction *per se* (Birchwood and Trower, 2006). Trials that have used 'psychological' outcomes rather than symptom scores, such as compliance with command hallucinations (Trower et al., 2004), global functioning (Grant et al., 2012), or psychological well-being (Freeman et al., 2014), have tended to report higher effect sizes. Recent research has focused on targeted therapies that evaluate individual components of therapy focusing on specific processes, such as worry (Freeman et al., 2015) or reasoning biases (Waller et al., 2011; Moritz et al., 2014; Garety et al., 2015), or specific sub-populations such as psychosis individuals presenting with command hallucinations (Birchwood et al., 2014) or post-traumatic stress disorder (van den Berg et al., 2015).

However, in clinical practice therapy tends to cover a range of difficulties within the same individuals, including distressing psychotic experiences, emotional problems, and quality of life. In the UK, (NICE, 2014) recommend that therapy should be formulation-based, and delivered on an individual basis for at least 16 sessions over a period of six or more months. While there are a number of obstacles in implementing NICE guidance in practice (Berry and Haddock, 2008; Haddock et al., 2014), nevertheless mental health services across the UK are attempting to deliver CBTp routinely. To date, only a handful of studies have evaluated CBTp delivered in routine clinical services, mostly reporting effectiveness RCTs (Farhall et al., 2009; Peters et al., 2010; Lincoln et al., 2012). While RCTs are clearly the gold standard in informing evidenced-based practice, there are limitations that need to be considered when inferring their efficacy to real life clinical settings (Morrison et al., 2004). RCTs, even those conducted as effectiveness trials within routine services, often have certain characteristics, such as strict exclusion criteria and pre-defined primary outcomes. Furthermore, in routine services there is often a greater emphasis on the goals of the individual client, causing variation in the focus of therapy (Farhall et al., 2009). Therapists may differ in experience, profession and training levels, and there are often limitations on time and resources.

There is a rich literature in other mental health disorders on the need for 'practice-based evidence,' which contributes in its own right to the evidence base for the effectiveness of psychological therapies (Lucock et al., 2003; Stiles et al., 2008). For instance, (Ehlers et al., 2013) demonstrated that clinicians' concerns that the good outcomes in efficacy trials of CBT for Post-Traumatic Stress Disorder (PTSD) would not generalize to the wider range of traumas and presentations seen in routine practice were not founded, with large improvements in PTSD symptoms being observed in a consecutive sample attending a psychological therapies clinic, and few of the selection criteria used in RCTS moderating treatment outcome. In contrast, (Quarmby et al., 2007) found that the outcomes for CBT for chronic fatig syndrome in a routine service were inferior to those found in a previous RCT, which the authors suggest may have stemmed from patient selection, therapist factors and the use of a manualised protocol in the RCT.

In psychosis the few naturalistic studies that have been carried out have been highly promising (Thomas et al., 2011; Jolley et al., 2015), although they have suffered from small sample sizes. In a slightly larger study ($N = 57$; Morrison et al., 2004) evaluated CBTp using non-expert therapists within a community mental health team (CMHT) setting. CBTp produced significant improvements in positive symptoms, general mental health problems, and depression, most of which were maintained at a 1-year follow-up. In the current study, we sought to extend this

work by investigating the effectiveness of CBTp on a range of outcomes in a large, unselected consecutive sample attending a psychological therapies service. (Peters et al., 2010) previously reported positive outcomes on a number of variables in an effectiveness RCT conducted at the Psychological Interventions Clinic for outpatients with Psychosis (PICuP), based at the South London and Maudsley NHS Foundation Trust (SLaM), some of which were maintained at follow-up. The current study reports the outcomes of those patients seen in the clinical service, developed from the trial, using data collected over a 12 years period as part of the service's routine assessments immediately post therapy and at a minimum of 6 months' follow-up.

MATERIALS AND METHODS

Service Setting

These data were collected at the Psychological Interventions Clinic for outpatients with Psychosis (PICuP), part of the Recovery Pathway of the SLaM Psychosis Clinical Academic Group (CAG), based in South London at the Maudsley Hospital, between 2003 and 2015. SLaM serves four London boroughs, each with high rates of diversity [50–60% Black and Minority Ethnic (BME) groups, Office for National Statistics, 2012], population movement, drug use, crime, socio-economic deprivation, and psychosis incidence. A minority of patients (<10%) were referred from other London and environs boroughs. PICuP is a stand-alone psychological therapies clinic offering CBTp for outpatients with distressing positive symptoms of psychosis, or with emotional difficulties in the context of a history of psychosis. Therapists liaise closely with care-coordinators in recovery multidisciplinary teams, but are not part of the team, and do not prescribe medication or care-coordinate/case-manage. PICuP was set-up as a National Health Service (NHS) clinic on the back of initial funding for the RCT (Peters et al., 2010), and has been running for 12 years.

Participants

The PICuP database provided an initial sample of 510 consecutive referrals whose therapy was completed and/or had been discharged and/or whose follow-up period had elapsed. Thirty-four people were excluded because they did not give consent for their measures to be used for service evaluation purposes, leaving 476 participants. The remaining sample consisted of 266 (56%) men and 210 (44%) women, with a mean age of 39 years ($SD = 9.9$). Almost half of the clients were from BME groups ($N = 205$; 48%), and a substantial majority were single ($N = 340$; 76%). Of the sample, 237 (50%) presented with current auditory hallucinations, and 296 (62%) with delusions. 35% were in the severe range for depression [>28 on the Beck Depression Inventory-II; BDI-II (Beck et al., 1996)], and 38% for anxiety [>25 on the Beck Anxiety Inventory (BAI; Beck et al., 1988)][1].

[1]There was one participant with missing data for age; 47 people did not wish to disclose their ethnicity, and 29 did not reveal their marital status. There were 6 people with missing data on the PSYRATS-H, 4 on the PSYRATS-D, 123 on the BDI, and 120 on the BAI (see section on measures for an explanation of the large amount of missing data on BDI and BAI).

Measures

The assessments consisted of a battery of measures assessing current symptoms of psychosis, emotional problems, and quality of life. The choice of routine outcome measures selected by the service is reflective of the wide range of problems held by many clients attending PICuP, and the individualized nature of therapy and people's goals (Peters et al., 2010). The PSYRATs scales (Haddock et al., 1999) were only administered to those clients presenting with hallucinations ($N = 237$) and delusions ($N = 296$). Pragmatic considerations typical of routine clinical services, such as financial constraints or Trust-wide initiatives, led to the discontinuation of some measures after a number of years (Beck Depression and Anxiety Inventories (Beck and Steer, 1990; Beck et al., 1996); Manchester Short Assessment of Quality of Life Questionnaire (MANSA; Priebe et al., 1999), and the introduction of others [Clinical Outcomes in Routine Evaluation-10 (CORE-10)] (Barkham et al., 2013).

Psychotic Symptom Rating Scales – Auditory Hallucinations (PSYRATS-H; Haddock et al., 1999)

Eleven item semi-structured interview including frequency, duration, location, loudness, beliefs about origin, negative content, distress, disruption to life and control. Each symptom is rated on a five-point ordinal scale (0–4) by the interviewer, and the total scores range from 0–44.

Psychotic Symptom Rating Scales – Delusions (PSYRATS-D; Haddock et al., 1999)

Six item semi-structured interview including preoccupation, conviction, distress, and disruption to life. Each symptom is rated on a five-point ordinal scale (0–4) by the interviewer, and the total scores range from 0–24.

Beck Depression (BDI-II; Beck et al., 1996) and Anxiety (BAI; Beck and Steer, 1990) Inventories

Twenty-one item self-report questionnaires assessing symptoms of depression and anxiety, respectively, over the past week (possible range 0–63).

Manchester Short Assessment of Quality of Life Questionnaire (MANSA; Priebe et al., 1999)

Twelve item self-report questionnaire assessing satisfaction with life as a whole and across various domains such as finances, leisure, and mental health (possible range 0–84).

Clinical Outcomes in Routine Evaluation-10 (CORE-10; Barkham et al., 2013)

Ten-item self-report questionnaire assessing emotional well-being. The CORE-10 generates a total distress score, based on each item being rated from 0 to 4, with total scores ranging from 0 (low) to 40 (severe).

Therapy

All clients were offered approximately 6–9 months of therapy, although there was considerable variation across individuals in

actual length of therapy received (median = 9; range = 3–34[2]; mode = 6). Overall 93% of the sample was seen for therapy within an 18-month therapy window.

The median number of therapy sessions attended was 19 (mode = 26, range = 5–63). Number of sessions was highly skewed, with only 13% receiving more than 26 sessions. While clients were in therapy with PICuP they continued to receive routine mental health care from their recovery team (such as medication and appointments with care-coordinators), or their General Practitioner (GP) if they had been discharged from their team, but they did not receive other psychosocial interventions.

Therapy was usually delivered in weekly or fortnightly 1-hour sessions, although again length of session was variable across clients. All of the therapists (n = 121) had received training in CBT but most were not experts in CBTp specifically. In addition to permanent staff and their clinical psychology trainees, a large number of therapists were employed in other roles by their NHS trust (e.g., clinical psychologist, psychiatrist, or nurse), and conducted the therapy during their Continuous Professional Development (CPD) sessions to develop their skills in CBTp. All therapists attended fortnightly group supervision sessions with a permanent senior member of staff and had access to a 'therapy pack' and a variety of reading materials. Clinical psychology trainees received individual weekly supervision, including listening to therapy tapes.

Therapy was conducted in a flexible style with an emphasis on engagement and building a good therapeutic relationship. Interventions were formulation-based and focused on the patient's own goals, which, in addition to managing and understanding distressing positive symptoms, often centered on emotional problems and/or social inclusion (see Fowler et al., 1995; Johns et al., 2014).

Procedure

Participants were assessed at four different time points as part of the routine outcome assessments for the clinic:

- Baseline (when first referred to the service, before going on the waiting list);
- Pre-therapy (just before starting therapy after having been on the waiting list median of 3 months after the baseline assessment (range 1–17 months; mode = 2);
- Mid-therapy (median of 4 months after the second or baseline assessment (range 2–15 months; mode = 4);
- Post-therapy (within a few days or weeks of finishing therapy; median of 5 months after the mid-therapy assessment (range 1–25 months; mode = 5);

There were two exceptions to this: clients did not complete the second assessment (pre-therapy) if the waiting list was <=2 weeks, and the MANSA (Priebe et al., 1999) was only administered at baseline and end of therapy assessments; both to minimize client burden.

Seven years following the start of the service, a fifth assessment time-point was added:

- Follow-up (at a minimum of 6 months post therapy; median 12 months following end of therapy assessment, range 6–46, mode = 6).

It was attempted to follow up early clients when the follow-up assessments started to be implemented routinely, but only a small percentage could be located; as a result the data-set for these assessments is smaller than for the other time-points.

Outcomes at the mid-therapy assessment are not reported here, but were included in the repeated measurements model in order to further reduce potential bias created by missing values (see statistical analysis section below).

Independent assessors (assistant psychologists trained in administering all the measures) conducted the assessments. Assessments lasted between 45 and 90 min, and could be conducted over more than one session if necessary. Demographic information from participants was collected at the baseline assessment and from the standard 'Patient Registration Form' used by SLaM.

Statistical Analysis

The software packages STATA (version 11.2) and SPSS (version 21) were used to run the statistical analyses using a two-sided 1% significance level[3].

The effectiveness of CBTp was tested by the following comparisons:

- Baseline vs. pre-therapy, to check stability of symptoms while on the waiting list
- Pre-therapy vs. post-therapy, to assess change over the course of therapy
- Change during waiting list (pre therapy – baseline) vs. during therapy (post therapy – pre-therapy), to test whether change was greater in the latter period than in the former
- Pre-therapy vs. follow-up, to assess whether any changes were maintained +6 months following the end of therapy
- Post-therapy vs. follow-up, to check stability between end of therapy and follow-up.

Longitudinal data were analyzed through repeated measurement models (mixed effects regression) by an independent statistician (DA). For each outcome a linear mixed model was run to compare the measurements at the five time points (baseline; pre-therapy; mid-therapy; end of therapy; and 6+ months follow-up), including all available data at each time point.

The model, called covariance pattern model (Brown and Prescott, 1996), analyses the repeated measurements nested within individuals, using an unstructured covariance matrix (which allows unequal variances and covariances between the different time points measures), under the missing data assumption of missing at random (MAR, which does not depend on the missing values being conditional on the observed data).

[2]Data on therapy duration were obtained from assessment dates; a few patients were put on hold during the course of therapy, explaining the upper ranges of therapy duration.

[3]1% rather than 5% significance level was used for all analyses to account for multiple testing.

In order to assess the five comparisons listed above, contrasts were formally expressed and estimated using STATA's 'lincom' function, and effects sizes (Cohen's *d*) for the changes of interest were subsequently computed. Cohen's *d* was calculated by dividing the absolute mean change estimate by the standard deviation of the mean baseline measure.

RESULTS

Therapy and Assessment Attrition

Attrition rates at each stage of assessment and therapy drop-outs are illustrated in the service consort diagram (see **Figure 1**). Clinical scores at each assessment stage (apart from mid-therapy) on each of the six outcome measures are shown in **Figure 2**.

Of the 476 consenting cases, a further 118 people were excluded from further assessments because they either did not proceed to therapy [$N = 78$ (16%)], or they dropped out of therapy too early to receive a meaningful 'dose' [defined '*a priori*' as attending fewer than five sessions[4]; $N = 40$ (8%)], according to the clinic's procedures. They did not differ significantly from the 358 people who engaged in therapy (five or more sessions attended) on gender ($\chi^2 = 0.04$, d.f. $= 1$, $p > 0.1$), age ($t = 1.6$, d.f. $= 473$, $p = 0.11$), ethnicity ($\chi^2 = 0.15$, d.f. $= 1$, $p > 0.1$), or marital status ($\chi^2 = 3.07$, d.f. $= 3$, $p > 0.1$), or on any of the baseline clinical variables [PSYRATS–H (Haddock et al., 1999): $t = 0.11$, d.f. $= 235$, $p > 0.1$; PSYRATS–D (Haddock et al., 1999): $t = 1.65$, d.f. $= 294$, $p = 0.10$; BDI-II (Beck et al., 1996): $t = 2.25$, d.f. $= 351$, $p = 0.03$; BAI (Beck et al., 1988): $t = 1.98$, d.f. $= 354$, $p = 0.05$; CORE-10 (Barkham et al., 2013): $t = 0.68$, d.f. $= 137$, $p > 0.1$, and MANSA (Priebe et al., 1999): $t = 2.04$, d.f. $= 354$, $p = 0.05$].

Of those who started therapy (398 people), 110 (28%) did not complete a second assessment (either because they declined or there was a therapist available within 2 weeks of baseline assessment).

Of those who initially engaged in therapy (attended five or more sessions; 358 people), 23 (5%) dropped out later on in therapy, giving a total drop-out rate of 13% [i.e., including those who did not engage ($N = 40$; 8%), and those who took up therapy but later dropped out].

Of the 358 people who engaged in therapy, 73 (20%; 53 therapy completers and 20 drop-outs) declined an end of therapy assessment, although 56% of them agreed to a mid-therapy assessment ($N = 36$; 31 therapy completers and five drop-outs) and/or a follow-up ($N = 5$; five therapy completers and zero drop-out) assessment. Those who declined the end of therapy assessment did not differ significantly from the 285 people who completed it on gender ($\chi^2 = 0.87$, d.f. $= 1$, $p > 0.1$), age ($t = 1.5$, d.f. $= 355$, $p > 0.1$), ethnicity ($\chi^2 = 0.14$, d.f. $= 1$, $p > 0.1$), or marital status [$\chi^2 = 5.7$, d.f. $= 3$, $p > 0.1$)], or on any of the baseline clinical variables [PSYRATS–H (Haddock et al., 1999): $t = 0.96$, d.f. $= 178$, $p > 0.1$; PSYRATS–D (Haddock et al., 1999): $t = 1.38$, d.f. $= 237$, $p > 0.1$; BDI-II (Beck et al., 1996): $t = 0.41$, d.f. $= 271$, $p > 0.1$; BAI (Beck et al., 1988): $t = 2.02$, d.f. $= 272$, $p = 0.05$, CORE-10 (Barkham et al., 2013): $t = 1.23$, d.f. $= 105$, $p > 0.1$, or MANSA (Priebe et al., 1999): $t = 2.31$, d.f. $= 281$, $p = 0.02$].

A significant number ($N = 245$; 68% of those who attended five or more sessions) were lost to follow-up (see procedures section). The 113 individuals who completed a 6+ months follow-up assessment did not differ from those who did not on gender ($\chi^2 = 3.0$, d.f. $= 1$, $p = 0.08$), age ($t = 0.59$, d.f. $= 355$, $p > 0.1$), ethnicity ($\chi^2 = 0.4$, d.f. $= 1$, $p > 0.1$), or marital status ($\chi^2 = 7.6$, d.f. $= 3$, $p = 0.06$), or on any of the baseline clinical variables [PSYRATS–H (Haddock et al., 1999): $t = 0.10$, d.f. $= 178$, $p > 0.1$; PSYRATS–D (Haddock et al., 1999): $t = 9.2$, d.f. $= 237$, $p > 0.1$;[BDI-II (Beck et al., 1996): $t = 0.55$, d.f. $= 271$, $p > 0.1$; BAI (Beck et al., 1988): $t = 1.4$, d.f. $= 272$, $p > 0.1$), CORE-10 (Barkham et al., 2013): $t = 0.6$, d.f. $= 105$, $p > 0.1$, or MANSA (Priebe et al., 1999): $t = 0.04$, d.f. $= 281$, $p > 0.1$].

Furthermore, those who did not complete a follow-up assessment did not differ significantly from those who did at the end of therapy (or mid-therapy for those who did not complete an end of therapy assessment) on any of the clinical variables [PSYRATS–H (Haddock et al., 1999): $t = 0.78$, d.f. $= 164$, $p > 0.1$; PSYRATS–D (Haddock et al., 1999): $t = 0.34$, d.f. $= 219$, $p > 0.1$; BDI-II (Beck et al., 1996): $t = 1.07$, d.f. $= 244$, $p > 0.1$; BAI (Beck et al., 1988): $t = 1.26$, d.f. $= 245$, $p > 0.1$, CORE-10 (Barkham et al., 2013): $t = 1.72$, d.f. $= 118$, $p = 0.09$, or MANSA (Priebe et al., 1999): $t = 0.71$, d.f. $= 216$, $p > 0.1$].

Outcome Analyses

The residuals from the six different linear models were approximately normally distributed, denoting that the model assumptions are plausible.

Results are displayed in **Table 1**. Total numbers available for the six mixed-effects regressions for each outcome were as follows: PSYRATS-Voices = 248; PSYRATS-Delusions = 302; BDI = 360; BAI = 362; CORE = 180; MANSA = 361. Results are provided for the following contrasts: baseline vs. pre-therapy (i.e., changes during the waiting list); pre- vs. post-therapy (i.e., changes during the therapy); pre-therapy vs. follow-up (i.e., changes during therapy + follow-up period); post-therapy vs. follow-up (i.e., changes between the end of therapy and follow-up). Finally the comparison between amount of change during therapy and amount of change during waiting list is also reported.

It can be seen that clients' symptoms remained stable during the waiting list period, with all comparisons[5] being either non-significant (voices; depression; anxiety; and well-being) or with low effect sizes (delusions; <=0.23). In contrast, all outcomes improved significantly after therapy (pre vs. post; all $p < 0.001$), and were maintained at the follow-up stage (pre vs. follow-up, also all $p < 0.001$), with effect sizes ranging from 0.44 to 0.75 at the end of therapy, and 0.29 to 0.82 at follow-up. Overall the effect sizes for both comparisons were largest for delusions, and smallest for anxiety. The change during therapy (post therapy – pre-therapy) was significantly greater than that occurring during the waiting list (pre therapy –

[4] <5 sessions was based on CBTp guidance that the first 4–6 sessions are usually devoted to engagement only.

[5] Quality of life (i.e., MANSA) data were not available for this comparison.

baseline) on all available measures. There was little change between end of therapy and follow-up, with all comparisons either being non-significant (voices; delusions; anxiety; well-being; qualify of life) or with low effect size (depression; <=0.18), indicating that clients did not deteriorate following the end of therapy, although they did not continue to improve either.

DISCUSSION

In one of the largest effectiveness study of its kind in psychosis, we provide evidence for the long term effectiveness of CBTp on a range of meaningful outcomes, delivered in a UK, NHS psychological therapies service. Bearing in mind that this study reported on a consecutive sample with a wide range of presentations from an ethnically diverse, socially deprived and high mobility area; that drop-out rate from therapy was low (13%); and that patients were seen by therapists with a wide range of experience in CBTp, these results are encouraging. They add support to the evidence-base from RCTs that suggests that people who have ongoing, residual distressing symptoms of psychosis and emotional difficulties represent one of the groups most likely to benefit from CBTp (Burns et al., 2014). They confirm that psychological well-being, emotional difficulties and quality of life can also be improved by psychological therapy, in addition to symptom-associated distress and disability.

Strengths

The results should be interpreted within the context of a number of strengths and limitations. One of the strengths was the large sample size, obtained from consecutive referrals over a 12 years period. The sample was representative of the heterogeneity and complexity of individuals presenting with psychotic symptoms, unlike RCTs that have been criticized on the basis of 'cherry-picking' their participants. As a service the PICuP clinic has an inclusive suitability policy: referrals are deemed appropriate

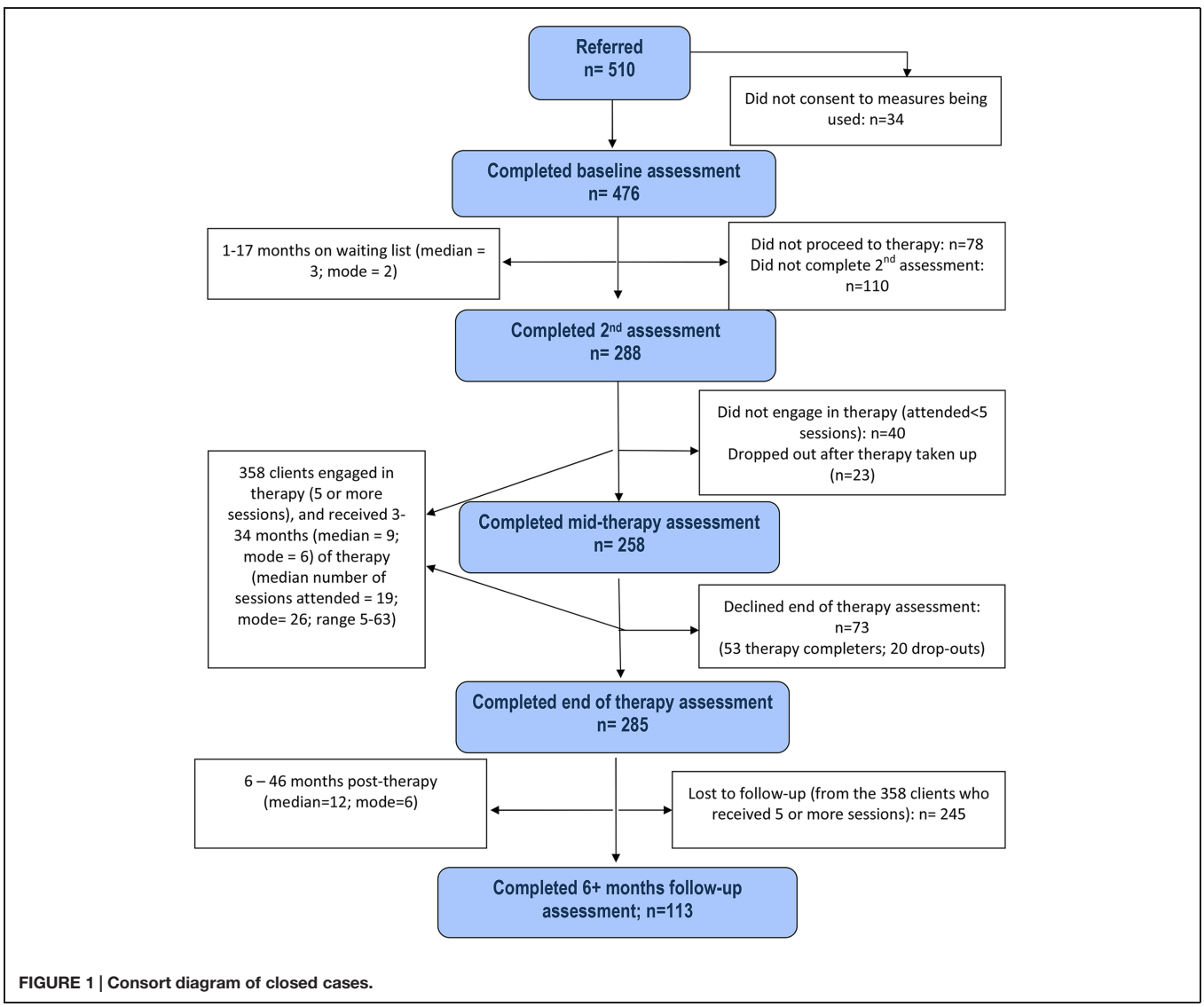

FIGURE 1 | Consort diagram of closed cases.

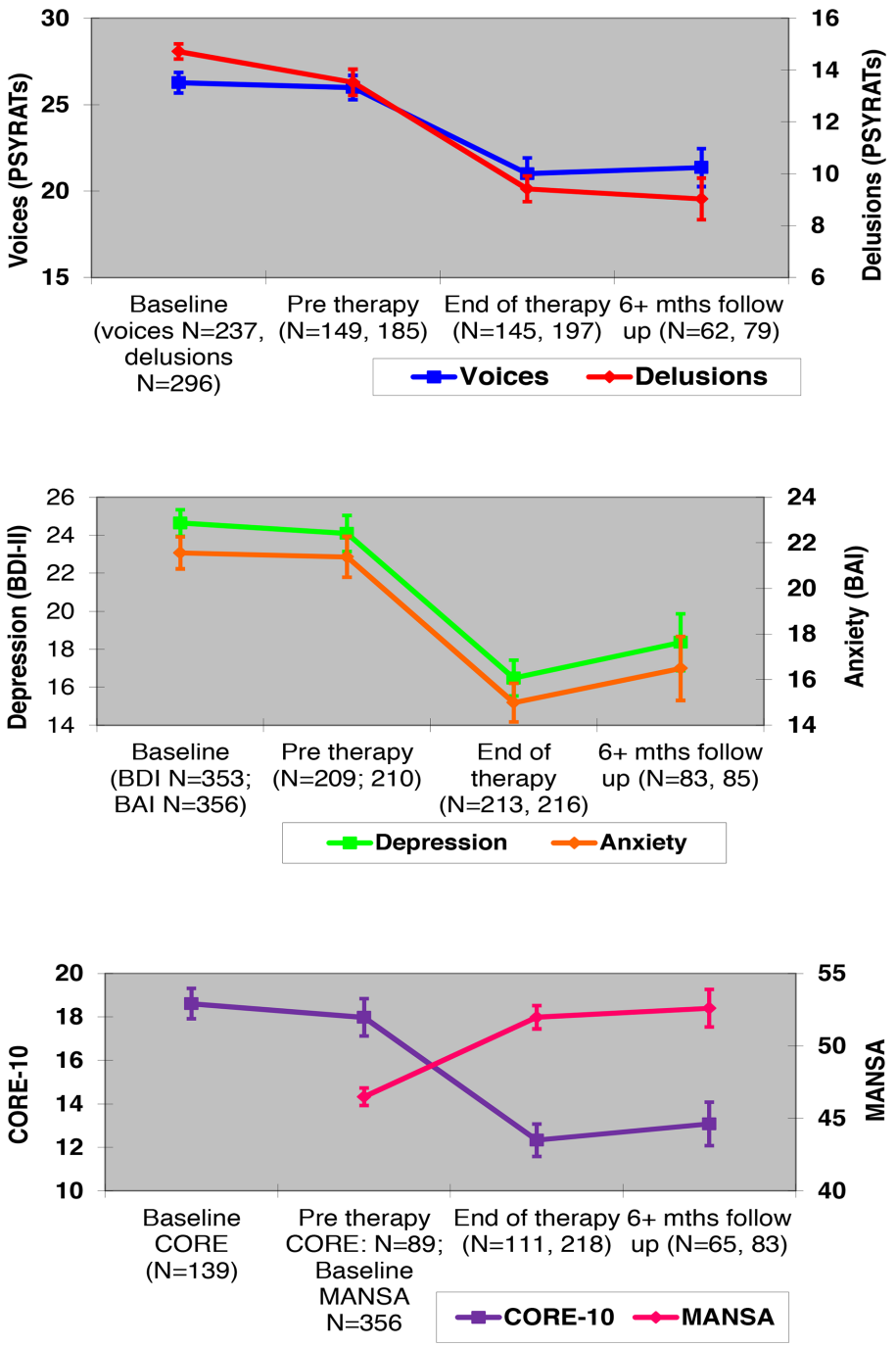

FIGURE 2 | Means (with standard errors) of clinical outcomes at each assessment time-point. PSYRATs, Psychotic Symptom Rating Scales (Haddock et al., 1999). BDI-II and BAI, Beck Depression Inventory-II (Beck et al., 1996) and Beck Anxiety Inventory (Beck and Steer, 1990). CORE-10, Clinical Outcomes in Routine Evaluation-10 (Barkham et al., 2013). MANSA, Manchester Short Assessment of Quality of Life Questionnaire (Priebe et al., 1999).

as long as people are presenting with distressing symptoms of psychosis and/or emotional difficulties in the context of a history of psychosis, and are willing and able to attend sessions. We accept referrals with any diagnosis (or indeed diagnostic conundrums), any type and severity of symptomatic presentation, including co-morbidities, any type of medication (or no medication), any level of cognitive ability, and any model of understanding of psychotic experiences, i.e., having clinical insight is not a pre-requisite. The only exclusion criteria are a primary diagnosis of substance abuse (such as hallucinations caused entirely by alcohol abuse), and a current, very high risk of harming others. People who have a dual diagnosis with

substance dependence, or are at risk of self-harm, are accepted by the service. In practice, our service-users tend to be those who do not need an assertive outreach service, i.e., they do not have substantial negative symptoms and/or have predominantly unmet social needs, and do not show severe chaotic behavior that would prevent them from being able to attend any sessions.

Another important strength was the large number of therapists ($N = 121$), most of whom were not expert in CBTp, and included clinical psychologists in training. The relatively large and enduring effects show that this type of therapy can be successfully implemented in an NHS setting with therapists with a range of experience. However, similarly to our trial (Peters et al., 2010), four crucial aspects of the therapy delivery were likely to have facilitated good outcomes (see also Jolley et al., 2015). First, all therapists had received training in CBT already, and most had a doctoral qualification (e.g., Doctorate in Clinical Psychology), ensuring they were already familiar with the cognitive model and general concepts of CBT, and had some basic understanding of psychological approaches to psychosis. Second, the service has a well-established supervision structure, ensuring they all received regular clinical supervision by senior staff specializing in CBTp (fortnightly in a group setting for qualified staff, and individual weekly supervision for trainees).

TABLE 1 | Mixed Effects Regression Results for the Effectiveness of CBTp.

Variable/Contrast	Coefficient	*SE*	*P*-value	Effect size
PSYRATS voices – Total (248 individuals)				
Baseline vs. pre-therapy	−0.46	0.57	0.42	0.05
Pre-therapy vs. post-therapy	−4.65	0.83	**<0.001**	**0.52**
Change baseline/pre-therapy vs. change pre/post-therapy*	−4.18	1.20	**<0.001**	
Pre-therapy vs. follow-up	−3.89	1.05	**<0.001**	**0.44**
Post-therapy vs. follow-up	0.76	1.04	0.47	0.09
PSYRATS delusions – Total (302 individuals)				
Baseline vs. pre-therapy	−1.23	0.42	**0.003**	**0.23**
Pre-therapy vs. post-therapy	−3.99	0.49	**<0.001**	**0.75**
Change baseline/pre-therapy vs. change pre/post-therapy	−2.75	0.77	**<0.001**	
Pre-therapy vs. follow-up	−4.34	0.76	**<0.001**	**0.82**
Post-therapy vs. follow-up	0.35	0.70	0.61	0.07
BDI (360 individuals)				
Baseline vs. pre-therapy	−1.45	0.59	0.014	0.11
Pre-therapy vs. post-therapy	−6.75	0.75	**<0.001**	**0.51**
Change baseline/pre-therapy vs. change pre/post-therapy	−5.30	1.15	**<0.001**	
Pre-therapy vs. follow-up	−4.44	1.04	**<0.001**	**0.34**
Post-therapy vs. follow-up	2.31	0.91	**0.01**	**0.18**
BAI (362 individuals)				
Baseline vs. pre-therapy	−0.78	0.65	0.23	0.06
Pre-therapy vs. post-therapy	−5.66	0.81	**<0.001**	**0.44**
Change baseline/pre-therapy vs. change pre/post-therapy	−4.87	1.26	**<0.001**	
Pre-therapy vs. follow-up	−3.73	1.01	**<0.001**	**0.29**
Post-therapy vs. follow-up	1.93	0.95	0.04	0.15
CORE -Total (180 individuals)				
Baseline vs. pre-therapy	−1.42	0.67	0.03	0.17
Pre-therapy vs. post-therapy	−5.18	0.72	**<0.001**	**0.61**
Change baseline/pre-therapy vs. change pre/post-therapy	−3.76	1.20	**<0.002**	
Pre-therapy vs. follow-up	−3.95	0.90	**<0.001**	**0.47**
Post-therapy vs. follow-up	1.23	0.71	0.08	0.15
MANSA (361 individuals)				
Pre-therapy vs. post-therapy	5.30	0.69	**<0.001**	**0.49**
Pre-therapy vs. follow-up	5.01	1.06	**<0.001**	**0.47**
Post-therapy vs. follow-up	−0.29	0.92	0.75	0.03

**Is the change between pre vs. post-therapy significantly greater than the change between baseline vs. second assessment?*
Significant results ($p < 0.01$) in bold.

Third, PICuP is a stand-alone psychological therapies service that operates independently from the referring teams, although therapists liaise closely with the referrer about the progress of their individual clients. This service context meant that therapists had assured protected time for the delivery of the therapy and attendance at supervision, free from competing demands of multidisciplinary team work, whether as permanent staff in the PICuP clinic or as CPD therapists employed in another setting. There is increasing evidence that attempts to deliver complex therapies such as CBTp by care-coordinators or staff with limited training, or by adequately trained therapists but without protected time or supervision, are not likely to be productive (Brooker and Brabban, 2004; Brosan et al., 2006; Steel et al., 2012). Finally, the specialized nature of the service ensured both an awareness of how to accommodate the difficulties facing people with psychosis by all staff, including assessors, as well as a predominant culture embracing a psychological approach to psychosis (Cooke, 2014).

Further strengths included the use of independent assessors, rather than outcomes being elicited by the therapists themselves, and the availability of data from mid-therapy assessments for five out of the six measures. The inclusion of mid-therapy outcomes in the analyses meant that potential bias created by missing values at the end of therapy assessment was reduced. Lastly the follow-up period was of reasonable length (median of 12 months post therapy), with the maximum being 46 months after having finished therapy.

The PICuP service was set-up as part of a funded RCT (Peters et al., 2010), and therefore its model of therapy delivery and outcomes monitoring mirrored closely the high standards of RCTs, which can be difficult to achieve in routine community services. However, it has been demonstrated recently (Jolley et al., 2015) that this service model can be implemented on a larger scale across different pathways of care [achieved with additional funding from NHS England for the Improving Access to Psychological Therapies for Severe Mental Illness (IAPT-SMI) initiative], with the important variables being the employment of appropriately trained therapists, access to regular supervision, protected time to deliver therapy, and the use of independent assessors. Whether this service model can be implemented in different health service contexts across countries remains to be investigated.

Limitations

The study also had limitations. The reported effects are within participants only, with no untreated or control therapy group, and the results therefore cannot be unambiguously interpreted as being due to the therapy. However, a number of factors suggest that the reported benefits are unlikely to represent natural recovery. First, our sample consisted largely of a fairly stable group with residual symptoms, rather than an early intervention or frequently relapsing group; in our trial the median length of illness was found to be 6.5 years (Peters et al., 2010). Second, no meaningful changes were found on any of the measures used while patients were on the waiting list, apart from a slight decrease in delusions (effect size = 0.23). Importantly, the differences in outcomes between pre- and post-therapy assessments were significantly greater than those between baseline and pre-therapy for all outcomes where this was available. It is also unlikely that the results are due to natural fluctuations in symptoms, since outcomes remained stable both before and following therapy, with the latter period being greater (median of 12 months) than the length of therapy (median of 9 months).

The assessments were conducted by independent psychology assistants, but they were not blind to the specific assessment time-point, meaning that effects may have been inflated by the expectations of the assessors. However, four of the six measures evaluated consisted of self-report, and would therefore not have been subject to assessor bias; their effect sizes were broadly equivalent to those obtained from interviewer-rated measures.

A third limitation was that we had limited assessments on those who dropped-out of therapy. Due to resource constraints on the clinic, it was decided a-priori that those who did not engage in therapy (i.e., attended fewer than five sessions) would not be pursued for further assessments. Although it was attempted to follow up those who engaged, but dropped out of therapy at a later stage (i.e., attended five sessions or more), only a minority agreed to be assessed (13%), although a further 20% had mid-therapy data available. Nevertheless, once therapy was started the number of drop-outs was low overall (13%: 8% did not engage, and 5% dropped out at a later stage), and therefore it is unlikely to have created a significant bias in the overall findings.

Although the overall sample size was large (number of cases available for analyses ranged from 180 to 362, depending on outcome), there were large amounts of missing data on some scales, due to their intermittent use throughout the 12 years of the service (due to financial constraints or NHS Trust initiatives). There was also a sizeable proportion (28%) who did not have waiting list data due to missing assessments or immediate allocation of a therapist.

Perhaps the most important limitation was that the follow-up assessments were conducted on only a sub-set of the sample who engaged in therapy (32%). This was partly because they were only implemented as a routine procedure 7 years after the start of the service, and partly because they tend to be de-prioritized in a busy clinical setting. Although those who were followed-up did not differ on any demographic or clinical variable, either at baseline or at the end of therapy, it remains unclear whether loss to follow-up was random. It is possible that those who feel they benefited from therapy may be more willing to agree to attend a follow-up assessment than others, thus creating a possible bias toward an overestimate of treatment effects at longer term follow-up. On the other hand, it is also possible that some people who are not doing well may be motivated to come back for an assessment in order to access booster sessions (six booster sessions are available to all those who request it). It is clearly desirable to obtain a much higher follow-up rate, although this is a difficult task to achieve in the context of routine clinical services. Overall it cannot be assumed that the long-term outcomes found would generalize to the rest of the sample, and the findings therefore have to be interpreted with this important caveat in mind.

Other limitations included the lack of data available on medication changes during therapy (or indeed any of the other periods assessed), although in general this has not been found to be a moderating factor in CBTp RCTs. Our sample may not have been representative of all outpatients with psychosis; as a psychological therapies service we are dependent on referrals from other professionals (although a minority of our patients also self-refer), and we tend not to see people with both socially complex and chaotic presentations, who are better seen by therapists working within multidisciplinary teams. This means that our clients tend to be motivated to attend therapy, as is illustrated by the low drop-out rate.

CONCLUSION

This study has important implications for the practice of CBTp. It demonstrates that CBTp can have a positive impact on clients' experience of positive symptoms, levels of depression and anxiety and overall well-being and satisfaction with their life, even when conducted in a routine psychological therapies service by CBT therapists with a range of experience in psychosis, as long as people have regular supervision and protected time. It also provides promising evidence that gains can be maintained long-term, and opens the door for further research to explore which aspects of CBTp have the most impact long-term, and how we can aid the maintenance of therapy gains.

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OPINION
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Individual factors predicted to influence outcome in group CBT for psychosis (CBTp) and related therapies

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INTRODUCTION

Cognitive behavioral therapy for psychosis (CBTp) and CBT based interventions, such as Metacognitive Training for psychosis (MCT), have been found to be effective in symptom reduction, relapse prevention and, increased quality of life (Moritz et al., 2014). A number of reviews (Tarrier et al., 2002) and meta-analyses (Wykes et al., 2008) have confirmed that group CBT (including MCT) is effective for psychosis (Lecomte et al., 2012), but there is significant heterogeneity in outcome (Zimmermann et al., 2005), with some patients able to gain significantly from participating in psychotherapy, whereas others gain minimally. Given the limited resources available for psychotherapy in psychosis, an important endeavor is the identification of factors that may optimize the allocation of those resources (Zimmermann et al., 2005; Freeman, 2011). While there is a growing body of literature on factors influencing outcome in psychotherapy (Luborsky et al., 1971), that has examined patient, therapist and treatment factors, there is a relative paucity of research focussed on outcomes in group psychotherapy for psychosis. In this opinion paper, we highlight a number of patient factors (including aspects of symptomatology, cognition and personality) that might play a role in outcome in group psychotherapy for psychosis. These factors are based on research of psychotherapeutic outcomes (in psychosis and other disorders), with additional observations based on our clinical experience.

Symptom Related Factors

Paranoia, Lack of Insight and Their Effects on Treatment Alliance

There is a large body of literature that has focussed on the non-specific factors associated with outcomes in other psychiatric disorders, and synthesizing it is beyond the scope of the current paper. The bulk of this research has looked at the importance of the therapeutic alliance (Martin et al., 2000), as perceived by the therapist and the client, and suggests that client perceptions of alliance are better predictors of outcome (Krupnick et al., 1996). Crucial to the alliance is the client's belief that they can trust the therapist, and feel understood by them (Frank and Gunderson, 1990). In the context of groups, an additional factor is the ability to trust the other group members. These critical components are negatively impacted by paranoia, and therapists working with clients with psychosis need to grapple with therapeutic ruptures and to avoid being integrated into the client's delusional framework.

CBT based interventions also require ways to discuss specifics of the delusional beliefs (such as the nature of evidence used to maintain the belief), as well as finding shared goals, even when

clients have poor insight into their symptoms. This can be a delicate process, with a lot of potential for damaging the alliance. Goldsmith et al. (2015) found that the duration of therapy was associated with symptomatic improvement in those with good treatment alliance, but was actually detrimental for those clients with poor treatment alliance.

Skilled therapists find creative solutions to negotiate these processes. For some clients, particularly those with paranoia, relatively poor insight and an unwillingness to discuss the specifics of their delusional system, a more indirect approach (such as the one provided by MCT) (Kumar et al., 2015) may provide a more fruitful avenue of engagement (Menon et al., 2015). This is because MCT involves a group discussion of cognitive biases commonly associated with psychosis, and opportunities to examine the impacts of these biases in session, using non-delusion specific, and thus less threatening, material (Woodward et al., 2014).

Grandiose Delusions

In general, one could argue that changing beliefs is difficult, due to the anxiety caused by any challenge to one's belief structure. However, there may be more motivation to challenge beliefs (such as persecutory delusions) associated with negative self-evaluations and anxiety (Bentall et al., 2001). In contrast, grandiose beliefs may be particularly intransigent to therapy as they may serve an ego protective function (Smith et al., 2006; Knowles et al., 2011). This may be particularly true when there is little associated distress, even if the belief has other negative effects on the client's relationships and life. Recent research (Garety et al., 2013) has suggested that patients with grandiose delusions may show even more pronounced cognitive biases (such as the jumping to conclusions bias) than those with persecutory (but non-grandiose) delusions. The goals of therapy may therefore need to be modified with this subgroup, with the initial focus being on minimizing the impact of their beliefs on their relationships. Unfortunately, these individuals also tend to be less receptive to challenges from peers. We therefore hypothesize that these individuals may benefit from individual psychotherapies (including MCT+), rather than group approaches.

It may also be worth exploring whether group therapy is more efficacious in individuals with similar types of delusions or dissimilar beliefs. The former provides a better milieu for common goal development, but could lead to inadvertent reinforcement of beliefs by group members, while the latter allows for members with differing beliefs to help each other in exploring disconfirmatory evidence.

Mood and Anxiety

Depression, anxiety disorders and PTSD (Brady et al., 2003; Shevlin et al., 2008) are commonly comorbid with psychosis (Kessler et al., 2005). In socializing to the CBT model, we find that patients are more willing to explore the impact of their thoughts and behaviors on their depressive and non-psychotic anxiety symptoms. Thus, mood and "mood awareness" as targets for treatment may be initially less threatening than the potentially more threatening targeting of positive symptoms. Many participants identify with challenges and attribution biases related to depression and negative symptoms, while those associated with the positive symptoms are less frequently endorsed. Furthermore, addressing these difficulties can lead to an improved quality of life, as well as improved self-esteem and an increased sense of self-efficacy that can, in turn, build resilience and the capacity to challenge beliefs about hallucinations and targeting delusions.

Neurocognitive Deficits and Illness Duration

Neurocognitive deficits have been widely recognized as being a core feature of schizophrenia (Heinrichs and Zakzanis, 1998). Intervention studies for psychosis (both psychotherapeutic/CBTp and cognitive remediation) often involve exclusion criteria for individuals with learning disabilities or lower premorbid or current IQ (Garety et al., 2008; Freeman et al., 2014). In our groups, we find that patients may be able to comprehend core concepts, but may have difficulty retaining and understanding how these apply to their own symptoms or daily life. Nonetheless, recent research has suggested that neurocognitive functioning does not predict treatment retention (Baker et al., 2011) or treatment response in psychotherapy for psychotic disorders (Lincoln et al., 2014), and instead suggests that duration of illness is more closely associated with outcome, which may be indirectly related to cognition.

Although therapy might be helpful irrespective of the duration of the illness, it has repeatedly been noted that individuals might have maximal gains with early intervention (Lieberman et al., 2013). They may be more willing to challenge or change their beliefs given that these are not longstanding beliefs and patterns of thinking/behavior. Such individuals may tend to have more stable relationships and have not had the attrition in their social networks that occur over long duration of illness, and may be better able to engage in the social processes necessary to test alternative hypotheses.

Social Cognition

A growing body of research has suggested that social cognition might mediate the relationship between neurocognition and functional outcome in individuals with schizophrenia (Schmidt et al., 2011), thus indicating therapies that target and/or improve social cognition, such as social cognitive skills training (SCIT) (Horan et al., 2009; Roberts and Penn, 2009) and cognitive behavior social skills training (CBSST) (Granholm et al., 2007) may serve to improve functioning (Schmidt et al., 2011).

While MCT and CBT are distinctly different than social skills training, there is significant emphasis on improving social cognition through both psychoeducation (e.g., education regarding limitations in social perception, theory of mind) (Balzan et al., 2015), as well as exercises that encourage social interaction (during and outside group), and testing one's own abilities in these domains (Moritz et al., 2013). Although it may be hard to see overall differences between groups in head-to-head studies, we recommend studies comparing active interventions such as MCT and CBSST, to understand who might benefit more from social skills focussed interventions. Component analyses

may provide another avenue by which to evaluate the utility of interventions across patient subtypes.

Stigma

Stigma around psychosis and schizophrenia (both external and internalized) are common in our patients. In our experience, patient comfort with acknowledging their illness varies considerably. While patients may have the awareness of their symptoms and insight into how these symptoms manifest, they may be less comfortable discussing this in a group setting. We have noted that patients may take several sessions to endorse or engage in the therapeutic process. A true benefit of the group setting, and particularly a group with rolling intake, is that individuals can observe and attend to others' discussion of symptoms and self-chosen labels in order to gain comfort with terminology that they might not use in their everyday. Comparing approaches of a fixed entry vs. a rolling entry to groups and its impact on cohesion and stigma are areas that need to be examined in future studies.

Personality Factors

Psychotic disorders are associated with general personality pathology (Schultze-Lutter et al., 2014), as well as high neuroticism, and low openness, agreeableness, extraversion, and conscientiousness (Camisa et al., 2005). Personality traits such as psychoticism or schizotypy in particular have been highlighted as vulnerability factors for psychosis and potentially useful endophenotypes (Chmielewski et al., 2014). Yet, the prognostic or clinical utility of schizotypal personality features within treatment contexts has yet to be established.

Similar to neurocognitive factors, patient personality, particularly interpersonal features, have been linked to service utilization and clinical outcomes in patients with psychotic disorders. For example, high agreeableness and poor therapeutic alliance have been linked with poor treatment engagement and response (Lecomte et al., 2008). Other research has highlighted the impact of insight and attitudes related to recovery (such as optimism) (Lecomte et al., 2015) and stigma on alliance (Kvrgic et al., 2013) and outcome (Owen et al., 2015). In a group context, agreeableness, optimism and cohesion are particularly linked with positive outcomes (Lecomte et al., 2015).

Participant Selection in Studies

We hypothesize that a part of the reason for the reduced effect sizes seen in randomized control trials (RCTs) lies in the characteristics of the participants who participate in research studies, such as personality (Kushner et al., 2009) and their levels of intrinsic motivation (Choi and Medalia, 2010). Some of our participants, when queried about their reasons for participating, pointed to extrinsic motivators (e.g., paid assessments, approval by their families etc.). In contrast, other participants gave reasons congruent with intrinsic motivation, even requesting to participate in additional groups and sessions despite no additional payment. Previous studies (Pelletier et al., 1997; Zuroff et al., 2007) of psychotherapy outcome in depression, and schizophrenia (Medalia and Richardson, 2005) found that intrinsically-motivated individuals generally make greater gains in psychosocial and cognitive remediation programs. Thus, we speculate that psychotherapy groups running without the financial incentives of the research assessment may have a greater proportion of participants with intrinsic motivation, and thus, better outcomes. Future studies may wish to explicitly examine reasons for participating in RCTs of psychotherapy for psychosis, using measures such as the Client Motivation for Therapy scale (Pelletier et al., 1997) and whether these are associated with outcome.

CONCLUSIONS

Although this paper has focussed on group interventions, the majority of the research in this field has focussed on factors influencing outcome in individual therapy.

We have highlighted patient symptom, cognitive, and personality factors associated with therapeutic alliance and outcome (in individual and group therapy settings), which we hope will be examined in detail in future studies. It is important to acknowledge that for some of the factors we have highlighted, the effect size differences between groups might be small (e.g., comparing CBT to CBSST). This leads to a research challenge as many studies may be underpowered to address issues related to combinations of individual difference variables. Yet, the potential of this line of inquiry to reduce the personal and societal impact of psychosis is substantial, and has motivated similar initiatives in other disorders (Oquendo et al., 2014).

We suggest that this body of research can lead us down two distinct pathways. The first involves prospective studies to evaluate whether therapeutic benefits can be optimized by better identifying individuals who might benefit from therapy for psychosis in addition to traditional treatment. The second, more inclusive strategy, might involve examining these issues in large samples, perhaps by naturalistic study designs, or by creating treatment consortia to allow for pooled data, to look at cumulative benefits (e.g., of explicitly targeting attitudes related to recovery and stigma earlier in treatments), as well as comparisons of different active interventions. These approaches may allow us to directly compare multiple subgroups of participants, to see if these variations in treatment improve who might not otherwise benefit from "standard" treatment interventions.

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Metacognition-augmented cognitive remediation training reduces jumping to conclusions and overconfidence but not neurocognitive deficits in psychosis

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The majority of patients with schizophrenia display neurocognitive deficits (e.g., memory impairment) as well as inflated cognitive biases (e.g., jumping to conclusions). Both cognitive domains are implicated in the pathogenesis of the disorder and are known to compromise functional outcome. At present, there is a dearth of effective treatment options. A total of 90 patients with schizophrenia were recruited online (a diagnosis of schizophrenia had been confirmed in a large subgroup during a previous hospital admission). Subsequent to a baseline assessment encompassing psychopathology, self-reported cognition as well as objective memory and reasoning tests, patients were randomized to one of three conditions: standard cognitive remediation (mybraintraining), metacognition-augmented cognition remediation (CR) condition (variant of mybraintraining which encouraged patients to reduce speed of decision-making and attenuate response confidence when participants made high-confidence judgements and hasty incorrect decisions) and a waitlist control group. Patients were retested after 6 weeks and again 3 months after the second assessment. Groups did not differ on psychopathology and neurocognitive parameters at any timepoint. However, at follow-up the metacognitive-augmented CR group displayed a significant reduction on jumping to conclusions and overconfidence. Treatment adherence correlated with a reduction of depression; gains in the training exercises from the standard mybraintraining condition were correlated with improved objective memory performance. The study suggests that metacognition-augmented CR may ameliorate cognitive biases but not neurocognition. The study ties in well with prior research showing that neurocognitive dysfunctions are rather resistant to change; the failure to detect significant improvement of CR or metacognition-augmented CR on psychopathology and neurocognition over time may partly be attributed to a number of methodological limitations of our study (low psychopathology and chronicity of participants, low "dosage," narrow range of tests, self-report psychopathology scales).

Keywords: psychosis, schizophrenia, neurocognition, cognitive biases, cognitive remediation

Introduction

Schizophrenia is frequently accompanied by neuropsychological deficits which are spread across a wide range of cognitive functions (Heinrichs and Zakzanis, 1998; Keefe and Harvey, 2012). Memory and attention problems in concert with social cognitive impairments (Fett et al., 2011) are a major predictor for disability and low functional outcome in the disorder (Green, 1996; Green et al., 2004; Lepage et al., 2014). Neurocognitive deficits are also a risk factor for poor symptomatic outcome. First, memory problems aggravate medication non-adherence as patients may fail to remember the rationale for drug administration or forget to take their medication (Moritz et al., 2013b), particularly due to prospective memory failure (Moritz et al., 2004). In addition, compromised attention, reasoning, and memory capacity may limit the comprehension and internalization of knowledge and skills acquired during cognitive therapy and thus impede transfer to everyday life.

The causes underlying neurocognitive deficits in schizophrenia are multi-facetted. Apart from early (neurodevelopmental) deficits that already manifest prior to the onset of the disorder (Bang et al., 2014; Corigliano et al., 2014), avolition/lack of effort and a restricted non-challenging environment/hospitalization may compromise cognition. Some recent studies suggest that (conventional) antipsychotics impair brain functioning (Ukai et al., 2004; Ho et al., 2011; Gasso et al., 2012), which in turn hampers neurocognition. While antipsychotic-induced cognitive deficits are clearly non-desired and thus usually considered a side-effect, there is emerging, albeit not yet conclusive, evidence that such secondary cognitive deficits may in fact be one mechanism through which antipsychotics reduce positive symptoms ("effect by defect" hypothesis; Moritz et al., 2013a). In other words, there may be two sides of the same coin: doubt and reduced speed of information processing induced by antipsychotics may be a prerequisite for the dissolution of delusions.

Currently, there is a dearth of potent treatment options against cognitive deficits. Early claims that atypical neuroleptics may act as cognitive enhancers have not lived up to its expectations (Keefe et al., 2007; Davidson et al., 2009; Keefe and Harvey, 2012). Atypical neuroleptics leave cognition uncompromised at best. It should also be taken into account that side effects such as extrapyramidal symptoms (Fervaha et al., 2015) and concomitant medication, particularly anticholinergic drugs (Vinogradov et al., 2009) and tranquilizers/benzodiazepines (Deckersbach et al., 2011) are known to aggravate neurocognitive deficits, too.

Cognitive remediation (CR) has shown some promise; meta-analyses indicate that CR exerts a (small-to-moderate) effect on neurocognition (McGurk et al., 2007; Wykes et al., 2011) but does not have a lasting impact on symptomatology (Wykes et al., 2011). However, this promising evidence has to be weighed against the effort that needs to be invested to produce those changes (e.g., one-on-one training, tailored material). Recently, low-threshold group CR trainings have shown some beneficial effect. A meta-analysis on 36 studies reveals that Integrated Psychological Therapy (IPT), a program at the interface of neurocognition and social cognition, exerts significant positive effects relative to control interventions on neurocognition, social cognition, psychosocial functioning, and negative symptoms (Roder et al., 2011). In a recent study we were able to show that a CR group improved attention after 3 years relative to a metacognition group (Moritz et al., 2014c).

Apart from "cold" cognitive deficits mirroring brain dysfunction in psychosis, particularly in the frontal and temporal lobes, there is an emerging interest in cognitive biases. Cognitive biases are not deficits *per se* but represent alterations or styles in the perception and processing of information, for example a preference to remember positive versus negative information. Cognitive biases are not pathological as such; some cognitive biases can even promote psychological well-being (e.g., self-serving bias, "Pollyanna effect"; Bentall, 1992; Pohl, 2004). Among other cognitive distortions, studies have implicated jumping to conclusions (Garety et al., 1991) and overconfidence in errors (Moritz et al., 2003) in the formation and maintenance of psychosis. To summarize, a plethora of studies suggest that patients with schizophrenia are hastier in gathering information (for reviews, see Garety and Freeman, 1999, 2013; Fine et al., 2007) and are more confident in erroneous responses pertaining to memory (Moritz and Woodward, 2006a; Gaweda et al., 2012; Peters et al., 2013) and social cognition (Kother et al., 2012; Moritz et al., 2012b) relative to non-clinical and psychiatric controls. Recent evidence suggests that this extends to perception (Moritz et al., 2014b). Both biases foster the formation of momentous false decisions that under some contextual factors may promote delusions (Moritz and Woodward, 2006b; Garety and Freeman, 2013). To illustrate, jumping to conclusions may lead a person with a history of psychosis to infer that a friend who is not calling back within 2 days has turned his back on him and is not trustworthy anymore. This along with overconfidence in errors may later turn the initial benign suspicion into a serious false belief (e.g., that the friend is a police spy who has gathered sufficient information against the patient so that they can terminate surveillance). Once such ideas have systematized, judgments are usually not validated or questioned anymore and the person is no longer open to disconfirmatory evidence, the latter representing another prominent cognitive bias (Woodward et al., 2006, 2008; Veckenstedt et al., 2011).

The present study examined the efficacy of CR training versus a CR training combined with a bias modification approach. To this end, a low-threshold online CR training called mybraintraining Professional (from here on "mybraintraining") was administered. Mybraintraining intends to improve neurocognitive functioning by training four major faculties: calculation, logic, memory, and vision. We set up two experimental CR conditions which were tested against a waitlist control group. In the standard CR condition, patients were encouraged to avoid making errors when performing cognitive tasks that were presented under time restriction. In the metacognition-augmented CR condition the same exercises were presented but patients additionally had to rate their responses in terms of confidence, that is, whether they were certain or not that their responses were correct. Whenever a subject made a high-confident error and/or an error committed with very short reaction time (i.e., less than half of the allocated time used) they

were advised to attenuate their confidence and to take more time if not fully confident for the remaining trials. The aim of this metacognition-augmented CR condition was to sensitize participants to the disadvantages of high-confident and hasty decision-making suggesting that "gut feelings" may be faulty. We hypothesized that the conventional CR condition may improve subjective and perhaps even objective cognitive impairment. The metacognition-enhanced CR condition was hypothesized to additionally improve the jumping to conclusions bias and to attenuate response confidence (as measured by a memory task).

Materials and Methods

Participants

The present study was approved by the ethics committee of the German Society for Psychology (DGPs). Participants were recruited from various sources. A total of 223 former patients of the Department of Psychiatry and Psychotherapy, University Medical Center Hamburg-Eppendorf (Germany) with verified diagnostic status (schizophrenia or schizoaffective disorder) were informed about the study via email. All participants had given explicit permission to be contacted for future studies. Furthermore, 309 emails were sent to clinicians asking them to pass on information about the study to patients meeting inclusion criteria. Finally, upon the approval of webmasters study invitations were posted in several guided self-help internet networks pertaining to schizophrenia and psychosis (these websites provided reliable information on the disorder and fostered the exchange of individuals affected with psychosis).

The following inclusion criteria were applied: age between 18 and 65 years, willingness to provide electronic informed consent and to participate in anonymous (internet-based) surveys as well as a diagnosis of schizophrenia or schizoaffective psychosis.

All posts and emails contained a weblink directing interested parties to the baseline survey. The trial was created using Questback® which does not store IP addresses. Group allocation was carried out at random.

The first page of the online survey essentially repeated the information of the email (random assignment to either the mybraintraining standard version, metacognition-augmented mybraintraining, or waitlist control group; inclusion criteria) in everyday language. It was announced that all participants would receive free access to the online program (mybraintraining) for 1 year, either immediately or after a 6-week delay. Moreover, all completers would receive a manual containing mindfulness exercises at the end of the study.

Multiple log-ins via the same computer were prevented by means of "cookies." The survey consisted of the following parts: invitation, informed consent (mandatory), optional consent to contact the patient's clinician in order to verify diagnostic status (to do this, participants had to provide their own name as well as the name and address of the clinician), demographic section (e.g., gender, age), medical information (e.g., medication, psychiatric diagnoses), assessment of psychopathology I (see questionnaire section below), encoding memory phase, assessment of psychopathology II (see questionnaire section below), memory recognition test, fish task (jumping to conclusions), and request for an email address (to match baseline and post survey data). Then, we asked participants to endorse whether or not they had responded honestly. Finally, participants were given the opportunity to leave comments.

No monetary compensation was offered for participation. Individuals who were randomly assigned to the waitlist condition were informed that they would receive access after completing the follow-up survey 6 weeks later.

Participants in two experimental groups were given access to one of two versions of mybraintraining within 24 h. This email also contained information about the rationale of mybraintraining or metacognition-augmented mybraintraining. Participants in the experimental groups received weekly email reminders encouraging them to use the program on a regular basis.

Procedure

Six weeks after the baseline assessments, participants were invited via email to participate in the post survey. Up to two reminders were dispatched in case subjects failed to complete the post assessment. Three months after the post assessment, invitations for a follow-up assessment were sent. Again, up to two reminders were dispatched if subjects did not fill out the final assessment.

Post Assessment

For the post survey, individuals were requested to enter their email address to allow matching post data with baseline data. The post assessment consisted of the following parts: introduction, current treatment and medication, assessment of psychopathology I, encoding memory phase, assessment of psychopathology II, memory recognition test, fish test (jumping to conclusions), and evaluation of the online training (see below). Similar to the baseline assessment, we asked participants whether or not they had responded honestly and gave them the opportunity to leave comments.

Subsequent to completion of the post assessment, all participants received a manual on relaxation and mindfulness exercises. Participants in the waitlist condition also received access to the standard CR condition. Patients in the standard mybraintraining condition did not receive the metacognition-augmented CR training and vice versa.

Follow-Up Assessment

Three months after the post assessment, participants were invited to a follow-up assessment. This final assessment was not part of our initial study design. As participants in the waitlist group received access to the mybraintraining standard version subsequent to completion of the post assessment, this final follow-up assessment did not allow comparison of the three groups. Hence, the follow-up analysis compared the standard CR group (immediate or delayed) with the metacognition-augmented CR group. As an incentive for continued participation, individuals received a manual with

exercises derived from "Acceptance and Commitment Therapy." The follow-up assessment was a shorter version of the post assessment and involved a selection of previously used scales (see below). As the follow-up was not announced from the start, we expected a higher non-completion rate.

Questionnaires (Online Assessment)

Participants were asked to complete the following questionnaires (the survey proceeded only after all items had been answered):

Paranoia Checklist (Freeman et al., 2005)

The Paranoia Checklist is an 18 item questionnaire assessing paranoid beliefs and suspiciousness. The psychometric properties are good (Freeman et al., 2005; Lincoln et al., 2010a,b). In our slightly adapted version, participants are asked to rate their present symptom severity on a five-point Likert scale ranging from 1 (not at all) to 5 (extremely).

Center for Epidemiologic Studies-Depression Scale (CES-D)

The Center for Epidemiologic Studies-Depression Scale (CES-D) is a 20 item questionnaire covering depressive symptoms; the reliability and validity of the CES-D have been established previously (Radloff, 1977; Hautzinger and Brähler, 1993). In the present study, CES-D items were presented intermixed with items from the Paranoia Checklist.

Launay-Slade Hallucination Scale-Revised (LSHS-R; Bentall and Slade, 1985)

The Launay-Slade Hallucination Scale-Revised (LSHS-R) is a 16 item questionnaire covering sleep-related hallucinations, vivid daydreams, intrusive thoughts, and auditory hallucinations. Its reliability has been demonstrated elsewhere (Goodarzi, 2009). Psychosis patients with hallucinations usually score higher than remitted patients, and the latter in turn reach higher scores than patients who never experienced hallucinations (Varese et al., 2012). The LSHS-R was not included in the follow-up assessment.

Beck Cognitive Insight Scale (BCIS) – Extended

The Beck Cognitive Insight Scale (BCIS; Beck et al., 2004) is a 15-item scale that measures the degree of patients' self-reflectiveness and overconfidence in the interpretation of experiences. Principal component analysis (Beck et al., 2004) suggests a two-dimensional structure (self-reflectiveness and self-certainty). According to the original article (Beck et al., 2004), the BCIS demonstrates good convergent, discriminant, and construct validity. The psychometric properties of the German translation used in the present study are good as well (Mass et al., 2012). We complemented the BCIS with a number of self-developed novel items asking for subjective cognitive deficits (e.g., "I have trouble learning new things"). The BCIS was not administered in the follow-up assessment.

Jumping to Conclusions

We administered an online version of the probabilistic reasoning task (Speechley et al., 2010; Moritz et al., 2012a), which slightly differs from the original beads task as it employs a different scenario (lakes with fish instead of jars with beads). Three parallel versions were set up to avoid practice effects. In each version, two lakes with colored fish in opposing likelihood (e.g., 80% orange vs. 20% gray fish, and vice versa) were presented to the participant. Following each "catch," participants were asked to make two judgments: (1) a probability judgment about the likelihood that the fish was/were being caught from lake A versus lake B, and (2) whether the available amount of information would justify a decision or not. The instruction emphasized that the fisherman would not change the lake throughout the task. The ratio of fish in each lake was shown at the bottom of each slide along with previously caught fish (the last catch was indicated with an arrow). In total, 10 fish were presented; one lake was

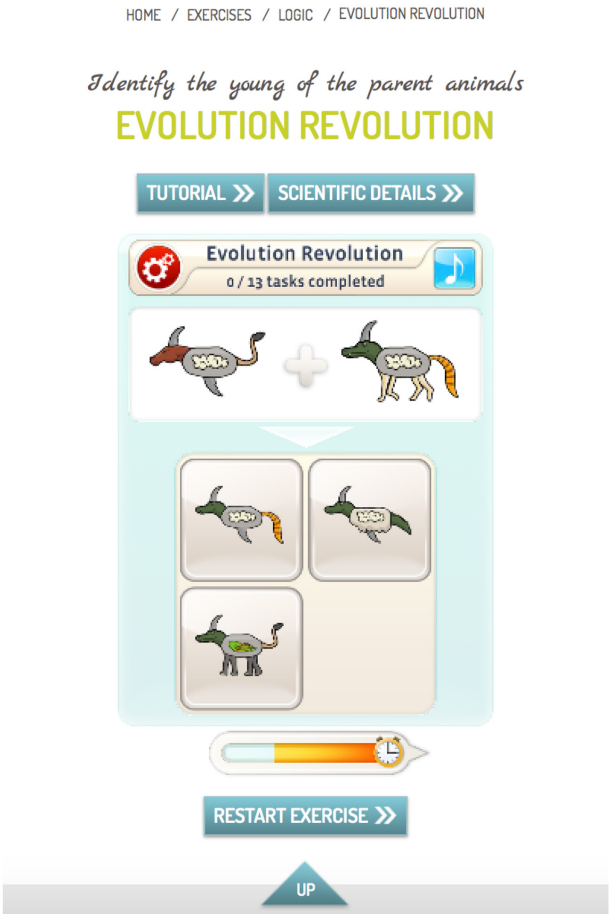

FIGURE 1 | Example for an exercise from category "Logic." The participant had to identify the young of the parent animals (the upper left response option is correct). In the standard version, the participant had to indicate his or her choice and was then informed about the outcome (correct versus incorrect). In the metacognitive-augmented condition, the participant was asked after each response whether he or she was certain that the response was correct. In case of a very fast incorrect response (less than half of the allotted time indicated by the time bar; see bar left to clock symbol) or a high-confident incorrect response, patients were encouraged by automatic feedback to either take more time before completing an item and/or to attenuate response confidence if the available evidence was insufficient.

TABLE 1 | Baseline characteristics of the full sample. Means, SD, (in brackets) and frequency.

Variable	Waitlist ($n = 30$)	Standard cognitive remediation ($n = 30$)	Metacognition-augmented cognitive remediation ($n = 30$)	Statistics
Background variables				
Age in years	37.03 (12.66)	40.10 (9.29)	40.80 (9.97)	$F(2;89) = 1.04$, $p = 0.356$
Sex (male/female)	10/20	11/19	12/18	$\chi^2 = 0.29$, $p = 0.866$
Parallel treatments				
Antipsychotics (yes/no)	27/3	25/5	26/4	$\chi^2 = 0.58$, $p = 0.749$
Inpatient treatment (yes/no)	1/29	2/28	1/29	$\chi^2 = 0.52$, $p = 0.770$
Outpatient treatment (yes/no)	20/10	17/13	17/13	$\chi^2 = 0.83$, $p = 0.659$
Psychotherapy (yes/no)	8/22	7/23	7/23	$\chi^2 = 0.12$, $p = 0.942$
Waiting for psychotherapy (yes/no)	1/29	2/28	1/29	$\chi^2 = 0.52$, $p = 0.770$
Reasoning				
Jumping to conclusions (decision after first or second fish)	40%	47%	40%	$\chi^2 = 0.36$, $p = 0.833$
Memory test				
Hits	13.23 (2.31)	13.50 (2.05)	13.52 (1.23)	$F(2;89) = 0.74$, $p = 0.483$
False alarms	1.00 (1.76)	0.93 (1.46)	0.77 (1.14)	$F(2;89) = 0.20$, $p = 0.820$
High-confident responses	25.97 (5.69)	25.00 (5.41)	26.83 (3.56)	$F(2;89) = 1.02$, $p = 0.365$
Beck Cognitive Insight Scale (extended)				
Self-reflectiveness	9.13 (3.16)	8.90 (2.88)	10.10 (3.08)	$F(2;89) = 1.31$, $p = 0.274$
Self-certainty	7.53 (2.61)	6.77 (2.53)	6.70 (2.31)	$F(2;89) = 1.04$, $p = 0.357$
Subjective cognitive dysfunction	9.20 (3.80)	8.40 (4.06)	9.00 (4.19)	$F(2;89) = 0.32$, $p = 0.726$

strongly suggested by the chain of events (D–D–D–N–D–D–D–D–N–D; D = dominant color of fish; N = non-dominant color of fish). Jumping to conclusions was defined as a decision after one or two fish. We also computed the number of draws to decisions.

Memory Test

Three parallel versions of a newly developed memory recognition test were composed. The test was modeled after the Auditory Verbal Learning Memory Test (AVLT) but did not encompass active recall. In the (incidental) encoding phase (i.e., unlike in the AVLT participants were not instructed that their later task would be to memorize the items), participants were presented 15 nouns [each five words that were pre-classified by the authors as positive (e.g., cake), negative (e.g., accident) or neutral (e.g., table)] and requested to appraise each noun as either positive, neutral or negative (valence). Later, participants were presented the previously presented 15 words intermingled with 15 distractor words of different valence in random order (recognition phase). Participants were asked to rate if the respective word had been presented before (i.e., in the valence task) and how confident they were in the correctness of their judgment. Items had to be endorsed on a four-point Likert scale (1 = old word, certain; 2 = old word, uncertain; 3 = new word, uncertain; 4 = new word, certain). There was an equal number ($n = 15$) of (pre-defined) negative, positive, and neutral words, both with respect to old (studied) and new (distractor) words.

Mybraintraining Professional

Mybraintraining is a CR program which is available online (no local installation on PC necessary) at http://www.mybraintraining.com/. The program can be used both as a self-help or conventional treatment device (i.e., guided treatment by neuropsychologist or occupational therapist). The program encompasses 30 exercises aimed at stimulating executive functioning. Exercises fall into four broad categories: calculation, logic, memory, and vision. The exercises were designed during development of the "Train your Brain with Dr. Kawashima" program in cooperation with the Industry University Research Project with Professor Dr. Ryūta Kawashima. According to the developers (personal communication), performance of each exercise had to be accompanied by activation of the frontal lobe (presented in the "Scientific Details" part of each exercise).

The difficulty of the sessions automatically adapts to the patients' performance. mybraintraining includes motivating elements as used commonly in video games in order to increase fun and adherence. The administrator can define individual training plans and adapt exercises to each patient's needs (e.g., level of difficulty, varied time limits, etc.). This tool also compiles statistics (e.g., to compare one patient with reference group, number of sessions completed, training success). Data protection and security comply with industry standards.

For the present study, we used the "daily test" tool of mybraintraining Professional which encourages patients to perform a random string of four exercises, one from each category (calculation, logic, memory, and vision).

In addition to the conventional version of mybraintraining Professional, a condition termed metacognitive-augmented CR condition was constructed, which aimed to reduce overconfidence and jumping to conclusions. This version asked participants to make a confidence judgment (certain versus uncertain) after each trial. The program then provided feedback

TABLE 2 | Differences among conditions across time (sample with available pre–post scores).

Variable	Waitlist ($n = 29$)		Standard cognitive remediation ($n = 20$)		Metacognition-augmented cognitive remediation ($n = 20$)		ANOVA (G = group effect, T = time, I = interaction) [for JTC generalized linear equations were applied]
	pre	post	pre	post	pre	post	
Draws to decision	3.72 (2.34)	4.55 3.27)	3.32 (2.36)	2.84 (1.77)	3.20 (2.14)	3.70 (2.27)	G: $F(2;65) = 1.31$, $p = 0.277$, $\eta_p^2 = 0.04$ T: $F(1;65) = 1.64$, $p = 0.204$, $\eta_p^2 = 0.02$ I: $F(2;65) = 3.09$, $p = 0.052$, $\eta_p^2 = 0.09$
JTC (decision after 1st or 2nd fish = 1)	0.38 (0.49)	0.31 (0.47)	0.47 (0.51)	0.53 (0.51)	0.40 (0.50)	0.40 (0.50)	G: Wald $\chi^2(1) = 0.48$, $p = 0.827$ T: Wald $\chi^2(1) = 0.00$, $p = 0.980$ I: Wald $\chi^2(1) = 0.78$, $p = 0.378$
Beck Cognitive Insight Scale – extended							
Self-reflectiveness	8.97 (3.08)	8.72 (2.85)	8.85 (2.30)	9.95 (2.76)	9.70 (3.20)	9.10 (3.91)	G: $F(2;66) = 0.37$, $p = 0.694$, $\eta_p^2 = 0.01$ T: $F(1;66) = 0.06$, $p = 0.813$, $\eta_p^2 = 0.00$ I: $F(2;66) = 1.87$, $p = 0.162$, $\eta_p^2 = 0.05$
Self-certainty	7.72 (2.43)	6.34 (1.91)	7.05 (2.28)	6.85 (2.66)	6.90 (2.31)	6.75 (2.17)	G: $F(2;66) = 0.06$, $p = 0.943$, $\eta_p^2 = 0.00$ T: $F(1;66) = 6.84$, $p = 0.013$, $\eta_p^2 = 0.09$ I: $F(2;66) = 3.56$, $p = 0.034$, $\eta_p^2 = 0.10$
Subjective cognitive dysfunctions	9.45 (3.61)	9.76 (3.47)	8.35 (3.51)	8.35 (4.22)	8.90 (4.04)	9.20 (4.37)	G: $F(2;66) = 0.71$, $p = 0.459$, $\eta_p^2 = 0.02$ T: $F(1;66) = 0.42$, $p = 0.520$, $\eta_p^2 = 0.01$ I: $F(2;66) = 0.10$, $p = 0.904$, $\eta_p^2 = 0.00$
Memory test							
Hits	13.21 (2.35)	13.00 (2.41)	13.63 (2.09)	12.47 (1.65)	14.00 (1.12)	13.05 (1.23)	G: $F(2;65) = 0.58$, $p = 0.563$, $\eta_p^2 = 0.02$ T: $F(1;65) = 6.86$, $p = 0.011$, $\eta_p^2 = 0.09$ I: $F(2;65) = 1.08$, $p = 0.346$, $\eta_p^2 = 0.03$
False memories	1.00 (1.79)	1.38 (2.08)	0.73 (1.24)	1.32 (1.86)	0.45 (0.60)	1.85 (2.81)	G: $F(2;65) = 0.60$, $p = 0.942$, $\eta_p^2 < 0.01$ T: $F(1;65) = 11.55$, $p = 0.001$, $\eta_p^2 = 0.15$ I: $F(2;65) = 1.85$, $p = 0.166$, $\eta_p^2 = 0.05$
All high-confident responses	25.93 (5.79)	24.34 (6.94)	24.42 (5.91)	22.42 (5.62)	27.65 (3.38)	23.50 (6.21)	G: $F(2;65) = 1.05$, $p = 0.356$, $\eta_p^2 = 0.03$ T: $F(1;65) = 11.34$, $p = 0.001$, $\eta_p^2 = 0.15$ I: $F(2;65) = 1.08$, $p = 0.345$, $\eta_p^2 = 0.03$
Psychopathology							
LSHS-R	29.39 (8.37)	29.00 (8.51)	28.85 (9.45)	28.40 (9.99)	28.00 (10.43)	29.25 (11.77)	G: $F(2;65) = 0.03$, $p = 0.971$, $\eta_p^2 = 0.00$ T: $F(1;65) = 0.09$, $p = 0.765$, $\eta_p^2 = 0.00$ I: $F(2;65) = 1.44$, $p = 0.243$, $\eta_p^2 = 0.04$
Paranoia Checklist	40.03 (17.88)	37.55 (16.86)	38.00 (16.67)	32.85 (13.79)	31.35 (17.23)	30.60 (16.59)	G: $F(2;66) = 1.37$, $p = 0.261$, $\eta_p^2 = 0.04$ T: $F(1;66) = 8.33$, $p = 0.005$, $\eta_p^2 = 0.11$ I: $F(2;66) = 1.62$, $p = 0.205$, $\eta_p^2 = 0.05$
CES-D	55.07 (14.49)	50.66 (14.32)	56.75 (13.49)	52.40 (16.30)	47.75 (15.98)	47.15 (15.75)	G: $F(2;66) = 1.42$, $p = 0.250$, $\eta_p^2 = 0.04$ T: $F(1;66) = 6.40$, $p = 0.014$, $\eta_p^2 = 0.09$ I: $F(2;66) = 1.00$, $p = 0.373$, $\eta_p^2 = 0.03$

CES-D, Center for Epidemiologic Studies-Depression Scale; LSHS-R, Launay-Slade Hallucination Scale-Revised; G, main effect of group, T, main effect of time, I, interaction effect of group and time.

in case of hasty and/or high-confident errors (see **Figure 1**). Since the termination of the study, this additional option is now part of the standard program.

Strategy of Data Analysis

Simple cross-sectional analyses were performed using *t*-tests for metric (e.g., age) and cross table statistics for nominal data (e.g., gender distribution). For group comparisons over time we used mixed ANOVAs with Group as the between-subject factor and Time as the within-subject factor when using metric data. In case of binary data (e.g., rate of jumping to conclusions) a generalized estimating equations procedure was performed which was deemed more appropriate than a conventional repeated-measures ANOVA.

Results

Table 1 shows the baseline characteristics of the sample, of which 76 patients could be reached for the post assessment and 38 for the follow-up. No significant differences emerged for any demographic, psychopathological, or cognitive variable.

Across time, medication status did not change between groups ($p > 0.3$). At baseline, 87% of the participants were medicated with antipsychotics, at post (85%) and follow-up (87%) the rate was almost identical. Likewise, treatment status [yes (i.e., outpatient, inpatient, day clinic, practitioner) versus no] did not change between groups across time ($p > 0.5$). Most patients were treated as outpatients (pre: 60%, post: 57.5%, follow-up: 53.3%). Rates did not differ among groups at any point in time ($p > 0.6$).

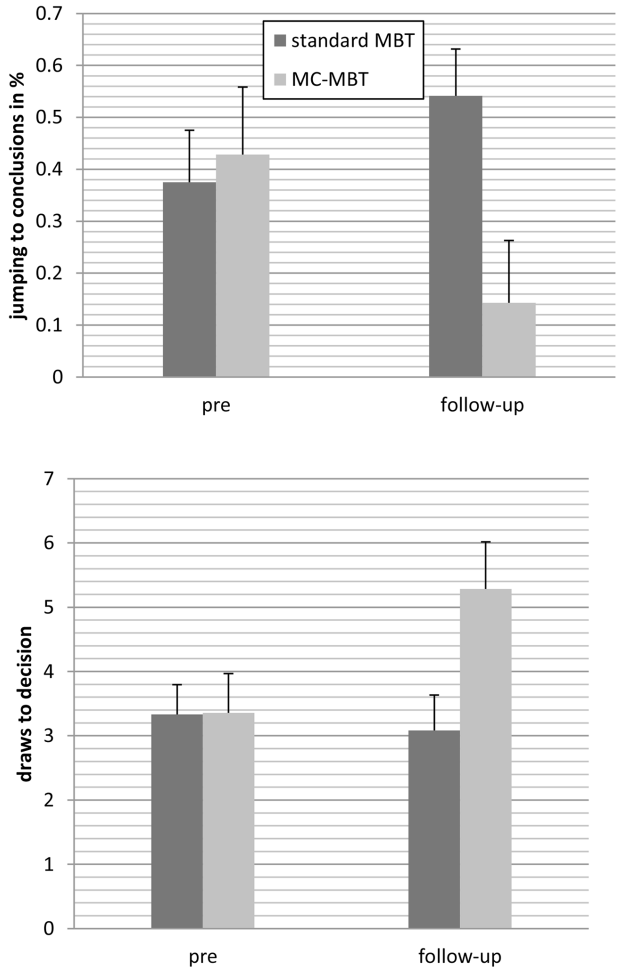

FIGURE 2 | Patients who underwent the metacognition-augmented cognitive remediation program (MC-MBT) showed less jumping to conclusions from baseline to follow-up (upper) and delayed decision-making (lower) relative to participants who received the standard version (MBT; immediately or delayed), respectively.

Pre versus Post

Table 2 shows between-group differences from pre to post for the per protocol sample (i.e., participants in the CR conditions had logged into mybraintraining at least once). Groups did not differ significantly on any symptoms, and cognition measures.

Pre versus Follow-Up

At follow-up, 38 individuals underwent another assessment [metacognition-augmented mybraintraining: $n = 14$; standard mybraintraining (immediate or delayed): $n = 24$]. For draws to decision, the effect of time achieved statistical trend level, $F(1;36) = 3.46$, $p = 0.071$, $\eta_p^2 = 0.09$, while the group effect was insignificant, $F(1;36) = 2.44$, $p = 0.127$, $\eta_p^2 = 0.06$. This was qualified by a significant interaction, $F(1;36) = 5.82$, $p = 0.021$, $\eta_p^2 = 0.14$; **Figure 2** shows that participants in the metacognition-augmented condition showed delayed decision-making while participants in the standard condition showed a tendency toward more jumping to conclusions. Likewise, using generalized estimating equations to fit a repeated-measures logistic regression to jumping to conclusions data (decision after fish 1 or 2), a significant interaction occurred favoring the metacognition-augmented condition, Wald $\chi^2(1) = 4.55$, $p = 0.033$.

For the number of high-confident responses on the memory test the effect of time, $F(1;36) = 5.12$, $p = 0.030$, $\eta_p^2 = 0.125$ but not group, $F(1;36) = 0.11$, $p = 0.737$, $\eta_p^2 < 0.01$ were significant, which was qualified by significant interaction at an almost large effect size, $F(1;36) = 5.59$, $p = 0.024$, $\eta_p^2 = 0.13$. As can be seen in **Figure 3** the number of high-confident responses remained stable in the standard CR group but declined in the metacognition-augmented group.

No significant interaction emerged for depression, $F(1;36) = 0.14$, $p = 0.91$, $\eta_p^2 < 0.01$, paranoia, $F(1;36) = 0.64$, $p = 0.428$, $\eta_p^2 = 0.02$, hits, $F(1;36) = 0.78$, $p = 0.785$, $\eta_p^2 < 0.01$, and false memories, $F(1;36) = 1.23$, $p = 0.276$, $\eta_p^2 = 0.03$.

Retrospective Assessment (Post)

Feasibility and comprehensibility of the training were rated high by respondents and did not differ between the two CR conditions (**Table 3**). Patients were able to perform the tasks alone and rated the exercises as helpful, although only a minority reported symptom improvement.

Correlations between Performance and Adherence with Symptomatology

We examined whether adherence and progress on the CR program impacted outcome variables. Progress in performance in CR memory exercises (slope change measure) was correlated at $r = 0.61$ ($p = 0.026$) with improvement in the memory test from pre to post for the standard mybraintraining group (no other variables turned significant). Gain in overall performance (all exercises combined) in the metacognition-

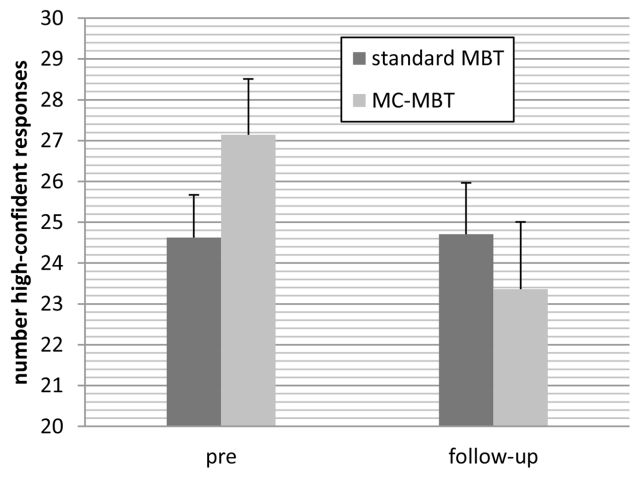

FIGURE 3 | Patients in the metacognition-augmented cognitive remediation condition (MC-MBT) attenuated confidence ratings from baseline to the follow-up period relative to the standard CR group (MBT).

TABLE 3 | Retrospective subjective assessment ("fully applies" and "rather applies" were combined) at post.

Variable	Standard cognitive remediation ($n = 20$)	Metacognition-augmented cognitive remediation ($n = 20$)	Statistics
Program is suitable for self-administration.	95%	100%	$\chi^2 = 1.13$, $p = 0.567$
The instructions of the program were understandable.	85%	85%	$\chi^2 = 1.90$, $p = 0.911$
I considered the exercises as helpful.	65%	70%	$\chi^2 = 0.70$, $p = 0.704$
I was able to regularly perform the exercises in the past weeks.	60%	70%	$\chi^2 = 1.18$, $p = 0.554$
I had to force myself to perform the program regularly.	25%	45%	$\chi^2 = 2.05$, $p = 0.359$
The extent of the training was just right.	75%	60%	$\chi^2 = 1.33$, $p = 0.515$
Other persons have helped me with the program.	10%	0%	$\chi^2 = 10.06$, $p < 0.001$
I think the training is more appropriate in the framework of a psychotherapy.	35%	15%	$\chi^2 = 4.51$, $p = 0.105$
I could integrate the lessons learnt into my daily routine.	45%	20%	$\chi^2 = 4.30$, $p = 0.116$
Symptoms have decreased due to the program.	30%	20%	$\chi^2 = 3.28$, $p = 0.149$

augmented mybraintraining condition correlated with more draws to decision in the fish task, $r = 0.54$, $p = 0.021$ and less jumping to conclusions at trend level, $r = -0.42$, $p = 0.079$. Similarly, the number of exercises performed (objective measure) in the metacognition-augmented mybraintraining condition correlated with less jumping to conclusions significantly ($r = -0.398$, $p = 0.040$) and less draws to decision over time at trend level ($r = 0.353$, $p = 0.071$). Adherence in the standard condition (number of days the CR program was used) was associated with reduction of depression over time ($r = 0.467$, $p = 0.028$). Likewise, number of exercises performed (objective) was correlated with decline of depressive symptoms ($r = 0.482$, $p = 0.023$), again for the standard version only.

Test–Retest Reliability of the Data and Plausibility Checks

Test–retest reliability was determined for pre–post scores only due to the low number of participants at follow-up. Consistency of the psychopathological scales was excellent (CES-D: pre–post: $r = 0.817$, $p < 0.001$; Paranoia Checklist: $r = 0.891$, $p < 0.001$, LSHS-R: $r = 0.936$, $p < 0.001$). The recognition test showed low reliability from pre to post ($r = 0.255$, $p = 0.024$). The correlation between subjective adherence (number of days exercises were performed: 0–7 days/week) and objective number of exercises performed (data extracted from log files) was good ($r = 0.817$, $p < 0.001$).

Discussion

The study set out to examine the effectiveness of conventional as well as metacognition-augmented CR training. Most patients were on antipsychotic medication and in outpatient treatment. Treatment status did not change substantially across time. Special precautions were taken to verify diagnostic status. Speaking for the quality of the data, the test-retest reliability of the questionnaires was very high. Further, subjective and objective adherence were highly correlated.

We used a low-threshold online CR training termed mybraintraining targeting four cognitive domains which according to the developers (personal communication, unpublished data) are linked with metabolic changes in frontal lobe areas. Patients carried out the exercises on their home computer. The program was delivered unguided; no individual adaption was performed apart from automatic adjustments pertaining to difficulty. Our hypotheses were partly confirmed. Group comparisons indicate that conventional CR did not impact any outcome measure suggesting that *cold* cognitive functioning is quite resistant to cognitive training interventions, at least in a rather chronic and subacute psychosis population. At the same time, the CR version showed some interesting correlations with depression: the number of completed sessions was correlated with a reduction on the CES-D which could hint at (but is no proof for) the possibility that training improves well-being. This would be a potentially important finding as neither antipsychotic (Leucht et al., 2009) nor antidepressant medication (Kishi and Iwata, 2014) exert substantial effects on depression in psychosis. Likewise, psychotherapy with cognitive-behavioral therapy only yields a small-to-medium effect according to a meta-analysis (Wykes et al., 2008). However, an opposite causal relationship cannot be fully dismissed: Improvement of well-being may enhance fidelity to perform the tasks. Further, performance gains on the memory task were correlated with improvements on the objective memory test, speaking for the ecological validity of the task. Again, however, group differences were not significant.

At follow-up, the metacognition-enhanced CR training yielded the expected significant effects on the JTC bias (i.e., delayed decision-making) and reduced overconfidence. These

findings are noteworthy since both biases are implicated in the formation of psychosis and JTC is rather resistant to change (Ross et al., 2011; So et al., 2012a,b). This delayed effect is interesting and may indicate that the newly acquired skills need some time to settle before they become manifest. At post, we found substantial correlations between fish task parameters with adherence and performance gain.

At first sight, the results are sobering in face of recent reviews indicating that CR tasks may yield at least small-to-medium effects on objective neurocognitive functioning (McGurk et al., 2007; Wykes et al., 2011). A number of factors may have prevented the hypothesized pattern of results from emerging. First, the training was self-paced, that is, individuals were encouraged to perform the tests daily but in fact many did not perform the tasks on a regular basis. In contrast, in many clinical trials on CR there are frequent appointments and homework is checked by therapists. A certain (cued) participation frequency may be necessary to show an effect. Our weekly email reminders may not have been sufficiently strong cues. Second, the group was not severely ill (mainly outpatient treatment) and self-help was performed predominantly at home as patients were not hospitalized. A chronic and more remitted sample is likely to show less benefit from training than an acute and hospitalized sample (e.g., because of regression to the mean). Thus, a first-episode and CR-naive treatment group may show better outcome. Third, the outcome measures did not cover the full range of domains targeted. In fact, we had only one objective memory test with rather low reliability. Perhaps the training exerted effects on functions not covered by our battery. Future studies should therefore administer a wider range of behavioral tests. Finally, while the initial sample was rather large and we had a good retention rate for the post phase, less than 50% participated in the follow-up.

Conclusion

The metacognition-enhanced CR condition showed delayed changes on two prominent cognitive biases which are implicated in the pathogenesis of positive symptoms: jumping to conclusions and overconfidence. The program under investigation now incorporates these additional metacognitive features which are deemed important as prior studies suggest that JTC is quite resistant to change (see above) and is not only tied to positive symptoms but predicts functional outcome to some degree (Andreou et al., 2014). It seems that the training – like metacognitive training (MCT; Moritz et al., 2014a) – successfully "sows the seeds of doubt." Further studies should investigate whether this leads to a reduction of symptoms in the long run.

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Metacognitive training for delusions (MCTd): effectiveness on data-gathering and belief flexibility in a Chinese sample

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Metacognitive training (MCT) was developed to promote awareness of reasoning biases among patients with schizophrenia. While MCT has been translated into 31 languages, most MCT studies were conducted in Europe, including newer evidence recommending an individualized approach of delivery. As reasoning biases covered in MCT are separable processes and are associated with different symptoms, testing the effect of selected MCT modules would help to develop a targeted and cost-effective intervention for specific symptoms and associated mechanisms. This study tested the efficacy of a four-session metacognitive training for delusions, MCTd (in Traditional Chinese with cultural adaptations, provided individually), as an adjunct to antipsychotics in reducing severity and conviction of delusions, jumping to conclusions (JTC) bias and belief inflexibility. Forty-four patients with delusions were randomized into the MCTd or the wait-list control condition. Patients on wait-list received the same MCTd after 4 weeks of treatment as usual (TAU). Assessment interviews took place before and after the treatment, and at 4-week follow-up. There was an additional baseline assessment for the controls. JTC and belief flexibility were measured by the beads tasks and the Maudsley Assessment of Delusions Scale. Attendance rate of the MCTd was satisfactory (84.5%). Compared to TAU, there was a greater reduction in psychotic symptoms, delusional severity and conviction following MCTd. There was a large treatment effect size in improvement in belief flexibility. Improvement in reaction to hypothetical contradiction predicted treatment effect in positive symptoms and delusions. JTC bias was reduced following MCTd, although the treatment effect was not significantly larger than TAU. Our results support the use of process-based interventions that target psychological mechanisms underlying specific psychotic symptoms as adjuncts to more conventional approaches.

Keywords: psychosis, delusions, metacognitive, reasoning, training, psychological intervention, flexibility, Chinese

Introduction

Psychosis is a complex condition encompassing a range of symptoms (van Os et al., 1999; Bürgy, 2008; Demjaha et al., 2009). In view of heterogeneity of illness experience and treatment needs, psychosocial intervention programs for psychosis have adopted a modular approach (e.g., Addington and Gleeson, 2005; So et al., 2013), including more broad-based interventions for all patients with psychosis (e.g., psychoeducation and support groups, Ascher-Svanum and Krause, 1991; Lincoln et al., 2007; Castelein et al., 2008; Rummel-Kluge and Kissling, 2008; Froböse et al., 2014), and more focused interventions for specific psychotic symptoms (e.g., cognitive-behavioral therapy for voices and delusions, Morrison and Renton, 2001; Trower et al., 2004; Freeman et al., 2008; Hagen et al., 2011; Thomas et al., 2011). Large-scale randomized-controlled studies and meta-analyses have found cognitive-behavioral therapy for psychosis (CBTp) to be effective in reducing treatment-resistant psychotic symptoms as well as depression in association with psychosis (Tarrier and Wykes, 2004; Garety et al., 2008; Wykes et al., 2008; National Institute of Clinical Excellence [NICE], 2014; Turner et al., 2014). However, effect sizes (0.2–0.4) were modest, especially in better-controlled trials, and there is a call to improve CBTp by focusing more on the cognitive mechanisms of change (Velligan, 2009; Garety et al., 2014; Jauhar et al., 2014).

Research has shown that a number of reasoning processes contribute to the development and maintenance of delusions (see reviews by So et al., 2010; Garety and Freeman, 2013; Freeman and Garety, 2014). In contrast to neurocognitive deficits such as memory and attention, these processes pertain to the way individuals gather and process information towards making a decision or interpreting experiences. These processes include the 'jumping to conclusions' (JTC) data-gathering bias, lack of belief flexibility, externalizing attributional style, and theory of mind deficit. JTC is a tendency for individuals to make decisions based on insufficient data-gathering, which is usually measured using the Beads task (Garety et al., 1991). Newer JTC studies have shown that patients with psychosis are not only hastier in data-gathering than non-clinical individuals, but also more confident in their decisions (Moritz et al., 2006; Kircher et al., 2007), suggesting the possibility that over-confidence in errors maintains delusional beliefs (Moritz et al., 2013). Lack of belief flexibility is a difficulty in appreciating that one may be mistaken of his/her delusional belief, and in accommodating alternative explanations (Freeman et al., 2004).

According to Moritz et al. (2010), the reasoning biases that have been identified in psychosis are separate factors and should be targeted independently in intervention. Our systematic review (So et al., 2010) further confirmed that different reasoning processes are related to different symptoms of psychosis. While JTC and lack of belief flexibility are closely associated with delusions, theory of mind deficit relates more to disorganization and negative symptoms than to positive symptoms, and attributional style may be related to overall psychopathology rather than to specific symptoms. In addition, JTC and lack of belief flexibility are associated with the strength of delusions (i.e., conviction), and predict treatment response (So et al., 2010).

Although JTC and lack of belief flexibility did not improve in response to antipsychotics (Peters and Garety, 2006; So et al., 2012), research suggests that they are potential moderating and mediating variables which, when effectively ameliorated, may promote improvement in delusions (Garety et al., 1997, 2014; Menon et al., 2008; Dudley et al., 2013; Sanford et al., 2013; So et al., 2014). As suggested by Freeman (2011), evaluating the effect of process-based interventions on clearly defined etiological factors and subsequent change in delusions provides a rigorous methodology for advancing understanding of the causes of delusions.

Metacognitive training (MCT) aims at raising patients' awareness of metacognitive disturbances so as to improve their repertoire of problem solving and to prevent relapse (Moritz and Woodward, 2007; Moritz et al., 2014a). Although MCT and CBTp both aim to improve psychotic symptoms and prevent relapse, their therapeutic components and processes are different. CBTp includes active therapy techniques as follows: enhancing self-regulatory strategies, development of a personal model of psychosis and relapse, work on reinterpreting the meaning of delusional beliefs and hallucinations, schema work, and relapse prevention (Dunn et al., 2012). Unlike CBTp, MCT does not emphasize patients' idiosyncratic belief systems or their views about psychosis. Rather than focusing directly on the content of patients' delusional beliefs and their associated emotions, MCT takes the 'back door approach,' identifying and discussing at length the underlying cognitive processes that contribute to the delusional interpretations of experiences (Moritz et al., 2011a; Kumar et al., 2014). This non-directive approach in addressing delusional beliefs and underlying reasoning biases is considered to be less threatening to participants and potentially helpful in minimizing treatment resistance (Moritz et al., 2014a).

The original MCT program consists of eight sessions. Each session focuses on one of the following cognitive biases: 'JTC' bias, attributional biases, bias against disconfirmatory evidence, social cognition (empathy and theory of mind), over-confidence in errors, and depressive cognition (Moritz and Woodward, 2007). Designed to be delivered as a psychoeducation group, MCT sessions are highly structured and manualized (http://www.uke.de/mct). Each MCT session consists of the following components:

(i) introduction and normalization of a specific reasoning bias, illustrated by historical events and daily life examples;
(ii) enhancing experiential learning about the bias by engaging group members in a series of exercises using cartoons, artwork or non-personalized daily-life events; and
(iii) linking the bias to problematic coping in general and symptoms of psychosis in particular.

An individualized format of MCT, the MCT+, has been subsequently developed as an extension to include generation of an illness model and a recovery plan, as well as intervention for negative symptoms (Vitzthum et al., 2014). Compared with MCT,

MCT+ takes longer (i.e., 10 sessions) and includes treatment components more comparable to CBTp (Moritz et al., 2011b).

Since its advent, efficacy of the MCT has been put to test in 17 small-to-medium sized studies, including randomized controlled trials (see review by Moritz et al., 2014a; see also Gawęda et al., 2015). MCT had shown superior effects over various control conditions, including treatment as usual (TAU; in most trials) and active controls such as CogPack and supportive therapy, with effect sizes ranging from small to large on positive symptoms including delusions (Moritz et al., 2014a). In the MCT trial that consisted of patients with delusions only (Kumar et al., 2010), there was a medium-to-large treatment effect on PANSS positive score, but change in delusions or delusional dimensions was not reported. There is emerging evidence supporting a longer-term efficacy of MCT, with a reduction in positive symptoms sustained up to 3 years after intervention (Favrod et al., 2014; Moritz et al., 2014b).

The MCT has been translated into 31 languages, and there is new evidence of the efficacy of MCT beyond Germany, where it originates (Kumar et al., 2010; Favrod et al., 2014; Kuokkanen et al., 2014; van Oosterhout et al., 2014; Gawęda et al., 2015). The Traditional Chinese version of the MCT has recently been tested for the first time (Lam et al., 2014). However, this trial focused on cognitive insight and self-efficacy only, without a report of symptom changes.

Treatment efficacy on the JTC bias had been reported in four group-based MCT trials (Aghotor et al., 2010; Moritz et al., 2011a, 2014b; Gawęda et al., 2015), with inconsistent findings. However, studies that tested individualized training or blended versions appeared to have more positive results for JTC. Moritz et al. (2011b) reported that the combined MCT/MCT+ intervention yielded a superior improvement in severity and conviction of delusions as well as JTC bias than an active control condition. Ferwerda et al. (2010) also reported a significant reduction in paranoid delusions, data-gathering and cognitive flexibility following MCT+. In Waller et al. (2011) and Garety et al. (2014), patients with delusions had significant improvements in JTC and delusional conviction following the one-session Maudsley Review Training Program (MRTP). The MRTP is a computerized treatment program with a particular focus on JTC and belief flexibility and their links with delusions. Unlike MCT, MRTP incorporates material intended to be salient and personally relevant, and encourages use of strategies through interactive tasks. The MRTP studies also provided the only evidence for change in belief flexibility following MCT-based intervention, although the change in belief flexibility was evident only after 2 weeks of post-treatment homework exercises whereas JTC change took place immediately after treatment. The success of the MRTP trial suggests that selected modules of the MCT can be delivered with efficacy that is clinically and statistically significant. It also supports a combination of MCT elements and individualized applications of the learnt skills.

The present study examined the efficacy of a brief four-session package of the Traditional Chinese MCT for delusions (MCTd) in reducing severity and conviction of delusions, JTC and belief inflexibility. As the study aimed to examine treatment outcome in delusions, only the modules related to data-gathering and belief flexibility were included in MCTd. Based on findings from Waller et al. (2011) and Garety et al. (2014), MCTd was delivered individually.

Key hypotheses of the study were as follows:

(1) The four-session package of MCTd will be considered feasible, acceptable and useful by patients with delusions
(2) There will be a greater reduction in severity and conviction of delusions after MCTd than wait-list
(3) There will be a greater improvement in data-gathering and belief flexibility after MCTd than wait-list
(4) Treatment effect on delusions will be mediated by improvement in cognitive biases (JTC and belief flexibility).

Materials and Methods

Clinical Ethics

Ethics approval and site approval were obtained from the Kowloon West Cluster Research Ethics Committee [Reference number: KW/EX-13-062(62-14)] and the Joint Chinese University of Hong Kong – New Territories East Cluster Clinical Research Ethics Committee [Reference number: CRE-2013.035].

Participants

Participants were outpatients who presented with delusions [scoring 4 or above on at least one of the delusion items on the Positive and Negative Syndrome Scale (PANSS), Kay et al., 1987] and had a casenote diagnosis of a schizophrenia spectrum disorder. Participants were on antipsychotics for at least a month, and were recruited from psychiatric clinics of the Hong Kong Hospital Authority. Patients with drug-induced psychosis or organic psychosis, patients with intellectual disability, and patients with a primary diagnosis of substance misuse were excluded.

Design

Procedure

In this randomized wait-list controlled study, consented participants were randomized into the MCTd condition or a wait-list condition (see **Figure 1** for the CONSORT diagram). Assessment took place before treatment, at the completion of treatment, and 4 weeks after (i.e., follow-up). The wait-list control group had an additional baseline assessment at the beginning of the waiting period (i.e., 4 weeks before the pre-treatment assessment).

All assessments were administered by a research assistant blinded to group allocation.

Metacognitive Training for Delusions

The MCTd included modules 2 and 7 (JTC), module 3 (Changing beliefs), and module 5 (Memory – Overconfidence in errors) of the original MCT program (manual and session materials downloadable from http://www.uke.de/mct). The sessions (1-hour each) took place once a week, over four consecutive weeks. All the MCTd sessions were delivered by a

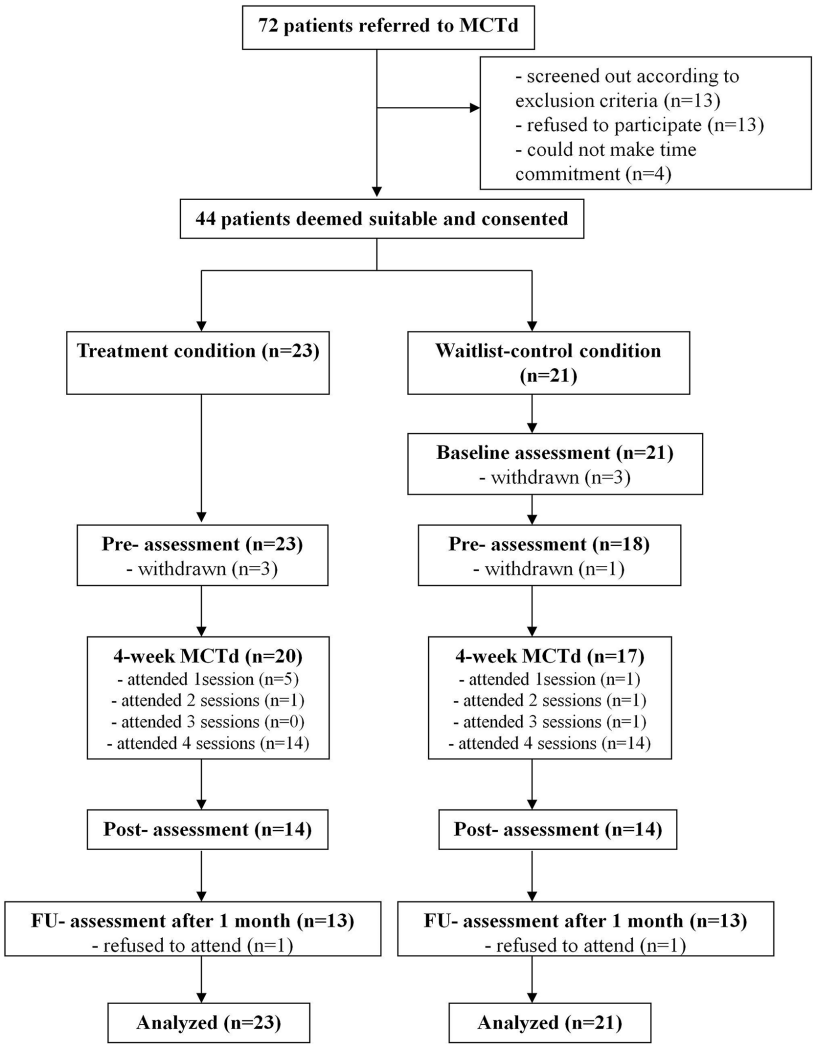

FIGURE 1 | Consort diagram of the study design.

qualified clinical psychologist who specializes in psychosis. The therapist received MCT training from the original authors of the MCT, and received regular training and supervision from the first author. Following the MCT manual, each MCTd session consists of (i) general introduction and normalization of the reasoning bias, (ii) illustration of the bias using interactive exercises where the participant was asked to make judgments and interpret events, and (iii) discussion on the link between the reasoning bias and delusional thinking, supported by scientific evidence.

Informed by studies using the individualized versions of MCT (e.g., Moritz et al., 2011b; Waller et al., 2011; Garety et al., 2014), we have made several adaptations to the MCTd. Firstly, MCTd was delivered in a one-on-one format, allowing the therapist to pace the sessions according to the individual's learning.

Secondly, part 3 of the session (i.e., discussion of the link between the reasoning bias and delusional thinking) was extended and enhanced in MCTd to identify specific examples of the patient's own experiences where the reasoning bias is in action. Whilst MCT groups also encourage participants to link their learning to their daily life, the discussion is more generic. In MCTd, the discussion bridged the reasoning bias with actual experiences and beliefs (which may include delusional beliefs if the patient was ready to discuss that), consolidating the individual's reflection on how the bias affected the way s/he interprets his/her own idiosyncratic experiences, worries, symptoms, and daily life problems. This adaptation renders the format of MCTd more comparable to that of MCT+ than to MCT.

Thirdly, to deepen the individual's learning after the session, each participant was given a handout which consists of (i) a summary of the learning points in the session, (ii) pictures abstracted from the session slides that would remind participants of the key points, and (iii) two reflective questions. Question 1 concerns the participant's own recent experiences on which the reasoning bias had an impact. Question 2 concerns strategies that the participant could practice in a similar situation in the future.

Participants were told how to fill out the handout before the end of each session, and were asked to bring back the completed handout for discussion in the next session.

While the Traditional Chinese and Simplified Chinese versions of MCT are available on the MCT website, no local adaptations have been made to the content of the modules. According to Bernal et al. (2009, p. 362), cultural adaptation for treatment protocols includes not just translation, but a "systematic modification. . . to consider language, culture, and context in such a way that is compatible with the client's cultural patterns, meaning, and values." Such adaptation is particularly important for MCT because the therapeutic process relies heavily on the discussion of daily life experiences commonly observed in the community. Without a clear understanding of the scenarios used, participants might encounter difficulty comprehending what the scenarios intend to explain.

The authors of the present study went through the presentation slides systematically to identify scenarios and examples that appeared to be more familiar to the West than to the Hong Kong Chinese population. We then came up with a list of alternative examples that were deemed culturally neutral or more relevant to the local Hong Kong Chinese service users. Two patients with delusions were invited to comment on the familiarity and relevance of the original (Western) scenarios and the newly suggested (local) scenarios. Based on their suggestions, some of the slides were revised. For example, the conspiracy theory about Paul McCartney's death, which was used to illustrate JTC in the original MCT, was substituted by a classic local myth about keeping pregnancy secretive during the first trimester so as to avoid miscarriage. Another scenario in the original MCT using the story of a man who believed himself to be the successor of the Prussian throne to explain JTC was replaced with a scenario about a lady misperceiving her colleagues' non-verbal cues as persecutory threats. In addition, following the pilot patients' comments and suggestions, some wordings on the presentation slides and handouts were adapted (e.g., "Stalinism" was replaced with "Communism," formal Chinese words were replaced with more colloquial spoken Cantonese words). To finalize the adaptation for the actual study, two clinical psychologists and one psychiatrist (all Cantonese speakers) were invited to review the overall presentation and clarity of the modified version of presentation slides and handouts. Some of the modified slides are shown in **Figure 2**.

Wait-List Condition

Participants on the wait-list condition received MCTd 4 weeks after baseline, provided by the same therapist. During the 4-week waiting period, participants would receive TAU, which includes outpatient assessment, psychiatric follow-up and pharmacological intervention (antipsychotics). There was no formal psychological treatment during the waiting period.

Measures

Clinical Rating Scales (Baseline, Pre-Treatment, Post-Treatment, and Follow-Up)

The PANSS Kay et al. (1987) is a 30-item, seven-point (1–7) rating scale developed for assessing phenomena associated with schizophrenia. Symptoms over the past week are rated. The PANSS has four scores: positive (seven items), Negative (seven items), General psychopathology (16 items), and Total (30 items). Good psychometric properties for the PANSS have been reported (Kay et al., 1987, 1989; Kay, 1990).

The Psychotic Symptom Rating Scales (PSYRATS; Haddock et al., 1999) is a 17-item, five-point (0–4) scale measuring multiple dimensions of auditory hallucinations and delusions. Symptoms over the past week are rated. Two scores are obtained: auditory hallucinations (11 items) and Delusions (6 items). The PSYRATS has good psychometric properties (Haddock et al., 1999) and has been used as outcome measure for psychological interventions for psychosis (Lewis et al., 2002; Durham et al., 2003).

Reasoning Bias Measures (Baseline, Pre-Treatment, Post-Treatment, and Follow-Up)

The Maudsley Assessment of Delusions Scale (MADS; Wessely et al., 1993; Garety et al., 2005) is a standardized interview that assesses eight dimensions of delusional experience. The belief maintenance section of the MADS inquires about the evidence for the delusion. In this section, the participant is asked whether it is possible for him/her to be mistaken about the evidence for the delusion. The interviewer also presents a hypothetical but plausible piece of evidence in contradiction to the delusion. Whether the participant reports that this would reduce conviction in the delusion is recorded. Responses to these questions have been used to assess belief flexibility in large-scale studies (Freeman et al., 2004; Garety et al., 2005).

To assess the JTC bias, two versions of the beads task (Garety et al., 1991) were used. In the original version of the beads task, individuals are presented with two jars each containing 100 colored beads. One of the jars contains 85 beads of color A and 15 beads of color B, while the other jar contains 85 beads of color B and 15 beads of color A. Individuals are told that beads will be drawn, one at a time, from one of the jars, and will then be replaced. They can see as many beads as they like before deciding from which jar the beads are drawn. Apart from the original version (consisting of 85:15 beads of two colors; Garety et al., 1991), this study also included the more difficult version (consisting of 60:40 beads of two other colors; Dudley et al., 1997). The variable is the number of beads the participant requests to view before his/her decision. The "JTC" bias is defined as making a decision with two beads or fewer (Garety et al., 2005).

For both beads tasks, once participants have decided on the jar that the beads were drawn from, they were asked to rate on their confidence in their decision. This procedure had been used in McKay et al. (2006) and Warman (2008).

Estimate Level of General Intelligence (Baseline or Pre-Treatment Only)

All participants were administered a three-subtest short form of the Taiwanese version of Wechsler Adult Intelligence Scale (Third Edition; WAIS-III; Weschler et al., 2002), the version commonly used in Hong Kong. This short form (Vocabulary,

FIGURE 2 | Samples of modified slides used in Metacognitive Training for Delusions (MCTd).

Matrix Reasoning, and Information) had been reported to have high reliability and validity (Sattler, 2008). The sum of the age-scaled scores was used as an estimate of the participant's general intellectual functioning.

Subjective Satisfaction and Effectiveness (Post-Treatment Only)

Upon completion of treatment, participants were asked to rate on eight questions about satisfaction and subjective efficacy of the treatment (e.g., "The training was useful, interesting and sensible"; "I would recommend the training to others," "I found the training easy to grasp and enjoyable," "I could apply what I have learnt in daily life," "MCT helped reduce my emotional, behavioral and cognitive distress" and "MCT is an important part of my treatment plan"). The total satisfaction score ranged from 8 to 40.

Statistical Analysis

For hypothesis 1, descriptive statistics of treatment compliance and subjective satisfaction ratings were reported, using data of

patients on both randomized conditions, following the intention-to-treat principle.

For hypotheses 2 and 3, changes in primary outcome measures were analyzed in two stages. The first stage of analysis aimed to test the hypotheses that change during MCTd is greater than change during the waiting period (i.e., TAU). In this stage, differences in outcomes between pre- and post-treatment assessments in the treatment condition were compared against differences between baseline and pre-treatment assessments in the wait-list condition. For changes in continuous variables (PANSS and PSYRATS scores), the outcome variables were entered as DVs, Time was entered as within-subject IV and randomized condition was entered as between-subject IV in mixed-design ANOVAs. For categorical measures (data-gathering and belief flexibility), changes in outcome variables were coded into binary variables (i.e., 1 = improvement; 0 = no improvement) for binary logistic regression. In order to compare the effect of MCTd and TAU, effect sizes of the outcome variables [Cohen's (1988) *d* and phi coefficients for continuous and categorical variables respectively] were calculated using change scores after MCTd for the treatment condition and change scores after TAU for the wait-list condition.

The second stage of analysis tested the MCTd treatment efficacy across time points, using data from both conditions. We tested changes across pre-treatment, post-treatment and follow-up assessments. In this stage of analysis, mixed-design ANOVAs were calculated for continuous outcome measures, with planned Bonferroni-corrected contrasts. Outcome variables were entered as DVs, Time was entered as within-subject IV and randomized condition was entered as between-subject IV. Cochran's *Q*-tests were performed for categorical outcome measures, with *post hoc* McNemar tests. In this two-stage analysis, all available data were used. If a participant missed one assessment time point, that time point would be dropped whereas the remaining time points were retained in the analysis.

To examine the role of JTC and belief flexibility as mediators of treatment (Hypothesis 4), linear regression models were tested using data from participants who completed the pre-treatment and post-treatment assessments. In these respective models, treatment change in reasoning biases (JTC and belief flexibility) was IV and treatment change in delusions (severity and conviction) was DV, controlling for pre-treatment level of delusions.

Statistical analysis was conducted on the IBM SPSS Statistics for Windows, Version 21.0 (IBM Corp. Released, 2012).

Results

Demographic and Clinical Data

The sample consisted of 44 Chinese participants, including 24 (54.5%) male and 20 (45.5%) female. Their mean age was 33.91 years (SD = 11.94). Psychiatric diagnoses, according to the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision (DSM-IV-TR; American Psychiatric Association [APA], 2000), were available from 41 patients' medical records as follows: schizophrenia 25 (61.0%); delusional disorder 8 (19.5%); schizoaffective disorder 1 (2.4%); psychotic disorder not otherwise specified 3 (7.3%); severe depression with psychotic symptoms 3 (7.3%); bipolar disorder 1 (2.4%). All but one participants ($N = 43$) were on antipsychotic treatment at the time of recruitment: 42 patients were on atypical antipsychotics (Risperidone, Olanzapine, Quetiapine, Amisulpiride, Clozapine, and Aripiprazole) and one was on Flupentixol. Mean dose of antipsychotics in chlorpromazine equivalents (CPZ; Woods, 2003; Andreasen et al., 2010) was 280.74 mg/day (SD = 216.43).

The overall mean PANSS scores were as follows: positive 20.68 (SD = 4.85), negative 14.70 (SD = 5.29), general 39.75 (SD = 9.20), total 75.14 (SD = 16.32). Mean score of the PANSS delusions item (P1) was 5.30 (SD = 0.88). A majority ($n = 36$; 81.82%) of patients scored 3 or above on the PANSS suspiciousness item (P6), whereas 15.91% ($n = 7$) scored 3 or above on the PANSS grandiosity item (P5). On PSYRATS, mean delusions score was 17.64 (SD = 2.72) and mean conviction score was 3.27 (SD = 0.69), with 40 patients (90.91%) reporting conviction of 50% or above and 17 patients (38.6%) reporting full conviction (100%).

Twenty-three participants were randomized to the treatment condition, and 21 to the wait-list control condition. As shown in **Table 1**, the randomized groups were matched on gender, age,

TABLE 1 | Demographic and clinical variables at baseline.

Measures	Treatment condition ($N = 23$)	Wait-list control condition ($N = 21$)	Group difference
Gender	Male 12 Female 11	Male 12 Female 9	$\chi^2(1, n = 44) < 0.01, p = 0.951$
Age	32.35 (12.87)	35.62 (10.89)	$U = 190.50, p = 0.230$
Years of education	($n = 21$) 11.67 (2.78)	($n = 21$) 12.81 (3.19)	$U = 171.50, p = 0.209$
Sum of WAIS subtest scaled scores	($n = 22$) 21.55 (6.04)	($n = 18$) 24.72 (9.76)	$t(38) = -1.26, p = 0.215$
PANSS total	80.13 (16.80)	69.67 (14.22)	$t(42) = 2.22, p = 0.032$
PANSS positive	21.48 (5.33)	19.81 (4.20)	$t(42) = 1.15, p = 0.259$
PANSS delusions	5.35 (0.89)	5.24 (0.89)	$t(42) = 0.41, p = 0.684$
Number of admissions	1.62 (0.35)	0.93 (0.20)	$t(41) = 0.73, p = 0.472$
Dosage of antipsychotics (CPZ)	217.36 (172.37)	336.79 (248.41)	$U(42) = 177.00, p = 0.127$

level of education, and sum of WAIS-III subtest scaled scores ($p > 0.05$). The groups did not differ in primary psychiatric diagnosis ($p > 0.05$). The groups were also matched on number of admissions, mean dose of antipsychotics in chlorpromazine equivalents, and most PANSS scores, including suspiciousness and grandiosity items ($p > 0.05$). However, the treatment group had a higher PANSS total score than wait-list controls ($p = 0.032$).

Treatment Compliance and Satisfaction

Metacognitive training for delusions attendance rates are shown in **Figure 1**. Independent-samples *t*-tests revealed no significant group difference in attendance rate ($p > 0.05$). Number of sessions attended was not associated with age, years of education, sum of WAIS-III subtest scores, family income, or PANSS scores ($p > 0.05$).

As shown in **Table 2**, participants reported a high level of subjective satisfaction of the intervention. The randomized groups did not differ significantly on the overall level of subjective satisfaction ($p > 0.05$).

Efficacy on Severity and Conviction of Delusions

Levels of severity and conviction of delusions and their test statistics are shown in **Table 3**.

Mixed-design ANOVAs comparing change before and after MCTd in the treatment condition and change before and after TAU in the wait-list condition revealed significant Group × Time interaction effects on PANSS positive score ($p < 0.001$), PANSS delusions score ($p < 0.001$), PSYRATS delusions score ($p < 0.001$), and PSYRATS conviction score ($p = 0.008$), indicating that changes during MCTd were significantly different from changes during TAU in these outcome measures. Group × Time interaction effects on these PANSS and PSYRATS scores remained significant after controlling for baseline PANSS total score ($p < 0.05$). Compared to change after TAU, there was a large effect size of change after MCTd for PANSS positive score ($d = -1.71$), PANSS delusions score ($d = -1.86$), PSYRATS delusions score ($d = -1.63$), and PSYRATS delusional conviction ($d = -0.98$).

Mixed-design ANOVAs for the entire sample revealed that there was a significant change over time (from pre-treatment to follow-up) in PANSS positive score, PANSS delusions score, PSYRATS delusions score, and PSYRATS conviction score ($p < 0.001$; see **Table 3**). There was no significant Group × Time interaction for these PANSS and PSYRATS scores ($p > 0.05$), indicating that changes after treatment did not differ between the two randomized conditions.

Post hoc Bonferroni tests revealed significant improvements between pre- and post-treatment assessments, and between pre-treatment and follow-up assessments, in PANSS positive score, PANSS delusions score, PSYRATS delusions score, and PSYRATS conviction score ($p < 0.05$, see **Table 3**).

Effect on Data Gathering and Belief Flexibility

Change in Data Gathering

Change in JTC bias is shown in **Table 4**.

At baseline, the two randomized groups were not significantly different in the number of beads drawn to decision (DTD) or confidence ratings in their decisions on either beads task ($p > 0.05$). Percentage of participants showing a JTC bias (defined by DTD ≤ 2) was also not different between groups on either beads task ($p > 0.05$).

Mixed-design ANOVAs and binary logistic regression comparing change before and after MCTd in the treatment condition and change before and after TAU in the wait-list condition revealed no significant group difference in changes in DTD, JTC bias or decision confidence on either beads task ($p > 0.05$). Therefore, changes in these data-gathering measures were not significantly different following MCTd or TAU.

Mixed-design ANOVAs for the entire sample revealed that there was a significant change over time in DTD on both beads tasks ($p < 0.05$; see **Table 4**). Change in decision confidence was at a trend level for the 85:15 task ($p = 0.053$) and was not significant for the 60:40 task ($p > 0.05$). Cochran's *Q*-tests showed significant reductions over time in JTC bias on both beads tasks ($p < 0.05$).

Post hoc Bonferroni tests revealed significant improvements between pre- and post-treatment assessments, and between pre-treatment and follow-up assessments, in DTD on the 60:40 beads task ($p < 0.05$, see **Table 4**). Decision confidence did

TABLE 2 | Ratings of subjective satisfaction towards Metacognitive Training for Delusions (MCTd).

Item (score range: 1–5)	Treatment condition ($N = 12$)		Wait-list condition ($N = 14$)		Whole sample ($N = 26$)	
	Mean	SD	Mean	SD	Mean	SD
(1) This intervention is useful.	4.25	0.62	4.21	0.43	4.23	0.51
(2) I can apply what I have learnt in daily life.	4.08	0.52	4.21	0.58	4.15	0.54
(3) This intervention is an important part of my treatment plan.	4.00	0.00	4.07	0.48	4.04	0.34
(4) This intervention helps to reduce my emotional, cognitive and behavioral distress.	4.17	0.39	4.29	0.47	4.23	0.43
(5) This intervention is interesting.	4.08	0.29	3.93	0.62	4.00	0.49
(6) This intervention is easy to understand.	4.00	0.43	3.93	0.62	3.96	0.53
(7) I enjoyed the intervention.	4.25	0.45	4.21	0.43	4.23	0.43
(8) I would recommend this intervention to others.	3.92	0.67	4.21	0.70	4.08	0.69

TABLE 3 | Comparisons of severity and conviction of delusions across time points.

Measures	Wait-list condition				Treatment condition			Overall change between pre-treatment, post-treatment, and follow-up assessments	*Post hoc* pairwise comparisons
	Baseline	Pre	Post	Follow-up	Pre	Post	Follow-up	Effect of time	
PANSS positive	19.81 (4.20)	18.65 (5.27)	12.36 (4.34)	11.54 (5.13)	21.48 (5.33)	13.64 (4.57)	13.23 (6.50)	Wilks' $\lambda = 0.31$, $F(2,23) = 26.09$, $p < 0.001$, observed power = 1.00, $\eta_p^2 = 0.69$	Post–Pre ($p < 0.001$) FU–Pre ($p < 0.001$) FU–Post ($p = 0.917$)
PANSS delusions	5.24 (0.89)	5.41 (1.18)	2.93 (1.27)	2.54 (1.56)	5.35 (0.89)	3.36 (1.45)	3.15 (1.91)	Wilks' $\lambda = 0.22$, $F(2,23) = 40.10$, $p < 0.001$, observed power = 1.00, $\eta_p^2 = 0.78$	Post–Pre ($p < 0.001$) FU–Pre ($p < 0.001$) FU–Post ($p = 0.262$)
PSYRATS delusions	17.62 (2.50)	16.35 (5.18)	7.29 (4.97)	6.77 (5.48)	17.61 (2.92)	8.93 (5.76)	8.00 (7.04)	Wilks' $\lambda = 0.20$, $F(2,23) = 45.65$, $p < 0.001$, observed power = 1.00, $\eta_p^2 = 0.80$	Post–Pre ($p < 0.001$) FU–Pre ($p < 0.001$) FU–Post ($p = 1.000$)
PSYRATS conviction	3.33 (0.58)	3.29 (0.59)	1.93 (1.44)	2.23 (1.36)	3.22 (0.80)	2.21 (1.12)	1.85 (1.57)	Wilks' $\lambda = 0.46$, $F(2,23) = 13.26$, $p < 0.001$, observed power = 0.99, $\eta_p^2 = 0.54$	Post–Pre ($p < 0.001$) FU–Pre ($p = 0.001$) FU–Post ($p = 1.000$)

not change significantly during the treatment, but increased (at a marginally significant level) on the 85:15 task during the follow-up period. *Post hoc* McNemar tests revealed that difference between pre-treatment and follow-up assessments of the JTC bias was significant on the 85:15 task ($p = 0.008$) and marginally significant on the 60:40 task ($p = 0.057$).

Change in Belief Flexibility

Changes in belief flexibility are shown in **Table 5** and **Figures 3** and **4**.

At baseline, there was no significant group difference in the possibility of being mistaken (PM) measure or the reaction to hypothetical contradiction (RTHC) measure of belief flexibility ($p > 0.05$).

Binary logistic regression comparing change before and after MCTd in the treatment condition and change before and after TAU in the wait-list condition indicated a significant group difference in RTHC change [$\beta = 2.93$, SE = 0.96, Wald χ^2 (1) = 9.37, $p = 0.002$] but not in PM change [$\beta = 1.73$, SE = 0.93, Wald χ^2 (1) = 3.48, $p = 0.062$]. This indicates that change in RTHC during MCTd was significantly different from change in RTHC during TAU. The group difference in RTHC change remained significant after controlling for baseline PANSS total score ($p < 0.05$). Compared to change after TAU, there was a large effect size of change after MCTd for both PM ($\varphi = 0.92$) and RTHC ($\varphi = 1.46$).

Using data of the entire sample, Cochran's *Q*-test revealed a significant improvement in both PM and RTHC across three time points ($p < 0.05$). *Post hoc* McNemar tests showed significant improvements in both belief flexibility measures between pre- and post-treatment assessments and between pre-treatment and follow-up assessments ($p < 0.05$; see **Table 5**).

Cognitive Processes as Mediators of Treatment Effect on Delusions

Regression analyses revealed that treatment change in DTD or confidence ratings on either beads task did not predict change in PANSS and PSYRATS scores ($p > 0.05$). Improvement in JTC bias (yes/no) on either beads task did not predict improvement in PANSS or PSYRATS scores ($p > 0.05$).

Treatment change in PM (yes/no) did not significantly predict change in PANSS and PSYRATS scores ($p > 0.05$). However, treatment change in RTHC (yes/no) predicted changes in PANSS positive ($\beta = -0.50$, SE = 1.78, $t = -2.95$, $p = 0.007$), PANSS delusions ($\beta = -0.40$, SE = 0.48, $t = -2.23$, $p = 0.035$), PSYRATS delusions ($\beta = -0.56$, SE = 1.67, $t = -3.46$, $p = 0.002$), and PSYRATS conviction ($\beta = -0.40$, SE = 0.48, $t = -2.23$, $p = 0.035$). After controlling for baseline scores, treatment change in RTHC remained a significant predictor of treatment changes in PANSS positive ($\beta = -0.41$, SE = 1.41, $t = -3.05$, $p = 0.005$), PSYRATS delusions ($\beta = -0.59$, SE = 1.72, $t = -3.54$, $p = 0.002$), and PSYRATS conviction ($\beta = -0.37$, SE = 0.48, $t = -2.08$, $p = 0.048$). Participants who improved in RTHC had more reduction in positive symptoms and delusions after treatment.

TABLE 4 | Comparisons of jumping to conclusions bias and over-confidence in decisions across time points.

Measures	Wait-list condition				Treatment condition			Overall change between pre-treatment, post-treatment, and follow-up assessments	*Post–hoc* pairwise comparisons
	Baseline	Pre	Post	Follow-up	Pre	Post	Follow-up	Effect of time	
85:15 beads task – DTD	2.52 (4.16)	2.53 (3.74)	3.79 (5.45)	5.08 (7.15)	1.52 (0.73)	2.29 (1.86)	3.00 (2.16)	Wilks' $\lambda = 0.74$, $F(2,23) = 3.95$, $p = 0.034$, observed power $= 0.65$, $\eta_p^2 = 0.26$	Post–Pre ($p = 0.080$) FU-Pre ($p = 0.062$) FU-Post ($p = 0.799$)
60:40 beads task – DTD	3.14 (4.48)	3.71 (5.06)	5.21 (6.60)	6.69 (7.13)	2.00 (1.24)	3.57 (3.03)	4.08 (3.12)	Wilks' $\lambda = 0.67$, $F(2,23) = 5.57$, $p = 0.011$, observed power $= 0.81$, $\eta_p^2 = 0.33$	Post–Pre ($p = 0.021$) FU-Pre ($p = 0.013$) FU-Post ($p = 0.913$)
85:15 beads task – JTC (%)	80.95	88.24	71.43	69.23	87.06	64.29	46.15	Cochran's Q $(2,26) = 9.46$, $p = 0.009$	Post–Pre ($p = 0.070$) FU-Pre ($p = 0.008$) FU-Post ($p = 0.687$)
60:40 beads task – JTC (%)	66.67	58.82	50.00	38.46	73.91	50.00	38.46	Cochran's Q $(2,26) = 7.43$, $p = 0.024$	Post–Pre ($p = 0.146$) FU-Pre ($p = 0.057$) FU-Post ($p = 0.500$)
85:15 beads task – confidence	75.43 (25.44)	75.63 (23.59)	65.29 (21.49)	78.77 (21.54)	66.67 (22.38)	63.93 (20.21)	74.23 (18.24)	Wilks' $\lambda = 0.76$, $F(2,21) = 3.38$, $p = 0.053$, observed power $= 0.57$, $\eta_p^2 = 0.24$	Post–Pre ($p = 0.753$) FU-Pre ($p = 1.000$) FU-Post ($p = 0.050$)
60:40 beads task – confidence	65.00 (20.37)	63.75 (24.19)	57.86 (20.45)	60.77 (16.18)	56.67 (19.58)	60.00 (16.64)	66.54 (25.45)	Wilks' $\lambda = 0.97$, $F(2,21) = 0.36$, $p = 0.705$, observed power $= 0.10$, $\eta_p^2 = 0.03$	Post–Pre ($p = 1.000$) FU-Pre ($p = 1.000$) FU-Post ($p = 1.000$)

TABLE 5 | Comparisons of belief flexibility across time points.

Measures	Wait-list condition				Treatment condition			Overall change between pre-treatment, post-treatment, and follow-up assessments	*Post hoc* pairwise comparisons
	Baseline	Pre	Post	Follow-up	Pre	Post	Follow-up	Effect of time	
PM (% showing flexibility)	57.1	58.8	92.9	84.6	59.1	100	84.6	Cochran's Q (2,26) = 14.00, $p = 0.001$	Post–Pre ($p = 0.004$) FU-Pre ($p = 0.031$) FU-Post ($p = 0.250$)
RTHC (% showing flexibility)	14.3	11.8	71.4	61.5	13.6	71.4	61.5	Cochran's Q (2,26) = 26.00, $p < 0.001$	Post–Pre ($p < 0.001$) FU-Pre ($p = 0.001$) FU-Post ($p = 0.375$)

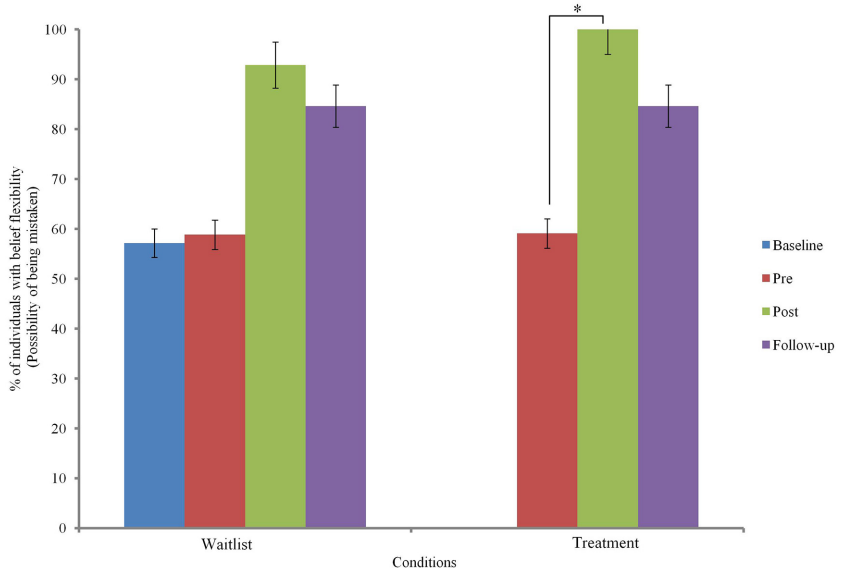

FIGURE 3 | Possibility of being mistaken (PM) across groups. * indicates $p < 0.05$.

Discussion

This study evaluated the effect of a four-session MCTd on reducing delusions and improving data-gathering and belief flexibility. We found (i) a large and significant effect of MCTd in improving positive symptoms and delusions, (ii) a large and significant effect in improving one of the measures of belief flexibility, and (iii) evidence for improvement in belief flexibility as the mediator for symptom improvement.

Psychosis is complex with patients experiencing highly varied symptom profile and treatment needs. Adopting a single-symptom approach, MCTd focused specifically on reasoning biases that have been shown to be closely associated with the pathogenesis of delusions. Despite its brevity, MCTd showed promise for symptom-specific improvement. We found statistically and clinically significant treatment effects in reducing positive symptoms and delusions, which were maintained after 1 month post-treatment. Our large treatment effect sizes for overall symptomatology, delusional severity and conviction were larger or comparable with previous MCT based studies (Moritz et al., 2011b; Erawati et al., 2014; Garety et al., 2014; Waller et al., 2015). MCTd was half the duration of the original MCT, and 40% the duration of the individualized MCT+ for psychosis. MCTd sessions rely less substantially on discussing and challenging the idiosyncratic content of delusions than in MCT+ or CBTp. The large effect sizes of delusion change achieved by MCTd suggests that MCT, with its modular structure each focusing on a specific reasoning bias, can be provided in a more cost-effective manner by matching selected treatment modules with the individual's symptoms and treatment needs. This treatment approach can be strengthened by identification of the symptom structure of psychosis (e.g., Potuzak et al., 2012; Russo et al., 2014) and research that links specific psychotic symptoms to specific reasoning biases (e.g., So et al., 2010). The level of subjective satisfaction and attendance rate (84.5%) reported by our sample, which consists of patients with a high level of delusional conviction, also showed promise for patients' acceptance of this form of intervention.

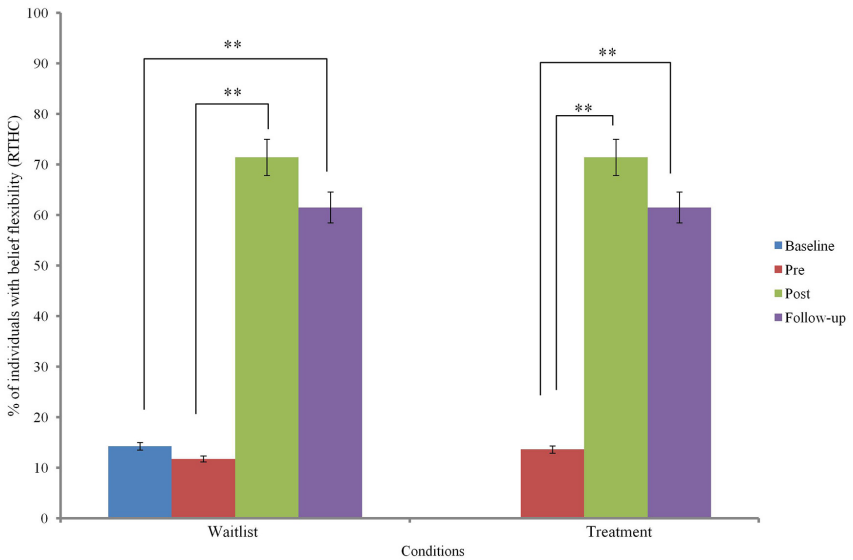

FIGURE 4 | Reaction to hypothetical contradiction (RTHC) across groups. ** indicates $p < 0.01$.

As a process-based intervention, we found an improvement in reasoning biases that MCTd was meant to ameliorate, especially belief flexibility. Following MCTd, patients became more flexible in accommodating new information that contradicts their delusional beliefs. Treatment effect in increasing perceived possibility of being mistaken did not reach statistical significance by a small margin. However, the percentage of participants who considered the possibility that their belief might be wrong increased from <60% before treatment to >90% after treatment, and the large effect size supported clinical significance of the change. While an improvement in PM was also reported in the MRTP trial (Garety et al., 2014), improvement in RTHC was reported for the first time in this study. More importantly, improvement in RTHC significantly predicted improvement in positive symptoms and delusions. This indicates that the ability to accommodate disconfirmatory evidence may be a mediator of treatment-induced delusion change. This is consistent with previous finding that patients who have better belief flexibility are more responsive to cognitive therapy for delusions (Chadwick and Lowe, 1994; Garety et al., 1997; Kuipers et al., 1998). Altogether, these findings suggest that MCTd is effective in ameliorating delusions, potentially via increasing belief flexibility. MCTd can also be used to prepare patients who may not yet be ready for CBTp (Waller et al., 2015).

In our study, change in belief flexibility was evident right after MCTd, whereas change in belief flexibility took place after 2 weeks of post-MRTP homework exercises (Garety et al., 2014). This raises the possibility that the combination of structured training and individualized homework exercises is beneficial to drawing links between the training and patients' daily life applications, hence augmenting treatment effect.

Treatment effect on data-gathering was more modest than on belief flexibility, and took place more slowly. We found no significant difference in JTC change between MCTd and TAU. However, when participants on both conditions were pooled for analysis, there was a significant post-treatment increase in number of draws to decision and a decrease in prevalence of JTC bias. Therefore, effect of MCTd on JTC may be subject to sample sizes, and hence replications of results are warranted. We found that change in JTC did not mediate symptom improvement following MCTd. This is consistent with Menon et al. (2008), which reported that change in JTC did not mediate delusion change following antipsychotics, and with previous studies that showed a closer association between delusions (especially delusional conviction) with BF than with JTC (So et al., 2010, 2012). Despite a small change in data-gathering, our results add to the accumulating evidence that individualized variants of MCT (including MRTP and MCT+) show promise for JTC improvement, which is not achieved by antipsychotics or CBT (Peters and Garety, 2006; So et al., 2012). Future research on these interventions with a larger sample and a longer follow-up may unveil a treatment effect that potentially takes place over a longer period of time.

This study had a number of limitations. Firstly, the 4-week follow-up period was relatively short for evaluating longer-term improvement in more trait-like variables such as JTC. Secondly, the small sample size limited the power of the mediation analysis and did not allow for more sophisticated approaches such as Baron and Kenny's (1986) causal-steps approach or Sobel first-order test (Fritz and MacKinnon, 2007). Thirdly, our sample had a range of psychiatric diagnoses and symptom profiles, introducing the issue of heterogeneity. However, the two randomized groups were matched on psychiatric diagnosis, as well as on major clinical and demographic variables. Where the groups were not matched, i.e., on the PANSS total score, the baseline score was controlled for in the main analyses. Fourthly,

psychiatric diagnosis was obtained from patients' medical notes. It would be preferred if a structured diagnostic interview, including a more comprehensive assessment of delusional subtypes were included. Lastly, we did not include measures of neurocognitive abilities that may affect patients' performance on the reasoning measures, such as working memory. Likewise, we may have missed other processes that are also important in maintaining delusions, such as emotional processes and coping behavior. Against these caveats, this study provided support for MCTd, a locally adapted brief reasoning training, in improving delusions and associated reasoning biases. With its theoretical basis, structured format, user-friendly manuals, and free availability of numerous translations, MCT and its variants invite larger scale outcome evaluations for wider dissemination across populations.

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CLINICAL CASE STUDY
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Metacognitive therapy (MCT+) in patients with psychosis not receiving antipsychotic medication: A case study

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Background: Psychotherapies for psychosis typically aim to develop an awareness of the implausible content of a delusion or target the underlying *cognitive biases* (i.e., problematic thinking styles, such as hasty decisions and illusory control) that foster and maintain delusional beliefs. A recently designed individual-based treatment entitled *metacognitive therapy* (MCT+) combines these two approaches. Emerging evidence suggests individualized MCT+, when used concurrently with antipsychotic medication, may be an effective psychological treatment for reducing delusional symptoms. However, it remains to be tested whether MCT+ can be effective in patients with active delusions who are not currently receiving psychotropic drugs.

Method: We present two cases (one patient with schizophrenia and the other with delusional disorder) experiencing active delusions who underwent 4-weeks of intensive MCT+, without concurrent antipsychotic medication (minimum 6-months unmedicated). Baseline and 6-week follow-up data are presented on a variety of measures assessing delusion symptom severity (i.e., PANSS, PSYRATS, SAPS), clinical insight, and cognitive bias propensity.

Results: After 4-weeks of MCT+, both patients showed substantial reduction in delusional symptoms, reported improved clinical insight, and were less prone to making illusory correlations.

Conclusions: The presented case studies provide preliminary evidence for the feasibility of MCT+ in treating patients not taking, or resistant to, antipsychotic medication.

Keywords: schizophrenia, psychotherapy, delusions, cognitive bias, CBT

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Introduction

Antipsychotic medications are an effective treatment for the symptoms of psychosis, such as delusions and hallucinations, and provide relief for many people with psychotic disorders. However, many studies report that 20–30% of clients with psychosis do not respond to these medications (Tandon, 2011; Leucht et al., 2012). Even when these treatments are effective, they are often associated with only medium effect sizes relative to placebo, high levels of relapse, issues with insight, and adherence, and serious side-effects (e.g., Leucht et al., 2009; Muench and Hamer, 2010).

Accordingly, interest in adjunctive non-pharmacological treatments has gathered momentum in recent years. For example, cognitive-behavioral therapy for psychosis (CBTp) is now routinely administered alongside antipsychotic medications to treat the core symptoms of psychosis (Lecomte et al., 2008; Bechdolf et al., 2010; Morrison et al., 2014). CBTp aims to identify and actively modify maladaptive delusional beliefs, attitudes and behaviors often associated with psychosis, and thereby helps clients to become aware of alternative explanations and coping strategies (Steel, 2013). Reviews and meta-analyses of its efficacy as an adjunct therapy to pharmacological treatments have shown that CBTp adds small to medium effect sizes on top of medication, and may represent an effective treatment alternative for medication-resistant or non-adherent clients (Wykes et al., 2008; Farhall and Thomas, 2013; Huhn et al., 2014).

Built on the principles of CBTp, novel psychological interventions for treating delusions are now starting to focus on the underlying cognitive and social biases that contribute to the formation and maintenance of delusional beliefs (Bell et al., 2006; Balzan et al., 2012, 2013a,b; Garety and Freeman, 2013), rather than targeting the idiosyncratic delusions specific to the individual client (Moritz et al., 2010b). One such intervention is metacognitive training (MCT), which is a group-based program consisting of eight intervention sessions (available free of charge from www.uke.de/mkt). MCT is categorized under six cognitive and social biases (i.e., attribution biases, jumping to conclusions, belief inflexibility, overconfidence in errors, theory of mind deficits, and depressive cognitive schemata). The program attempts to raise the metacognitive awareness of such biases within clients, thereby planting the "seeds of doubt," encouraging critical reflection, and ultimately reducing the severity of delusional symptoms. Similar to CBTp, clinical trials have consistently shown that MCT is effective in reducing delusional symptoms relative to controls (Aghotor et al., 2010; Moritz et al., 2011a, 2014a,b; Favrod et al., 2013), and exerts *sustained* effects on the reduction of delusions over and above the effects of antipsychotic medication (for an in-depth summary and review of MCT see Balzan et al., 2014b; Moritz et al., 2014c).

In response to the emerging efficacy for the group-orientated MCT program, an individually administered program entitled "metacognitive therapy" (MCT+), has recently been developed. This program combines the "process-oriented" approach of the MCT group-training with elements of individual cognitive-behavioral therapy for psychosis (CBTp). The combined approach involves relating information from the original MCT modules to the individual experiences, observations, and symptoms of the individual client (Moritz et al., 2010a). MCT+ comprises a similar layout to the group-based MCT, and covers the same six cognitive and social biases. However, the individualized approach also includes opportunities for clients to share their own personal experiences in relation to the material being presented. This allows for a greater range of therapeutic strategies, such as establishing therapy goals (e.g., reducing paranoia in public spaces), reality testing (e.g., recalling certain events in everyday life that could be regarded as clear evidence for delusional ideas), and Socratic discussion (i.e., extensive questioning to generate pros/cons and consequences of a particular viewpoint). To date, the evidence for MCT+ is limited to two small-scale studies (Moritz et al., 2011b; Balzan et al., 2014a) and a single case report (Vitzthum et al., 2014), which suggest that the therapy program is effective in significantly reducing delusion severity and conviction, increasing clinical insight, and improving performance on cognitive bias tasks.

Despite the demonstrated efficacy of CBTp, MCT, and MCT+ in alleviating the symptoms of psychosis, few trials have been able to test the efficacy of these psychotherapies in the absence of antipsychotic medication. This is an important clinical issue, as people with psychosis may become non-adherent and discontinue taking antipsychotic treatment, or demonstrate treatment resistance to these medications (Lieberman et al., 2005). While at least one trial has been able to show the efficacy of cognitive therapy in reducing psychiatric symptoms in people with schizophrenia spectrum disorders who had chosen not to take antipsychotic drugs (Morrison et al., 2014), more reports are required. The purpose of the current paper is to detail the case histories of two clients with psychosis (one with schizophrenia and one with delusional disorder), neither of whom were taking antipsychotic medication, but both had received 4-weeks of MCT+ as part of a larger randomized control trial investigating the effectiveness of MCT+ in reducing the symptoms of psychosis. MCT+ is a useful platform in order to observe the efficacy of psychotherapies in the absence of pharmacological treatment as it combines the approaches of both CBTp and group-lead MCT, and therefore may be more effective in reducing delusional symptoms than either treatment offered in isolation.

Background

The following case study deals with two clients diagnosed with a psychotic disorder, and who were experiencing active delusions at the time of entering a larger randomized control trial investigating the effectiveness of MCT+. Neither client was taking antipsychotic medication (or any other psychotropic), or receiving any other psychological therapy, at the time of investigation (6-months unmedicated for Client 1; 9-months unmedicated for Client 2), and both were outpatients living in the community (for full summary of baseline symptoms, see **Table 1**). Clinical insight was minimal for both clients.

Client 1

At the time of his involvement in the trial, Client 1 was a 20-year-old male who had been diagnosed with treatment-resistant schizophrenia (limited success on trials of olanzapine, ziprasidone, risperidone (oral and depot), pericyazine, and quetiapine). He was diagnosed from a young age (records indicate first diagnosis of schizophrenia was made at the age of 14-years), with four psychiatric hospital admissions. He was unemployed (receiving a government youth allowance) and was living with a young family (two adults, two children under 5-years) who had taken him in. He would otherwise have been homeless. Pre-morbid IQ was estimated at 86 (using the WTAR; see Design below).

Psychiatric symptoms included vivid auditory hallucinations, which he described as a number of male and female voices that (i) commented on what he was doing or thinking, (ii) made derogatory comments, and (iii) commanded him to harm himself and others. He did not feel compelled to act on the command hallucinations. He also experienced visual hallucinations, including seeing floating facial parts in the dark. His delusional beliefs included being persecuted by government agencies who had been tracking him via secret cameras on his street (which had recently increased in number), and a device planted in his neck; he often had thoughts removing the device, but worried about cutting his neck. He was a long-term frequent user of THC ("1–2 bags per day" since he was 12 years old), and was a heavy drinker (consuming approximately "10 liters of wine and a carton of beer" weekly). Aggression, highly-impulsive behavior (e.g., assaulting strangers), and psychiatric symptoms intensified whilst taking either substance. A risk assessment identified some occasional suicidal thoughts, but overall low risk, with no definite motive or detailed plans. His treatment goals included reducing his paranoia (e.g., leave the house at different times) and conflicts with other people in his street (e.g., no longer accusing them of persecution).

Client 2

Upon commencing the trial, Client 2 was 31-year-old male, with delusional disorder (diagnosed 2 years prior), unemployed and living on a disability support pension in a private boarding house. He had at least two prior psychiatric hospital admissions. Client 2 had no history of auditory or visual hallucinations, did not describe any current hallucinations, and did not drink alcohol or use THC. Whilst very functional across a number of cognitive domains, with above average intelligence (pre-morbid IQ was estimated at 109), his paranoid delusional ideas have prevented him from obtaining a stable career path, and reaching full social independence.

His core paranoid delusion was that his personal identity and details of his private life were readily available for people to observe. His feeling of being "watched" first arose whilst working in a large warehouse of approximately 400 employees, where he suspected that he was being laughed at and talked about behind his back. These ideas culminated with him confronting the other employees about their knowledge of his personal life, and his subsequent dismissal, whereby he moved across country and relocated to another city in the hopes of escaping the persecution. However, similar persecutory ideas persisted in his new residence, with frequent thoughts that strangers were trying to mess with his mind through social media and the internet, but escalating to the belief that all computers were monitoring and recording his actions and thoughts. He had previously sought help from a psychotherapist with limited success, and hoped the MCT+ sessions could help him to improve his ability to "test reality" and thereby reduce his paranoia and ideas of persecution in social settings.

Design

Both clients were randomized into the MCT+ treatment group as part of a larger treatment trial that allocated participants to either MCT+ or to cognitive remediation (active control condition). The trial consisted of six sessions, consisting of baseline assessment, four MCT+ sessions (covering all six cognitive biases plus additional material), and a follow-up session that mirrored the baseline measures, which was administered 1-week after completing MCT+ (i.e., 1 month from commencing the trial). Each of these six sessions lasted approximately 90–120 min. Clinical ethics was approved by the Human Ethics Research Committee (TQEH/LMH/MH), Adelaide, Australia.

MCT+

Following the first baseline session, both clients commenced 4 weeks of MCT+, with one 90–120 min session per week, usually consisting of two MCT+ "units" per session. MCT+ consists of ten units. Unit 1 is designed to build up the therapeutic alliance and establish symptoms, which was not necessary as these were established at the baseline session. Therefore, the first therapy session combined a brief introduction to MCT+ (Unit 2), generating an illness model (Unit 3), and covered attributional styles (Unit 4), which specifically observed the importance of considering multiple attributions (e.g., situational, personal, internal) jointly for a single event. The second therapy session combined Unit 5 on decision-making, which looks at the jumping to conclusions (JTC) bias and the importance of gathering sufficient evidence before making a decision, and Unit 6 on changing beliefs, which encourages clients to re-evaluate the validity of their opinions and change them when necessary, rather than always insisting on one's opinion and/or ignoring disconfirming evidence. The third session covered Unit 7 on empathizing (e.g., the complexity of social cues and the importance of collecting multiple social cues before making strong social inferences) and Unit 8 on overconfidence in memory errors. The final therapy session focused on improving self-esteem and mood by looking that factors that perpetuate depressive styles of thinking (Unit 9), and concluded by looking at relapse prevention (Unit 10). For an in-depth description of all MCT+ therapy units, please refer to Balzan et al. (2014b) or by way of the following link: http://www.clinical-neuropsychology.de/metacognitive-therapy-plus-individualized-mct-for-psychosis.html.

Baseline and Follow-up Assessment

A number of assessments observing clinical and cognitive domains were made as part of the larger trial. Only assessments pertaining to the current case study are documented here. As the principle aim of MCT+ is reduce the severity of delusional ideation, a number of measures were included to assess delusional propensity. Interview-led measures of delusional severity included the Positive and Negative Syndrome Scale (PANSS; Kay et al., 1987), which consists of seven positive, seven negative, and 16 general psychotic symptoms; the Psychotic Symptom Rating Scales (PSYRATS; Haddock et al., 1999), which focuses on the frequency and duration of hallucination and delusions; and the Scale for the Assessment of Positive Symptoms (SAPS; Andreasen and Olsen, 1982), which covers a variety of common hallucinatory and delusional themes (e.g., auditory hallucinations, delusions of reference, persecutory delusions). Clinical insight was estimated using the Schedule for Assessing

TABLE 1 | Raw baseline and follow-up scores of symptom severity (PANSS; PSYRATS; SAPS; PDI-21), insight (SAI), and cognitive bias performance (illusory control) for both clients.

	Client 1 (schizophrenia)		Client 2 (delusional disorder)	
	Baseline	**Follow-up**	**Baseline**	**Follow-up**
SYMPTOM SEVERITY				
PANSS (total)	89	80	65	46
PANSS-Delusions (P1)	6	5	5	3
PANSS-Positive	26	21	18	11
PANSS-Negative	16	15	17	9
PANSS-General	47	44	30	26
PSYRATS-Hallucinations	34	28	–	–
PSYRATS-Delusions	23	20	18	12
SAPS-Hallucinations	23	19	–	–
SAPS- Delusions	37	30	14	9
PDI-21-Global	281	243	83	58
PDI-21-Distress	77	74	23	17
PDI-Preoccupation	89	77	27	19
PDI-Conviction	95	75	25	15
INSIGHT				
SAI	2	7	8	10
COGNITIVE BIAS TASK				
Illusory control (%)	50	37.5	37.5	0
Illusory control: perceived connection (%)	50	37.5	50	12.5

PANSS, Positive and Negative Syndrome Scale; PSYRATS, Psychotic Symptom Rating Scales; SAPS, Scale for the Assessment of Positive Symptoms; PDI-21, 21-item Peters et al Delusions Inventory; SAI, Schedule for Assessing Insight (higher scores indicate greater insight; max score = 18); illusory control task was completely non-contingent (i.e., any perceived control >0 was interpreted as "illusory control").

Insight (SAI) for psychosis patients (adapted from David, 1990). The PANSS and PSYRATS interview-based assessments were undertaken by a trained rater blind to treatment allocation (i.e., this rater did not conduct the intervention). Additionally, clients completed the self-report 21-item Peters et al Delusions Inventory (PDI-21; Peters et al., 2004), which provides a scale for global delusional ideation, and subscales for delusional distress, preoccupation and conviction. Pre-morbid intelligence was estimated by the Wechsler Test of Adult Reading (WTAR; Wechsler, 2001).

The "illusion of control" bias, shown to be higher in delusional samples (Balzan et al., 2013b), was assessed at baseline and follow-up, consistent with a previous MCT+ efficacy study that observed changes in this bias post-intervention (Balzan et al., 2014a)[1]. Illusory control was assessed using a non-contingent "tone task" adapted from Matute (1995). Participants were presented with four buttons (labeled A, B, C, and D) on a screen that could be activated using a mouse click, and instructed that they would periodically hear a loud "tone" noise (maximum duration 5-s), and that their task was to find a way to stop it within this time by clicking the correct combination of the four A, B, C, and D buttons. The task comprised 40 trials of uncontrollable tones (i.e., all tones were non-contingent on the participant's response); 75% of tones terminated automatically after 1-s (i.e., 30 trials appeared to turn off after clicking buttons), and 25% terminated after 5-s (i.e., 10 trials appeared to "max out"). After the 40 trials, participants were asked to indicate the percentage of control they had over the termination of tones, and the percentage of trials in which the tones terminated because they had clicked on the correct sequence of buttons (i.e., perceived response-outcome connection).

[1]Note: JTC was also assessed using the "beads task" (for a detailed overview, see Fine et al., 2007), but neither client exhibited a "JTC bias" at baseline (i.e., definite decision on first or second bead), so results of this task are not reported.

Results

Table 1 summarizes the baseline and follow-up scores across the clinical and cognitive measures of interest for both clients. Symptom severity was reduced across all measures used. The overall reductions in PANSS scores (Client 1: −9 points; Client 2: −19 points) were reflected in the positive subscale (Client 1: −5 points; Client 2: −7 points); importantly, there was modest reduction in the delusions item (P1) specifically (Client 1: −1 point; Client 2: −2 points). This reduction in delusional severity was mirrored by the both the PSYRATS (Client 1: −9 points; Client 2: −19 points) and SAPS (Client 1: −7 points; Client 2: −5 points) delusions subscales, which take into account the frequency, duration, distress, and level of conviction of the delusional belief/s. Interestingly, both clients self-reported reductions in delusional distress, preoccupation, and conviction as evidenced by the PDI scale (Client 1: −38 points; Client 2: −25 points).

Clinical insight was minimal in both clients at baseline (i.e., Client 1 scored 2 and Client 2 scored 8, out of a maximum score of 18) but improved post-intervention, whereby both clients started to doubt the validity/creditability of their beliefs, and admitted the cause of their unusual experiences may be due to internal causes (e.g., stress) rather than purely delusional causes (e.g., chip inserted into neck). Client 1 also acknowledged the potential role of THC in heightening the severity of his paranoia, and was open to cutting down his usage, and even resuming antipsychotic medication. Improvements were also observed for the illusory control bias task, whereby both clients expressed reduced perceived control over a non-contingent task (Client 2 correctly responded zero control at follow-up), and less perceived "response-outcome" connection.

Discussion

The present case study reports the impact of individualized metacognitive therapy (MCT+) in two clients with psychosis (schizophrenia and delusional disorder), who were experiencing active delusions, but were not receiving antipsychotic medication at the time of the current trial. MCT+ aims to improve the well-being of people living with psychosis, with a particular focus on reducing the severity of delusional symptoms. MCT+ achieves this by (1) bringing about an awareness of the underlying cognitive biases or "traps" that are thought to contribute the formation and maintenance of delusions, (2) offering clients strategies to reduce their propensity to these biases, and (3) relating the material to the personal experiences and belief systems of the individual client.

The current findings suggest that MCT+ is effective in reducing the symptoms of psychosis, and notably delusional ideation, in the absence of antipsychotic medication. For both clients, we observed overall improvements in positive symptoms and delusional conviction, preoccupation, frequency, and level of distress they caused (assessed by blind interviewer and self-report). Clinical insight was still low at follow-up, but had improved from baseline, and propensity to the illusion of control bias was reduced. Of note, the illusion of control bias is not specifically targeted in any of the MCT modules, which suggests that MCT may be improving some underlying cognitive mechanism that is responsible for a variety of cognitive biases observed in psychosis (Balzan et al., 2014a). It is also worth pointing out that neither client missed a single session (i.e., all nine therapy units were covered over the 4-week therapy phase), which highlights the ability of the therapy program to motivate and actively engage with clients (even those with minimal clinical insight), without being too confrontational or damaging to the therapeutic alliance. The results also demonstrate that the therapy program may be effective across multiple diagnoses (i.e., the majority of MCT studies to date have mainly observed schizophrenia or schizoaffective disorders), and different levels of functioning (i.e., Client 2 had higher "above-average" pre-morbid intelligence).

Overall, these findings are not only consistent with the growing evidence-base for MCT (e.g., Moritz et al., 2014a), but are also consistent with recent findings suggesting that psychotherapy may be effective even in the absence of antipsychotic medication or in treatment-resistant clients (Morrison et al., 2014). Although the results of this case study are promising, a number of methodological issues, common to the majority of case studies, should be acknowledged. First, the results should not be broadly generalized, and the reported improvements may actually represent statistically non-significant trends in the larger participant sample. Further hindering generalization of the results is the lack of extended (e.g., 6-month) follow-up data, which would provide evidence on the sustainability of the reported improvements, and the SAPS assessment was made by a rater who was aware of group allocation. Neither client exhibited the typical JTC bias at baseline (i.e., definite decision on two or less beads), which ruled out the possibility of observing a reduction in JTC post-intervention. Moreover, it is possible that the observed improvements may be attributable to the natural fluctuations of psychotic symptoms ("waxing and waning") that occur across time, or to practice effects in the illusion of control task. The results could also reflect a more general effect of the therapeutic relationship. More methodologically rigorous randomized control trials evaluating the efficacy of MCT+ are required to properly address these issues.

Concluding Remarks

Psychotherapeutic approaches in the treatment of psychosis have been gaining ground in recent years, and have been shown to be effective as adjunctive therapy when used alongside antipsychotic medication, and represent a better treatment option when added to antipsychotic therapy, than pharmacological therapy alone. The therapeutic efficacy of psychotherapy in "treatment-resistant" clients or where antipsychotic adherence is poor, is much less well-understood. The current case study suggests that individualized metacognitive therapy (MCT+), a combination of the "process-oriented" approach of the MCT group-training and individual cognitive-behavioral therapy for psychosis (CBTp), may be an effective treatment option in such cases.

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Longitudinal relations between symptoms, neurocognition, and self-concept in schizophrenia

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Objective: Cognitive models suggest that the self-concept of persons with psychosis can be fundamentally affected. Self-concepts were found to be related to different symptom domains when measured concurrently. Longitudinal investigations to disentangle the possible causal associations are rare.

Method: We examined a sample of 160 people with a diagnosis of schizophrenia who took part in a psychotherapy study. All participants had the DSM-IV diagnosis of a schizophrenia and pronounced negative symptoms. Neurocognition, symptoms, and self-concepts were assessed at two time points 12 months apart. Structural equation modeling was used to test whether symptoms influence self-concepts (scar-model) or self-concepts affect symptoms (vulnerability model).

Results: Negative symptoms correlated concurrently with self-concepts. Neurocognitive deficits are associated with more negative self-concepts 12 months later. Interpersonal self-concepts were found to be relevant for paranoia.

Conclusion: The findings implicate that if deficits in neurocognition are present, fostering a positive self-concept should be an issue in therapy. Negative interpersonal self-concept indicates an increased risk for paranoid delusions in the course of 1 year. New aspects for cognitive models in schizophrenia and clinical implications are discussed.

Keywords: cognitive models, structural equation modeling, self-esteem, psychological model, self-schema

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Introduction

In cognitive models of paranoid delusions and negative symptoms negative self-concepts in terms of reduced self-efficacy, self-acceptance, self-esteem, and expectancies for pleasure play a major role (Rector et al., 2005; Kesting and Lincoln, 2013). Self-concepts integrate cognitive, emotional, and motivational reflections of the self. For the emotional aspect, self-esteem, as an evaluative self-concept, is a prominent factor as well as an important outcome in mental health research. Self-concepts are central to the health care of people with schizophrenic psychoses as a core element of quality of life (Weinberg et al., 2012) as well as a potential mediator between treatment and outcome. Self-esteem in schizophrenia was found to be linked to depression (Cavelti et al., 2012a),

quality of life (Staring et al., 2009), functional outcomes (Vracotas et al., 2012), negative symptoms (Palmier-Claus et al., 2011a), and positive symptoms (Barrowclough et al., 2003; Thewissen et al., 2011).

The relationship between symptoms and self-concepts are typically discussed in two ways (Klein et al., 2011). First, negative self-concepts can be regarded as vulnerability for higher symptom severity as the capability for coping with stressful events might be reduced (Zubin and Spring, 1977; Bentall et al., 1994). Second, symptoms might induce negative changes in the self-concepts, which may be considered as a scar (Lewinsohn et al., 1981). The ideas of the vulnerability and the scar model are summarized graphically in **Figure 1**. In a meta-analysis of 77 studies with representative, non-representative, and clinical samples the vulnerability model showed stronger effects than the scar model for depression (Sowislo and Orth, 2013).

Although the course of self-concepts and symptoms has been studied extensively in depressive disorders, evidence is scarce in psychotic disorders. Most available studies refer to the development and course of paranoia. Cognitive models state that dysfunctional self-concepts contribute to paranoid delusions (Bentall et al., 1994; Garety et al., 2001; Freeman et al., 2002). Recent clinical (Thewissen et al., 2011), non-clinical (Thewissen et al., 2008), and experimental evidence (Palmier-Claus et al., 2011b; Kesting et al., 2013) elucidated the association between self-concepts and positive symptoms, especially paranoid delusions. Particularly the relationship between self-esteem, stigma, insight, depression, and positive symptoms has been studied comprehensively (Lysaker et al., 2007; Cavelti et al., 2012b; Erickson and Lysaker, 2012). In their review regarding this topic, Kesting and Lincoln (2013) concluded that negative interpersonal self-concepts and low self-esteem can lead to persecutory delusions.

Neurocognition is a reliable predictor of functional outcome (Green et al., 2000; Bowie et al., 2010). These cognitive dysfunctions are relative stable through the course of the illness and are merely unaffected by medication (Harvey and Keefe, 2001). Neurocognitive deficits are even present in first-episode populations (Reichenberg et al., 2009). Verbal memory performance is enhanced in the year after remission of positive symptoms but performance levels remain impaired (Wittorf et al., 2004). The same picture is shown for high-risk patients; the deficits are viable before onset, but improve over time (Bora and Murray, 2014). Intensified programs of cognitive remediation can yield to better cognitive performance and functioning (Wykes et al., 2011; Sanchez et al., 2014).

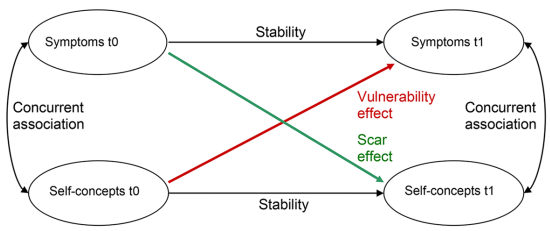

FIGURE 1 | Theoretical model integrating the scar and the vulnerability model at two time points (t0 and t1); adapted from Sowislo and Orth (2013).

In the cognitive model of negative symptoms, defeatist beliefs are related to symptoms like avolition, anhedonia, and affective flattening (Rector et al., 2005). Some studies confirmed these associations between self-reported expectancies about competences, success, or acceptance, and observer-rated negative symptoms (Grant and Beck, 2009). In the same study the authors found that defeatist beliefs about oneself mediate the association between neurocognition and functional outcome, supporting the scar model for neurocognition. Furthermore, interpersonal self-concepts and self-esteem correlated with negative symptoms (Lincoln et al., 2011). Palmier-Claus et al. (2011b) reported data supporting the vulnerability model for negative symptoms in early psychosis. In their study, the change in self-concepts predicted the course of negative symptoms.

Self-concepts can play a substantial role for subjective well being and for recovery. Especially self-esteem and self-efficacy have been pointed out as important personal traits within the recovery process (Yanos and Moos, 2007). Self-concepts are targets in narrative enhancement therapy (Yanos et al., 2011), schema-therapy (Bortolon et al., 2013), meta cognitive therapy (Moritz et al., 2014), and acceptance, and commitment therapy (Gaudiano and Herbert, 2006). Especially in the narrative enhancement therapy fragmented self-narratives and self-stigma are targeted. These approaches could enrich cognitive behavioral therapy for psychosis (Tai and Turkington, 2009) as well as self-concepts could give a new focus for family interventions (Hesse et al., 2015; Yesufu-Udechuku et al., 2015).

In the present study, our purpose was to examine the plausibility of the scar and vulnerability models regarding the clinically most significant areas of symptoms and neurocognition in people with schizophrenic psychosis. First, we expected that all symptom domains, including neurocognitive deficits, are associated with self-concepts. Second, we expected to find further evidence for the vulnerability effect referring to positive and negative symptoms and a scar effect referring to neurocognition.

Materials and Methods

Subjects and Procedures

The original sample comprised 198 outpatients who participated in a randomized controlled trial for the treatment of negative symptoms with cognitive behavioral therapy in three University Hospitals (TONES-study, ISRCTN25455020; Klingberg et al., 2009, 2011). All participants gave written informed consent. The study was conducted in accordance with the Declaration of Helsinki and the guidelines of the local University ethics committees (Tuebingen, Frankfurt, and Duesseldorf). The DSM-IV diagnosis of schizophrenia was confirmed by a structured clinical interview (SCID-I). Assessment of symptoms was performed by trained raters. The inclusion and exclusion criteria are reported in detail in the study protocol (Klingberg

et al., 2009). Study participants had to have at least moderate negative symptoms and no severe depressive (PANNS G07, depression ≥6) or severe positive symptoms [any item of the standard PANSS positive scale (P1, P2, P3, P4, P5, P6, P7) ≥6]. The study population represents a more homogenous subgroup of people diagnosed with schizophrenia, than a random or unselected sample. A little loss of data (19%) occurred due to reward given for ratings to all participants and external data monitoring. We analyzed data of 160 participants whose follow-up data (12 months) were available. Missing data were imputed with expectation-maximization imputation models.

Measures and Latent Variable Construction

We grouped indicators to five latent constructs and tested the measurement adequacy empirically (Klingberg et al., 2006; Nuechterlein et al., 2008; Kim et al., 2012; Khan et al., 2013). As indicators of a latent construct may differ in the degree to which they represent the latent construct, we examined factor loadings as a measure of the strength of association between the indicator and the construct.

Negative symptoms were measured by the *Positive and Negative Symptom Scale (PANSS) and the Scale for the Assessment of Negative Symptoms (SANS)*. The corresponding factor loadings to the negative symptoms factors in our analyses can be considered as high (0.86–0.96), respectively.

Paranoia was measured by the "delusions" item from the PANSS (item P1) and the "vsuspiciousness/persecution" item from the PANSS (item P6). The factor loadings ranged from 0.51 to 0.84.

Two domains of *neurocognition*, verbal recall and processing speed, were selected as particularly relevant. The *Trail Making Test (TMT)* consists of two parts, one (part A) measures mainly processing speed. Verbal memory was measured by the *Verbaler Lern und Merkfähigkeitstest Test (VLMT)*. The two tests represent two different domains of neurocognitive functioning, therefore lower factor loadings were expected. For sake of content validity of the factor we decided to keep verbal memory in the construct. The factor loadings of the tests ranged from 0.41 to 0.81, indicating that verbal memory is not as well represented in the neurocognitive functioning construct as processing speed.

Self-concepts were assessed with the *Frankfurt Self-Concept Scales* (FSKN; Deusinger, 1986). This inventory comprises 10 one-dimensional scales with specific self-concepts concerning relevant aspects of the self. The internal consistency of the scales was highly satisfactory ($\alpha = 0.93$–0.97; $n = 1794$). The questionnaire has been used in psychosis research frequently (Lincoln et al., 2010, 2011; Wittorf et al., 2010). We used six subscales for our analysis, three to measure positive self-concept, and three to measure interpersonal self-concept.

The self-concepts "general achievement," "solving daily problems," and "self-esteem" were used to measure *positive self-concept*. The factor loadings of these subscales ranged from 0.88 to 0.93. *Interpersonal self-concept* was measured with three subscales from the FSKN: "valued by others," "ability to make contact with other people "and" emotions and relations to others." The factor loadings of these subscales ranged from 0.59 to 0.86.

Statistical Analysis

First we checked if the two psychotherapeutic interventions to which patients were allocated in the RCT have any significant differential treatment effect on the variables of interest. Analysis of covariance (ANCOVA) was conducted with t1 as the dependent and t0 and treatment group as independent variables for each symptom and self-concept. We used structural equation modeling (SEM) techniques to test the main hypotheses of longitudinal associations. SEM is a confirmative technique allowing the construction of latent variables by observed indicators and testing the relations between the latent constructs.

We examined the vulnerability model and the scar model for different symptoms and self-concepts comparing estimates of strength of association and fit indexes. In a preparatory investigation of assumptions of SEM both skewness and kurtosis of the modeled indicators were within acceptable limits (Kline, 2011). A total of six longitudinal models were defined using data from baseline (t0) and 12-months follow-up (t1) with combinations of the two areas of self-concepts (positive self-concept and interpersonal self-concept) and three symptom domains (paranoia, negative symptoms, and neurocognition). We allowed autocorrelations between indicators over time. When Heywood cases (negative error variances) occurred, problematic autocorrelations have been fixed at 0. For each self-concept-symptom pair, an unrestricted model including all paths and thus allowing for both scar and vulnerability effects was estimated. Subsequently, partly restricted models omitting one path each representing the vulnerability or the scar model were fit, respectively. Finally, a fully restricted model excluding both scar and vulnerability effects was estimated.

All analyses were performed with AMOS and SPSS (Version 21.0. Armonk, NY: IBM Corporation).

Results

The ANCOVAs for differential effects of the interventions resulted in no significant ($P < 0.05$) difference between the two groups for any reported variable. Therefore the treatment group was not considered in further analyses. Anyway, we report in the appendix on models incorporating the group factor to rule out influence of treatment.

The mean scores and SD for all variables are summarized in **Table 1**. The sample comprised only a few first-episode patients, and the majority was male. Level of occupation and of general functioning indicates that the sample was moderately to severely impaired. The sample is characterized by rather weak positive symptoms and moderate to severe negative symptoms. The mean results in the VLMT are about one SD lower than the results in an age-matched normative sample ($M = 52.27$, SD = 7.84; Lux et al., 1999). The time needed to complete the TMT A is more than one SD above the mean in the age-matched normative sample ($M = 28.54$, SD = 10.09; Tombaugh, 2004).

TABLE 1 | Demographic and clinical characteristics of the sample.

	t0 (Baseline)		t1 (12 months)	
	Frequency	**Percent**		
Female	66	41		
High school	84	52		
Occupation	44	28		
Married/with partner	65	41		
Adverse child events	31	19		
First episode	11	7		
	Mean	**SD**	**Mean**	**SD**
Age (years)	36.90	9.83		
Age at first psychiatric symptom (years)	23.77	8.74		
GAF (score)	59.58	8.91	63.34	11.47
Verbal IQ	108.72	16.72		
PANSS				
PANSS P01 (item score)	1.89	1.00	2.06	1.23
PANSS P06 (item score)	2.00	0.91	1.94	1.07
PANSS MNS (mean item score)	3.02	0.80	2.58	0.90
SANS (mean score)	2.01	0.65	1.69	0.78
TMT A (section)	38.68	15.71	33.59	14.11
VLMT learning (sum words)	45.16	10.66	46.69	11.79
FSKN				
General achievement (FSGA)	3.51	0.90	3.70	0.90
Solving daily problems (FSSP)	3.65	0.81	3.78	0.82
Self-esteem (FSSE)	3.68	1.05	3.95	0.99
Valued by others (FSVO)	3.69	0.99	3.87	1.03
Ability to make contact (FSAC)	3.73	0.84	3.91	0.78
Emotions and relationships (FSEO)	3.80	0.82	3.75	0.78

N = 160; Occupation, Fulltime occupation or education; GAF, Global Assessment of Functioning, PANSS P01, delusions; P06, suspiciousness/persecution; MNS, modified negative symptom scale; SANS, Scale for the Assessment of Negative Symptoms; TMT A, Trail Making Test Trail A; VLMT, Verbaler Lern und Merkfähigkeitstest; FSKN, Frankfurt Self-Concept Scales.

Negative symptoms were the first domain to be tested with regard to the vulnerability and the scar model. The fit of all models is good. The restricted model, omitting the paths representing the vulnerability and the scar model, does not significantly impact the model fit. The goodness of fit statistics are summarized in **Table 2**. Negative symptoms were fairly stable over time as indicated by a standardized coefficient of 0.66. Whereas the correlation between negative symptoms and positive self-concept was −0.32 at t0, it increased marginally to −0.44 at t1. The test of models with negative symptoms and interpersonal self-concepts result in similar results as shown in **Table 2**. Incorporating treatment group in the model (see Supplementary Figure S1), did not change these results. In summary, for negative symptoms our data did not support either the scar or the vulnerability model.

With regard to neurocognition, the scar model was identified as the best model both for positive and interpersonal self-concepts. These results are presented in **Table 2** and **Figure 2**. Neurocognition is highly stable over time indicated by a high auto-regression coefficient. The standardized coefficient from neurocognition at baseline to positive self-concept at follow-up representing the scar model is 0.26 with $p = 0.008$. In nested model comparison for positive self-concept, the difference between the restricted model and the scar model is significant, indicating a substantially increased model fit for the scar model than for the restricted model ($df = 1$; $\Delta X^2 = 10.24$; $p = 0.001$). For interpersonal self-concepts the same pattern is depicted; the scar path coefficient (0.25; $p > 0.019$) and the difference to the restricted model are both significant ($df = 1$; $\Delta X^2 = 5.80$; $p = 0.016$). When treatment group is added to the model (see Supplementary Figure S2), the relationship between neurocognition at t0 and positive self-concept in t1 remains significant ($p = 0.008$). In summary, for neurocognition the data supported the scar hypothesis.

For paranoia, the vulnerability model showed better fitting indices. The unrestricted model for interpersonal self-concepts is presented in **Figure 3**. Whereas the concurrent correlation between paranoia and self-concepts is −0.44 at baseline, it decreases to −0.27 12 months later. The stability of paranoia is smaller than for negative symptoms or neurocognition with a standardized coefficient of 0.31. The standardized coefficient from interpersonal self-concept at baseline to paranoia at follow-up representing the vulnerability model is −0.25 with $p < 0.029$. Moreover the chi-square statistics of the vulnerability model fits significantly superior than the restricted model ($df = 1$; $\Delta X^2 = 4.60$; $p = 0.032$). Although the results were fairly comparable for the models with positive self-concept, the coefficient representing the vulnerability model did not reach the threshold for strict statistical significance ($p < 0.097$). As well, the chi-square statistics between the vulnerability model and the restricted model did not differ significantly, indicating no significant incremental fit for the vulnerability model with positive self-concepts.($df = 1$; $X^2 = 2.17$; $p = 0.141$). When treatment group is added to the model (see Supplementary Figure S3), the relationship between paranoid delusions at t0 and interpersonal self-concept in t1 remains significant ($p = 0.031$). In summary, for paranoia the data supported the vulnerability model, particularly with regard to interpersonal self-concept.

Discussion

Cognitive models on negative symptoms, positive symptoms, and neurocognition can inform treatment development as they shed light on the development and maintenance of symptoms (Garety et al., 2001, 2007; Freeman et al., 2002; Rector et al., 2005; Kesting and Lincoln, 2013). In order to obtain a robust evidence base, these models need to be tested by different methodologies including epidemiological studies (Krabbendam et al., 2002; Fowler et al., 2006), experimental data with healthy controls, or clinical samples (Kesting et al., 2013), as well as longitudinal data from clinical samples like the study presented in this article.

Negative Symptoms

Cognitive models of *negative symptoms* (Rector et al., 2005) as well as the psychotherapeutic rationale (Staring et al., 2013) rely on defeatist beliefs and negative self-concepts. Most

TABLE 2 | Goodness-of-fit indices of the tested models and model comparisons.

	Chi-sq	Chi-sq/*df*	CFI	TLI	RMSEA	BIC	AIC	Coefficient (SE; *P*)
Threshold for good models	n.a.	≤2	≥0.950	≥0.950	≤0.050	l.v.p.	l.v.p.	$P < 0.05$
Negative Symptoms								
Positive self-concept								
Unrestricted model ($df = 26$)	22.05; $P = 0.63$	0.882	1.000	1.004	0.000	174.31	82.05	
Scar model ($df = 27$)	22.18; $P = 0.68$	0.853	1.000	1.005	0.000	169.36	80.18	−0.10 (0.07; 0.128)
Vulnerability model ($df = 27$)	24.35; $P = 0.56$	0.937	1.000	1.002	0.000	171.53	82.35	0.02 (0.08; 0.719)
Restricted model ($df = 28$)	24.39; $P = 0.61$	0.903	1.000	1.003	0.000	166.50	80.39	
Interpersonal self-concept								
Unrestricted model ($df = 26$)	25.78; $P = 0.42$	1.031	0.999	0.999	0.014	178.03	85.78	
Scar model ($df = 27$)	27.17; $P = 0.40$	1.045	0.999	0.998	0.017	174.35	85.17	−0.08 (0.08; 0.232)
Vulnerability model ($df = 27$)	25.78; $P = 0.48$	0.992	1.000	1.000	0.000	172.96	83.78	0.01 (0.08; 0.943)
Restricted model ($df = 28$)	27.18; $P = 0.45$	1.007	1.000	1.000	0.006	169.28	83.18	
Neurocognition								
Positive self-concept								
Unrestricted model ($df = 26$)	27.54; $P = 0.28$	1.145	0.997	0.995	0.030	184.87	89.54	
Scar model ($df = 27$)	27.90; $P = 0.31$	1.116	0.998	0.996	0.027	180.16	87.90	0.26 (0.02; 0.008)
Vulnerability model ($df = 27$)	38.00; $P = 0.05$	1.520	0.989	0.981	0.057	190.25	97.99	−0.05 (0.63; 0.563)
Restricted model ($df = 28$)	38.14; $P = 0.06$	1.467	0.990	0.983	0.054	185.32	96.14	
Interpersonal self-concept								
Unrestricted model ($df = 26$)	25.63; $P = 0.37$	1.125	0.998	0.996	0.020	183.91	87.63	
Scar model ($df = 27$)	26.43; $P = 0.39$	1.096	0.998	0.997	0.019	179.61	86.43	0.25 (0.02; 0.02)
Vulnerability model ($df = 27$)	31.54; $P = 0.17$	1.218	0.992	0.985	0.040	184.72	91.54	−0.07 (0.80; 0.39)
Restricted model ($df = 28$)	32.27; $P = 0.19$	1.195	0.992	0.987	0.038	180.31	90.24	
Paranoia								
Positive self-concept								
Unrestricted model ($df = 26$)	28.57; $P = 0.24$	1.191	0.996	0.992	0.035	185.90	90.57	
Scar model ($df = 27$)	31.21; $P = 0.18$	1.248	0.994	0.990	0.040	183.46	91.20	0.03 (0.07; 0.714)
Vulnerability model ($df = 27$)	28.70; $P = 0.28$	1.148	0.997	0.994	0.030	180.95	88.70	−0.18 (0.15; 0.097)
Restricted model ($df = 28$)	31.30; $P = 0.22$	1.204	0.995	0.992	0.036	178.48	89.30	
Interpersonal self-concept								
Unrestricted model ($df = 26$)	29.41; $P = 0.21$	1.225	0.992	0.985	0.038	186.74	91.41	
Scar model ($df = 27$)	34.02; $P = 0.11$	1.361	0.987	0.976	0.048	186.28	94.02	0.01 (0.08; 0.904)
Vulnerability model ($df = 27$)	29.42; $P = 0.25$	1.117	0.994	0.988	0.033	181.68	89.42	−0.25 (0.14; 0.029)
Restricted model ($df = 28$)	34.03; $P = 0.13$	1.309	0.988	0.980	0.044	181.21	92.03	

Chi-sq, discrepancy chi-squared statistic; df, degrees of freedom; Chi-sq/df, normed chi-squared statistic; Coefficient, the standardized estimates in the unrestricted model; SE, Standard error of the coefficient; P, significance level of the coefficient; CFI, Comparative Fit Index; TLI, Tucker-Lewis Index; RMSEA, Root Mean Squared Error of Approximation; BIC, Bayes Information Criterion; l.v.p., lower values preferred (only for model comparisons).

studies use measures of defeatist attitudes and expectancies such as measured by the dysfunctional attitude scale (Beck et al., 2013). In our study, negative symptoms were associated concurrently with self-concepts as predicted by the cognitive model of negative symptoms. Contrary to our expectation, self-concept at pre-treatment did not predict negative symptoms after 12 months. The construct of negative symptoms has been stable, thus there was change in individuals and in the mean, but relative low change in the individual residuals. However, the longitudinal analysis did not support an influence, like found in first-episode patients (Palmier-Claus et al., 2011a). As in our study the time between t0 and t1 was 12 months, multiple causation might have influenced negative symptoms as well as self-concepts during this period. The variance in our sample is limited due to the inclusion criteria; this might have limited the covariances as well. For further research a shorter duration of measurement intervals is supposed to test.

Neurocognition

As hypothesized, neurocognitive functioning at baseline predicted positive self-concept after 12 months. Yet, self-concepts are not in the focus of interest in research on *neurocognition* in people with psychosis. In the general population there is strong evidence that people can estimate their cognitive abilities well (Freund and Kasten, 2012). Our findings support the scar model. Possibly service-users perceive the loss of memory function and processing speed during the course of the disorder and integrate them in a negative self-concept. In concurrent analyses of people with schizophrenia, defeatist beliefs operated as a mediator between neurocognitive impairments and negative symptoms (Grant and Beck, 2009). These results demonstrate

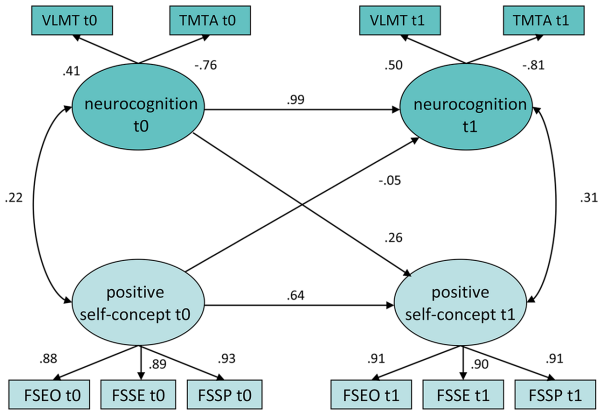

FIGURE 2 | Unrestricted longitudinal model of Positive Self-concept and Neurocognition. Rectangles indicate observed indicator variables. Ovals indicate unobserved latent variables. Figures on single-headed arrows indicate standardized regression weights; figures on double-headed arrows correlations. Error variables are omitted. TMT A, Trail Making Test Trail A; (VLMT) Verbaler Lern und Merkfähigkeitstest; Frankfurt Self-Concept Scales: (FSGA, general achievement; FSSP, solving daily problems; FSSE, self-esteem). The overall model fit was $\chi^2 = 27.538$, $df = 24$, $P < 0.280$; CFI = 0.997, TLI = 0.995, RMSEA = 0.030 (0.000 – 0.074).

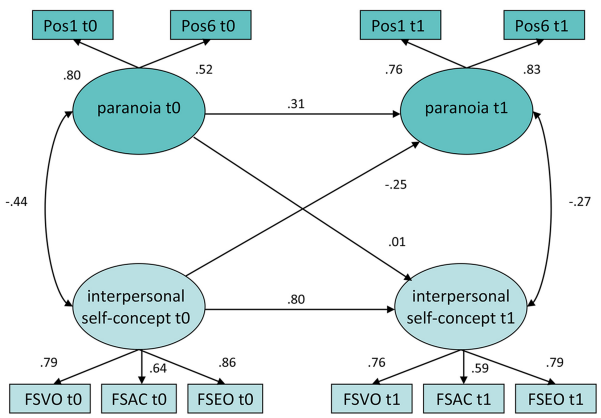

FIGURE 3 | Unrestricted longitudinal model of interpersonal self-concept and paranoia. Rectangles indicate observed indicator variables. Ovals indicate unobserved latent variables. Figures on single-headed arrows indicate standardized regression weights; figures on double-headed arrows correlations. Error variables are omitted. Pos1, PANNS P01 delusions; Pos06, PANSS P6 suspiciousness/persecution; Frankfurt Self-Concept Scales: (FSVO, valued by others; FSAC, ability to make contact with other people, FSEO, emotions and relations to others). The overall model fit was $\chi^2 = 29.41$, $df = 24$, $P = 0.21$; $CFI = 0.992$, $TLI = 0.985$, $RMSEA = 0.038$ (0.000 – 0.078).

the importance of functional illness-concepts. In a cross-sectional model of visual perception, social cognition, and social functioning the same mediating effect of negative beliefs about the self was found (Green et al., 2012). It is plausible that more negative self-concepts may lead to negative symptoms due to the perception of neurocognitive deficits and maladaptive illness-concepts.

Paranoid Delusions

In our study, evidence was found for a prediction of paranoia after 12 months by interpersonal self-concept at pre-treatment. Other researchers yielded empirical support for the vulnerability model in *paranoid delusions* was as well (Fowler et al., 2012; Kesting and Lincoln, 2013). For example, in daily life reports of fluctuations in self-esteem predicted the development of paranoia (Thewissen et al., 2008). Some cross-sectional studies found positive correlations between self-concepts and positive symptoms (Barrowclough et al., 2003) or paranoid delusions (Smith et al., 2006). In the data presented above the stability of paranoid delusions was weak, primarily indicating that most people involved in this trial had only modest paranoid delusions at entry but some of them relapsed in the course of the study. The scales "negative self" and "negative others" of the Brief Core Schema Scale (BCSS; Fowler et al., 2006) have shown positive correlations with paranoid delusions (Freeman et al., 2013; Garety et al., 2013). There is a slight difference between the "negative others" scale in the BCSS and the interpersonal self-concepts measured in the FSKN. Whereas the BCSS assesses appraised threat from others, the items used in our study are formulated as self-concepts, i.e., how the person is thinking about itself in social relationships. The three scales which has been used to measure interpersonal self-concepts reflect the feelings of being valued by others, trustworthy for others and competent in making contacts. In the BCSS one item is for instance: "Other people are supportive," whereas in the FSKN a corresponding inverted item is "With many of my friends, I'm afraid that when I need them they won't be there for me." In our study, the more global positive self-concepts did not support the vulnerability model; the path from positive self-concept at baseline to paranoia at follow-up did not reach statistical significance. The long interval of 12 months, the limited variance in paranoia and the sample size may have caused these non-significant findings. Lincoln et al. (2010) found although that paranoia was not associated with self-esteem but with interpersonal self-concepts. In our study, interpersonal self-concepts predicted paranoia too, hence when psychological models of paranoia are studied, interpersonal self-concepts in addition to more general positive, or negative self-concepts should be considered. Bentall et al. (2001) have hypothesized that people with tendencies to paranoid delusions avoid negative beliefs about the self, by attributing threatening events to other persons. Interpersonal self-concepts could reflect not only the self though how we see ourselves in social context and how we see other people in relation to us. Our findings support the model of persecutory delusions of Garety et al. (2001) and Freeman et al. (2002) who proposed that certain beliefs about the self and others are important factors in the development of persecutory delusions.

Clinical Implications

There may be some clinical implications for our findings, assuming that cognitive behavioral therapy for psychosis is an effective treatment, one mechanism of change could be the improvement of self-concepts. Interpersonal self-concepts could be influenced by the quality of the therapeutic alliance in psychotherapy, which is indeed a common effect in the treatment

of schizophrenia (Frank and Gunderson, 1990) as well as in every therapeutic intervention (Martin et al., 2000). We can speculate that in many therapeutic settings interpersonal self-concepts are influenced as the therapeutic relationship might be a positive model in terms of trustworthiness, reliability, and acceptance. The possible change in the interpersonal self-concept due to the therapy could be one explanation for the reduction in positive symptoms in supportive therapies (Penn et al., 2004) and for symptom changes during therapy even when they are not directly addressed. When neurocognitive deficits are seen in people with schizophrenia, interventions aiming at compensating deficits and modifying dysfunctional attitudes and self-concepts could be helpful in reducing negative performance expectancies and negative symptoms. When neurocognitive deficits are present, minimizing the deficits is crucial and partly possible (Wykes et al., 2011). The awareness of cognitive impairments is negatively correlated with self-esteem (Cella et al., 2014), therefore when neurocognition does not remit, service-users should be helped in accepting and destigmatizing limits caused by symptoms. For this purpose psychological interventions could be helpful, like combinations of cognitive therapy, and cognitive remediation (Greenwood et al., 2005; Wykes et al., 2011). For this purpose cognitive intervention could focus more on interpersonal self-concepts and narrative enhancements (Yanos et al., 2011) to protect people with schizophrenia from relapse to paranoid delusions.

Strengths and Limitations

A main strength of our study is that patients have been investigated and followed-up over a period of 12 months. From the 198 patients interviewed at baseline we had almost complete data from 160 participants 12 months later, indicating a low risk of bias due to informative censoring. Whereas other studies showed effects for some hours (Thewissen et al., 2008) up to 9 months (Fowler et al., 2012), in our analysis the interval was 12 months. The relatively small coefficients have to be interpreted in this context.

There are some limitations in the study. First, the study is part of randomized controlled trial with systematic therapy regime. We tried to rule out influences from treatment statistically; anyway a sample without explicit psychotherapy would be more adequate to test the hypotheses. Second, the tested models had to be simple, because the sample size of 160 participants limits more complex structural equation models (e.g., a single model including all tested constructs and associations simultaneously). Furthermore, our sample consists of patients with predominantly negative symptoms and relatively weak positive symptoms, and thus might limit the possibility of generalization. On the other hand a strength of the study is to include a relative large sample of people with distinct inclusion criteria and a relative homogenous phenotype. Neurocognition as measured in this study consisted only of verbal memory and processing speed, other important domains like executive functions or verbal fluency were not included. We had other measures in the dataset available, but we could not reach appropriate model fits when including measures of attention and problem solving. Nevertheless we included two good established markers for neurocognition in our analysis. The Hopkins Verbal Learning Test (a similar verbal learning test as we used) and the TMT are included in the MATRICS-Battery, both are correlated with functioning and have the highest ratings for practicability by experts (Nuechterlein et al., 2008).

Conclusion

We found some evidence for the importance of self-concepts in the course of symptoms in people with schizophrenia. We could find evidence for the scar model in neurocognition: global positive self-concepts as well as interpersonal self-concepts seem to be endangered when neurocognitive impairments occur. This study provides further evidence for a vulnerability model of paranoia: the presence of a negative interpersonal self-concept is a risk factor for paranoid delusions. This result is consistent with theories proposing a relationship between negative social experiences, mood, self-concepts, and paranoia (Garety et al., 2001; Freeman, 2007; Kesting and Lincoln, 2013).

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Supplementary Material

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Lessons learnt? The importance of metacognition and its implications for Cognitive Remediation in schizophrenia

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The cognitive problems experienced by people with schizophrenia not only impede recovery but also interfere with treatments designed to improve overall functioning. Hence there has been a proliferation of new therapies to treat cognitive problems with the hope that improvements will benefit future intervention and recovery outcomes. Cognitive remediation therapy (CR) that relies on intensive task practice can support basic cognitive functioning but there is little evidence on how these therapies lead to transfer to real life skills. However, there is increasing evidence that CR including elements of transfer training (e.g., strategy use and problem solving schemas) produce higher functional outcomes. It is hypothesized that these therapies achieve higher transfer by improving metacognition. People with schizophrenia have metacognitive problems; these include poor self-awareness and difficulties in planning for complex tasks. This paper reviews this evidence as well as research on why metacognition needs to be explicitly taught as part of cognitive treatments. The evidence is based on research on learning spanning from neuroscience to the field of education. Learning programmes, and CRT, may be able to achieve better outcomes if they explicitly teach metacognition including *metacognitive knowledge* (i.e., awareness of the cognitive requirements and approaches to tasks) and *metacognitive regulation* (i.e., cognitive control over the different task relevant cognitive requirements). These types of metacognition are essential for successful task performance, in particular, for controlling effort, accuracy and efficient strategy use. We consider metacognition vital for the transfer of therapeutic gains to everyday life tasks making it a therapy target that may yield greater gains compared to cognition alone for recovery interventions.

Keywords: schizophrenia, cognition, metacognition, psychological therapy, learning, awareness, recovery

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Introduction

Across diagnoses the defining feature of mental ill health is impairment in the ability to function, which often translates into difficulties in attaining personal objectives or achieving expected goals. People with schizophrenia are often (but not always) at the most severe end of the functional disability spectrum and these difficulties, once established, tend to last a long time and affect all aspects of their life. Functioning difficulties are further limited by reduced normative developmental experiences, such as fewer or disrupted years in education, loss of friends or a lack

of opportunity to make them, arising as a result of mental health problems. These may be particularly marked in people with schizophrenia as the disorder starts early and so there is less chance of learning or practicing skills important for future achievements. Society further limits opportunities through discrimination and stigma which prevent testing or practicing skills. Although these societal limitations are being addressed by campaigns (Evans-Lacko et al., 2013; Henderson and Thornicroft, 2013; Wykes, 2013) it is likely to take many years to reduce these effects.

There is consensus that cognitive difficulties in different domains including memory, attention, information processing speed and executive function play a relevant role in influencing functional difficulties and limiting recovery in people with a diagnosis of schizophrenia (Allott et al., 2011; Cella and Wykes, 2013; Miles et al., 2014). This prompted the development of therapies targeting cognition. Pharmacological therapies designed to target symptoms have a limited impact on cognitive difficulties (Keefe et al., 2007). Recently there has been an interest in developing medications to enhance cognition but most studies tend to report no boosting effects in uncontrolled trials (Freedman et al., 2008; Keefe et al., 2013). Psychological and behavioral interventions have more successfully been developed to fill this gap. Cognitive Remediation (CR) was designed to target cognitive problems with the broader aim of improving functioning. There is evidence that CR is beneficial but there is still a limited understanding of how the putative active therapy ingredients contribute to changes in functioning (Wykes et al., 2011; Cella et al., 2015). CR is designed to provide intensive practice in both basic and high level cognitive functions and the evidence suggests that supplementing cognitive task practice with strategy use can achieve higher returns in terms of functional gains (Wykes et al., 2011). This has prompted research into the mechanisms that may facilitate transfer of therapy gains into everyday life functional changes and can support recovery (Wykes et al., 2012). This paper will focus on the key role of metacognition in aiding transfer of therapy gains to everyday life.

Unraveling Metacognition

Metacognition has various definitions and applications across different fields. Flavell first used this term to define the cognitive process that relate to "thinking about thinking" (Flavell, 1979). Since its first definition, many authors have contextualized this concept to specific approaches and adapted and elaborated on its original meaning. The main developments have been in the sphere of pedagogy and the concept has driven much of the innovation in learning and teaching over the past 20 years (Education Endowment Foundation, 2013). In the domain of psychopathology the concept has received a high level of attention as problems in metacognition are thought to be implicated in a large number of higher level mental functions including self-reflection, introspection and behavior implementation. Problems in these functions are cardinal features of a number of severe mental health conditions including borderline personality disorder and psychosis (Bateman et al., 2007; Liotti and Gilbert, 2011). In people with schizophrenia the term metacognition is used by different proponents with diverse meanings and implications for outcomes and therapy. To avoid confusion it is useful to delineate briefly the different uses of the term.

Metacognition in Narrative

Lysaker and Dimaggio (2014) consider that problems in the sphere of metacognition affect the ability of people to make sense of their illness experience and compromise the integrity of their personal goals. Difficulties in these mental functions become evident when individuals are engaged in processes requiring an understanding of their own and other people's mental processes but also when this information is required to be mastered for social use. This has led these researchers to integrate their metacognitive approach as part of cognitive behavior therapy protocols and evaluate narrative coherence following therapy as a measure of metacognitive improvement (Lysaker et al., 2002; Wiffen and David, 2009).

Metacognition and Illness Insight

A different approach is to consider metacognition as the cognitive function responsible for insight (David et al., 2012). A wealth of research suggests that the ability of people with schizophrenia to think about their symptoms (e.g., thinking about their delusion) is compromised (Koren et al., 2013; Nair et al., 2014). Limited insight and illness awareness have been associated with poor outcomes in people with psychosis (Frith, 2004) and changes in this function associated with clinical improvement (Corcoran and Frith, 2003). Despite a shared sense amongst clinicians that this may be an important domain to target there are no specific interventions for this domain.

Metacognitive Self- and Cognitive-control

Self-related cognitive processes have been extensively linked to metacognition and considered important in influencing psychotic symptom development and maintenance. People with psychosis have negative beliefs about themselves and display unhelpful coping strategies toward their psychotic symptoms (Pickup and Frith, 2001). Coping strategies may be controlled by metacognitive beliefs and difficulties in this domain may influence illness outcomes. A study by Morrison and Wells (Morrison and Wells, 2003) reinforced this idea by suggesting that people who experience hallucinations, but do not develop schizophrenia, have higher levels of cognitive control compared to people with schizophrenia. This stresses the importance of metacognitive control and appraisal of psychotic experiences as a factor contributing to transition to schizophrenia and illness prognosis. This concept has been reformulated in a variety of ways, and is incorporated into different models of psychological therapies for psychosis (Tan, 2009; Ward et al., 2014).

Self-related concepts feature implicitly in another prominent theory of psychotic symptoms development. Frith (2004) proposed that psychotic symptoms result primarily from the inability to represent one's own and other people's mental states. This cognitive function is now widely referred to as theory of mind but can be seen as a metacognitive ability. According to Frith psychotic phenomena, such as thought

insertions or delusions of control, are dependent on the inability to correctly represent intentions and actions or to exert monitoring and control over cognitive operations (Frith, 2004). Similarly, other proponents have elaborated on this idea and proposed that psychotic symptoms may result from problems in source monitoring (Keefe et al., 1999) through as the difficulty in distinguishing between the origins of self-generated and externally generated stimuli. Source monitoring can be seen as a metacognitive component providing agency information and facilitating the appraisal of events and life situations.

Metacognition and Thinking Bias

It is well established that people with schizophrenia have a number of thinking biases which influence the development and maintenance of key psychotic symptoms such as delusions. These biases are targeted by psychological interventions such as Cognitive Behavioral Therapy for psychosis (CBTp) (Wykes et al., 2008) and specifically by Metacognitive Training (MCT) (see this issue [insert issue references]). Therapy focusses on improving awareness and mastery of the cognitive processes leading to erroneous conclusions (e.g., overconfidence).

Metacognition and Cognition

Most definitions described above consider metacognition as the function responsible for regulating thoughts, emotions and beliefs. An alternative, but not opposing, view characterizes metacognition as the process that regulates learning and information processing. This is not a new idea in psychology and has roots in Vygotsky's theories of learning potential but has been revisited more recently by Flavell (1979). Here the components of metacognition are: ***monitoring*** (evaluation of cognitive functioning), ***control or regulation*** (directing and evaluating cognitive and behavioral performance), and ***knowledge*** (understanding task difficulty and the resources required).

Awareness of cognitive problems can be thought of as a form of metacognitive knowledge that can effectively guide the deployment of cognitive resources to a specific task. This knowledge is essential for individuals to access the relevant resources required for maximal efficiency (Flavell, 1979). Individuals with a diagnosis of schizophrenia exhibit a mismatch between the subjective awareness and objective performance on cognitive tasks usually in the direction of under-estimating the problems (Cella et al., 2014). This mismatch indicates this lack of ***metacognitive knowledge***. Evidence of poor ***metacognitive regulation*** problems comes from the studies showing difficulties in executive functioning and in the control of decisions (Koren and Harvey, 2006; Koren et al., 2006). This concept coincides with executive function and is thought as the process that regulates and controls cognitive functions including working memory, attention, reasoning and information retrieval (Elliott, 2003). This process is often involved in tasks requiring the coordination of complex cognitive operations such as changing a plan in view of freshly gathered information, generating strategies, solving unexpected problems and organizing sequences of behaviors to accomplish a task.

It is possible to consider metacognitive ***knowledge*** and ***regulation*** as a hierarchy of mental processes referring to cognitive operations with some of these processes being more complex than others (**Table 1**). This framework may be useful in the context of therapy to identify competence levels at the beginning of an intervention and to consider progression milestones in mastering metacognitive skills.

For the purpose of this paper we define metacognition as the process that regulates learning and information processing via metacognitive knowledge and regulation processes.

Metacognition and Functional Outcomes in People with Psychosis

Functional and recovery outcomes are poor in individuals with a diagnosis of schizophrenia in terms of work (Turner et al., 2015), their self-care and their relationships (Combs et al., 2011). The associations of poor functional performance with cognition are now well established but even though cognitive and social cognitive skills play a crucial role in influencing functional and treatment outcomes, it is not clear *how* they are related (Galderisi et al., 2014; Green et al., 2015). Studies conducted in the field of CR have highlighted the limited direct effect that enhancing cognition alone has on functioning suggesting that more complex mediating and moderating factors may be implicated in explaining the effects of the therapy (Wykes and Spaulding, 2011). More recently empirical evidence and theoretical accounts have emerged suggesting that metacognitive skills may be relevant in predicting functioning levels (Koren et al., 2006; Stratta et al., 2009; Hamm et al., 2012; Lysaker et al., 2013). This has prompted a number of studies specifically investigating the contribution that regulation and knowledge may have to functioning in people with schizophrenia. Stratta et al. (2009) first demonstrated that the association between metacognitive skills and functioning exceeds that of cognition with functioning when they showed that the relationship with cognition disappeared after testing a model including metacognition.

There is some confusion between executive function and metacognition. Metacognition requires some of the processes measured as executive functioning but is a wider concept involving decision making (see further explanatory examples in the discussion). Executive functioning, a concept akin to metacognitive regulation and monitoring, has been the focus of measurement which has demonstrated important links with clinical and functioning variables. In a recent study executive functioning was a significant predictor of duration of untreated psychosis (Fraguas et al., 2014) and individuals in remission were also found to have a higher performance on executive function tasks compared to non-remitted patients (Braw et al., 2012). These studies suggest links between illness symptoms and this cognitive domain. Executive function predicts supported and employment outcomes (Tan, 2009) and social functioning in people with schizophrenia receiving disability benefits (Tandberg et al., 2013). This suggests that aspects of metacognition captured

TABLE 1 | Shows proficiency levels (with examples) of metacognitive knowledge and regulation.

Metacognition type and level	Proficiency level	Example
Knowledge 1	The person is aware that cognitive operations are necessary for accomplishing everyday life tasks	Following a conversation is hard work and very confusing
Knowledge 2	The person has an understanding of the mental processes necessary to complete specific tasks	Following a conversation is hard because you have to pay attention to what the person is saying and remember the information
Knowledge 3	The person understands the impact of specific cognitive operations and associated difficulties on everyday life tasks and operations	I have problems in remembering people's name and because of that people sometime think that I'm rude
Regulation 1	The person has suboptimal adjustment to compensate for cognitive difficulties	I only pick up leaflets and small books because I'm not good at reading (e.g., avoidance)
Regulation 2	The person can anticipate some demands, shows limited degree of adaptation and planning	Studying in a quiet environment helps concentration but it is hard to retain information
Regulation 3	The person regularly uses strategies, adapts cognitive effort to task demands and can improve performance given practice and feed-back (e.g., learning from experience)	If I'm rested, I take notes and rehearse the material a couple of times I'm more likely to remember information. If there is too much to learn I can divide information in manageable chunks and take breaks

by executive functioning measures are important to symptom and functional outcomes.

Metacognition, Learning and Skills Transfer

Given that people with schizophrenia have poor recovery outcomes, it is surprising that little research has concentrated on how gains made in therapy through CR or other therapies transfers into functional gains. Unlike in mental health, the field of education has stressed the importance of promoting transferable skills and evidence now exists for the mechanisms that may facilitate their acquisition and usage.

Methods such as problem based learning (PBL) allow learners to acquire knowledge by exposure to problems. Learners seek information that would reduce their uncertainty and self-guide their learning on the basis of problem demands. This method is often claimed to be the rationale for apprenticeships and it has been applied across disciplines from vocational training to medical education (e.g., Imanieh et al., 2014). Research in this area has also demonstrated the importance of the learning environment for generalization and transfer. Knowledge is learnt only as part of a unique context and it is less likely to generalize if the learning and the everyday life application contexts are different. This consideration stresses the importance of focussing on maximizing the opportunity for learners to acquire and maintain schemas that can be used in different situations. Providing practice in every possible environment where the schema may be needed is, however, impossible so the focus has shifted to which learning strategies may facilitate this transfer process. Abstract explanations can supplement practice (Anderson et al., 1996) but more recently the research focus has been on cognitive control and how the allocation of cognitive resources may influence learning, transfer and usage of learnt material in everyday life (Tullis and Benjamin, 2011).

These processes are generally referred to as metacognitive. Education reviews suggest that metacognitive skills can guide strategic learning by explicitly teaching strategies and knowledge use, and ensuring that learners use monitoring processes to implement and review their performance (Education Endowment Foundation, 2013). The effect of adopting this metacognitive approach to facilitate learning has tangible effects. In learning to read this method resulted in improvement of about 8 months of reading age suggesting this approach not only as effective but also cost effective (Dignath et al., 2008; Education Endowment Foundation, 2013). More recently, the connection between an individual's metacognition and learning and especially how it can be boosted has been investigated. Effective monitoring (part of metacognitive regulation) is essential for the self-management of learning (e.g., Anderson et al., 1996; Tullis and Benjamin, 2011) and improved monitoring accuracy increases the effective allocation of study time between different items as well as overall recall performance (e.g., Thiede et al., 2003). Recent reports also suggest changing metacognition by boosting awareness, e.g., "being aware of one's strengths and weaknesses as a learner, developing self-assessment skills, and being able to set and monitor goals," and a repertoire of strategies to choose from during learning are vital to improve learning (Education Endowment Foundation, 2013). So there is evidence that targeting metacognition can improve learning and recall and improves generalization to other tasks. This is achieved through explicit teaching of strategies for learning and generalization to other situations.

Cognitive Remediation and Metacognition

With learning being the vehicle of change in most psychological therapies it is perhaps surprising that metacognition has only recently started to feature in CR descriptions. Even then there is still little emphasis on how it builds functional benefits. For CR

the primary target is cognition as changes are thought to exert an effect on functioning, however, there is limited knowledge on how the transfer from improved cognition to improved functioning may work. Here we will describe how we think metacognition should be used as part of CR to maximize transfer and functional gains.

The potential importance of metacognition in CR programmes comes from the evidence that everyday tasks and even the costs of care (a proxy for the level of functional support needed) are more likely to improve following improvement on executive tasks (i.e., changes in metacognitive regulation and executive functions) (Reeder et al., 2004, 2014; Eack et al., 2010a; Penadés et al., 2010; Wykes et al., 2012). Wykes et al. (2012) investigated the "how" of cognitive change impact on functional changes in a study of the effects of improved cognitive performance on work outcomes. The model tested is shown in **Figure 1**. However, mediation models of improving functioning suggest that the variance accounted for by improved cognitive performance alone is only 15%, leaving as much as 85% of variance unexplained. Notwithstanding the measurement problems in cognitive outcomes following remediation, we contend that some of this unexplained variance relates to skills learnt directly within CR that are immediately transferrable to everyday tasks and social relationships. **Figure 2** provides this framework. Here CR changes metacognition and the cognitive tasks but it is mainly metacognition (indicated by the width of the line) which drives the effects on functional outcome. Performance on cognitive tasks may also improve not just through task practice but through improvements in metacognition. This new model suggests that cognitive task improvement is not a mediator but is a third variable affected by the mediator (metacognition) and that therapy should target metacognition.

So how might this inform a newer model for cognitive remediation? We can use some evidence already gleaned on types of programmes. Broadly speaking CR implementation methods can be differentiated into two "schools." The first, the drill and practice approach, proposes that cognitive improvement can be obtained primarily by frequent and intensive task practice tailored to the individual's ability. The second school adopts a strategy approach, which suggests that intensive practice should be supplemented by explicit training of strategies and approaches to the tasks (Cella et al., 2012). Both these types of programme have shown to have an impact on neural plasticity and can alter functional and structural brain parameters including network efficiency and gray matter loss (Eack et al., 2010b; Subramaniam et al., 2012; Penadés et al., 2013; Pu et al., 2014). However, in meta-analyses the strategy based programs have greater and significant effects on transfer to functional outcomes, particularly in the context of opportunities for functional gains e.g., within rehabilitation programmes (Wykes et al., 2011).

Strategy use and the explicit attempt to increase knowledge about the individual's cognitive resources are metacognitive competencies (i.e., *metacognitive knowledge*). This is often explained to patients as the knowledge they have about their thinking in general including what they think they can do best (i.e., cognitive strengths) and what they have difficulties with. Metacognition is also applied in the context of CR as a process of recognizing the needs of a task and implementing the appropriate strategies and resources. This is referred to as *metacognitive regulation* which is generally divided into three sub-processes—planning, monitoring and evaluation. In the planning stage individuals bring to mind all the relevant information to complete a task and organize the stages into the necessary sequence for the task. In the monitoring phase the individual monitors actions as they are executed and adapts them if needed. In the evaluation stage the individual reconsiders the cognitive operations and evaluates their usefulness for similar future tasks. This process can be introduced to patients using the acronym PriME (i.e., Planning, Monitoring and Evaluation) and systematically applied to tasks during training. In the planning phase patients are encouraged to make plans formally before acting, to forecast possible difficulties in order to prevent problems. This includes non-cognitive factors such as, social anxiety, boredom and feeling low in mood. In the monitoring stage patients are encouraged to check the execution of the plan including making an assessment of the proficiency of the strategies used and flexibly adapt them to the situation. In the evaluation phase, patients are encouraged to assess and review

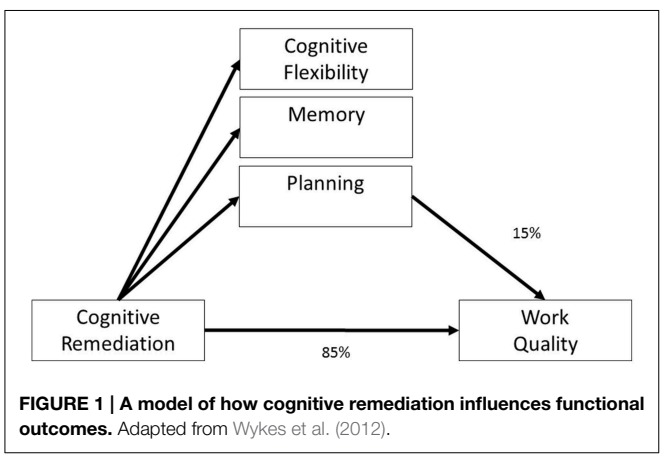

FIGURE 1 | A model of how cognitive remediation influences functional outcomes. Adapted from Wykes et al. (2012).

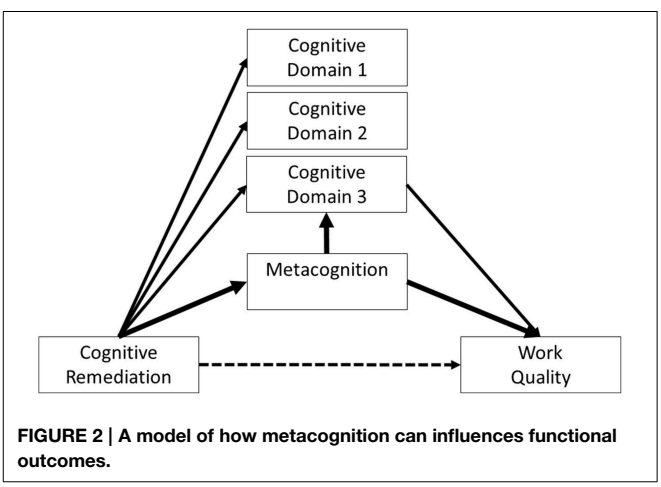

FIGURE 2 | A model of how metacognition can influences functional outcomes.

their performance and consider what went well and what could have been done differently. The training supports the integration of this information in future planning.

Applying Metacognition to Cognitive Remediation

The model adopted by Wykes and Reeder (2005; Wykes et al., 2007) integrated metacognition as part of CR and is shown in **Figure 3**. Here personal recovery-based goals are set with the client and these goals are ones that can be related to cognitive problems. We call these *Cog-SMART goals* (i.e., Cognition related- Specific- Measurable- Achievable- Relevant- Time specific) which are always embedded in real-world activities. These goals are usually formulated as a series of stages to demonstrate that the highly valued end goal is achievable and directly linked to the smaller goals set in therapy. For instance, a first step goal might be "improving my attention so I rely on fewer prompts in a session." This may lead to a second step goal—"I will be able to describe what I am reading to someone"—and this in turn can lead to a third step goal—"I can communicate my needs and be understood." Success in these milestones may also lead to the development of other personal goals, e.g., enroll in a carpentry course or go back to college, depending on the stage and competencies of the client. Goal development may depend on the client's competencies in metacognitive regulation and knowledge which can be extracted from metacognitive assessments or based on discussions with clients or observations of their behavior in cognitive assessments. Setting goals also requires a discussion of other factors that may affect cognitive outcomes e.g., when anxious you may not perform as well.

CR programmes can then aim to increase awareness of cognitive strengths and weakness that can be overcome using strategies developed in therapy. For instance, helping the individual become aware of mnemonic strategies that can aid memory and the situations where these strategies are likely to be required. This type of remediation emphasizes the explicit teaching of strategies and the prompting of awareness. This can be partially achieved through automatic mechanisms embedded in CR software. An example is the CIRCuiTS CR programme which contains not only tasks with a focus on cognitive skills but also prompt individuals to select and use strategies (Reeder et al., 2015). The software has basic cognitive tasks and exercises that closely resemble valued functional activities such as writing your cv, looking for a job, cooking a recipe, going shopping etc. In order to encourage metacognitive processing before each task it is essential to select one or more strategies and to predict how difficult the task might be and how long it might take. Following the task the client receives feedback which can aid monitoring. Task performance is tailored to 80% success to keep engagement and efficacy high. Once a task is completed the client is asked to rate how difficult they had found the task and how helpful the strategy had been. Building strategies in this programme is linked to improved functioning and cognitive improvements (Wykes and Cella, 2015).

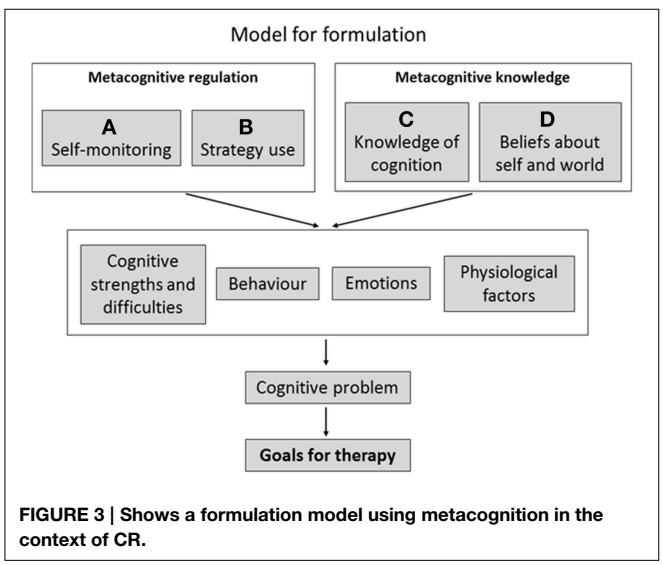

FIGURE 3 | Shows a formulation model using metacognition in the context of CR.

Discussion

The Optimism of a Metacognitive Approach

For individuals with a diagnosis of schizophrenia whose cognition is often poor, adopting a metacognitive approach has promise. Research in education suggests that this is an approach that is particularly beneficial for low achieving students or older people where larger improvements have been noticed (Education Endowment Foundation, 2013). This means that it may be particularly suited to individuals with a diagnosis of schizophrenia who have failed to benefit from usual rehabilitation or recovery programmes that provide direct on-the-job teaching. This notion is supported by recent research demonstrating the significant improvement in employment provided by CR in addition to work rehabilitation, but only in those who were already functioning at a lower level (Bell et al., 2014). The effect of CR in the higher functioning group was negligible. It may be that the metacognitive abilities of individuals in the higher functioning group were intact and only an opportunity for practice in a work setting and support to overcome stigma and discrimination in the workplace is required.

Metacognition also gives a structured approach to learning which has been absent for some time in therapy development. This learning approach allows the therapist to lead the client through the therapy with a clearer idea of what learning processes need to be in place. Many CR programmes already provide metacognitive input. For example any programme that mentions explicit teaching of strategy and help with reflection on task performance is essentially aiding metacognition. However, in many programmes this aspect has not yet been formalized as an "active therapy component" and we think this does not recognize the value of an important therapy ingredient.

Where Now with Metacognition Research?

We require more evidence on the role of metacognition in the context of all therapies but particularly in CR. The recognition of its importance needs to fuel assessment as part of therapy in order to bolster those aspects which are problematic. For instance,

if a client had a store of metacognitive knowledge including effective strategies but little awareness of where and when they might be used then their therapy programme should emphasize metacognitive regulation.

We also have limited information on what may negatively influence metacognition. We know that in stressful situations our cognitive abilities are affected. If these situations do affect metacognition generally then encouraging alternative responses through methods other than cognitive remediation would be appropriate, including increasing self-esteem or targeted therapy for auditory hallucinations. However, the evidence on these potential therapy avenues is not clear and there is no specific recommendation as to how different interventions gains may contribute to global outcomes.

Evidence on self-awareness may throw some light on how sub-domains of metacognition, including metacognitive knowledge, may be changed by affective components. In one of our recent studies we demonstrated that when self-esteem levels were controlled, cognitive performance evaluations were more in keeping with the corresponding objective neuropsychological assessments (Cella et al., 2014). Self-esteem also affects strategy use in people with schizophrenia within a CR programme. Those with higher self-esteem used fewer strategies even though more strategy use increases the effects of therapy (Wykes and Cella, 2015). Here self-esteem may dampen the effects of CR and may be a factor important for therapists to monitor as a potential barrier to therapy-related improvements.

Currently, we do not know which tasks best facilitate the active use of metacognitive competencies. This information is vital if we are to improve the efficiency of therapy and laboratory task development can aid this selection. We also need to know how individual characteristics, e.g., poor cognitive reserve, can inhibit task efficiency. Studies of moderators and mediators of the treatment effects will contribute to clarifying the role of intensive training and strategy use but also to characterize these active CR building blocks by comparing different therapies.

The boundaries between cognition and metacognition are not distinct. Some domains of executive function, such as monitoring, overlap with metacognition and this makes the measurement of metacognition and cognition difficult to separate. CR programs that target executive function do seem to achieve higher functional gains but it is unclear if these gains are separate from or included in metacognition gains. In **Figure 2** we suggest that metacognition may partially exert its influence on functioning via executive function but we propose that there may be also a direct link related to higher metacognitive competencies not captured by executive functions alone. For instance two individuals experiencing low mood may be equally able to make a good plan in relation to organizing a visit to a friend. However, only one may perceive the low mood as a limitation to the implementation of the plan and realize that it may not be a good day to travel while the second person may try and fail. Both these people may have similar scores on a planning assessment but may have different levels of metacognition.

Conclusion

It has been 10 years since we first suggested the importance of metacognition (Wykes and Reeder, 2005) in the context of CR and since then this concept has become increasingly used. However, although this provides structure for learning and is supported by a long research programme in education, the term is being used too loosely. Therapy developers need not only to refer to "thinking about thinking" but to specify the concept in a way which allows its measurement. The ability of metacognition to be helpful is totally dependent on our ability to replicate the findings of others and to be less circular in our outcome assessment. To move forward the field needs better operationalization of the term, more rigorous measurement and testing in the context of interventions.

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Motive-oriented therapeutic relationship building for patients diagnosed with schizophrenia

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Treatment options for patients with schizophrenia demand further improvement. One way to achieve this improvement is the translation of findings from basic research into new specific interventions. Beyond that, addressing the therapy relationship has the potential to enhance both pharmacological and non-pharmacological treatments. This paper introduces motive-oriented therapeutic relationship (MOTR) building for schizophrenia. MOTR enables therapists to proactively adapt to their patient's needs and to prevent problematic behaviors. For example, a patient might consider medication as helpful in principle, but the rejection of medication might be one of his few remaining means for his acceptable motive to stay autonomous despite hospitalization. A therapist who is motive-oriented proactively offers many degrees of freedom to this patient in order to satisfy his need for autonomy and to weaken the motivational basis for not taking medication. MOTR makes use of findings from basic and psychotherapy research and is generic in this respect, but at the same time guides therapeutic action precisely and flexibly in a patient oriented way.

Keywords: schizophrenia, motive-oriented therapeutic relationship, Plan Analysis, case conceptualization, therapeutic relationship, psychosis, CBT

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The Therapeutic Relationship—A Starting Point for Improving Schizophrenia Treatments?

Besides antipsychotic medication, cognitive behavioral therapy for psychosis (CBTp) is an evidence-based treatment option for patients with schizophrenia and related disorders (Pfammatter et al., 2006; Wykes et al., 2008; Turner et al., 2014). Even though CBTp and antipsychotic medication are effective, their effects are only medium-sized, and not every patient profits. Meta-analyses report medium effect-sizes both for second generation antipsychotics compared to placebo (Hedge's $g = 0.51$; Leucht et al., 2008) and for CBTp compared to social support ($g = 0.42$; Turner et al., 2014). Thus, there is room for further improvement of pharmacological and psychotherapeutic treatment options for patients with schizophrenia. Considerable efforts are being made to translate findings from basic research in order to improve CBTp (Freeman and Garety, 2014). For example, interventions for insomnia, worrying or trauma have been adapted for schizophrenia treatment (Jackson et al., 2009; Myers et al., 2011; Freeman et al., 2015). Apart from more and more specific interventions, are there other targets for improving the treatment of schizophrenia?

The relation of therapeutic alliance and outcome is a robust finding in psychotherapy research (Flückiger et al., 2012). In the treatment of schizophrenia, direct evidence of the alliance-outcome

relation is scarce but consistently positive for psychotherapy (Svensson and Hansson, 1999; Priebe et al., 2011; Huddy et al., 2012), for case management (Farrelly et al., 2014) and also for compliance with pharmacotherapy (Lacro et al., 2002). Thus, the therapeutic relationship is an important factor in the treatment of schizophrenia and a potential target for improving both pharmacological and psychological interventions.

In stark contrast to the elaborated models of the development and maintenance of psychotic symptoms (e.g., Bentall et al., 2001; Garety et al., 2001), there is no evidence-based theoretical framework of the therapeutic relationship in schizophrenia treatment that informs therapeutic action. Consequently, research on the therapy relationship in schizophrenia treatment is theory-driven only to a minor degree and focuses on patient (e.g., symptoms, insight into illness, attachment style; Kvrgic et al., 2013) and therapist variables (e.g., empathy or trustworthiness; Evans-Jones et al., 2009), or investigates the potentially negative impact of specific intervention strategies, such as cognitive dispute, on therapeutic relationship (Wittorf et al., 2010). Many authors agree that therapeutic relationship building is important and challenging in CBTp (Dilks et al., 2013; Johansen et al., 2013; Jung et al., 2014), but the recommendations are divergent and range from specific suggestions for difficult situations in therapy (e.g., mistrust or affective flattening; Klingberg and Wittorf, 2012) to empathy and mindfulness trainings in therapist qualification programs (Jung et al., 2014). In addition, treatment manuals for schizophrenia highlight the importance of building and maintaining a good therapeutic relationship (e.g., Lincoln, 2006; Chadwick, 2008) and recommend specific therapeutic techniques (e.g., emotional validation and normalization; Lincoln, 2006) and stances (e.g., radical collaboration; Chadwick, 2008). However, empirical findings and practical recommendations are not integrated within an overarching framework. Nonetheless, a growing number of psychotherapy approaches focus on the therapy relationship in the treatment of patients with schizophrenia (e.g., metacognitive interpersonal therapy, Salvatore et al., 2012; for a case study, see Hillis et al., 2015; as well as a mentalization-based approach, Brent, 2015).

In sum, the therapeutic relationship is a promising starting point for improving both pharmacological and psychotherapeutic schizophrenia treatments, but there is need for a therapy relationship framework in schizophrenia treatment. A framework for building and maintaining a therapeutic relationship in schizophrenia treatment has to meet multiple demands. An optimal framework (a) integrates existing empirical findings on the therapy relationship, (b) informs therapeutic action both proactively and reactively, individualized for each patient, (c) makes full use of findings from basic research, and (d) is compatible with the diversity of interventions (e.g., pharmacological and psychotherapeutic interventions). Motive-oriented therapeutic relationship (MOTR; Caspar, 2011) is a framework that has the potential to meet these requirements and has begun to demonstrate its utility in mental disorders such as borderline personality disorder (Kramer et al., 2011) and narcissistic personality disorder (Kramer et al., 2014). MOTR was also applied to severe Axis-I disorders such as bipolar disorder (Kramer et al., 2009). Moreover, a flexible, motive-oriented therapist behavior seems to be particularly beneficial for patients with more severe symptomatology and less resources (Grawe et al., 1990).

Motive-Oriented Therapeutic Relationship Building in Schizophrenia Treatments

What is MOTR and how does it work? In pharmacological and psychotherapeutic treatments, patient behavior which interferes with a generally useful therapeutic procedure and potentially at the end with outcome can be defined as *problematic behavior*. In that sense, refusing medication, not acknowledging a mental disorder or concealing symptoms are problematic behaviors in the treatment of schizophrenia. Therapists who insist on taking medication, try to argue patients into being insightful or try to convince patients of giving up their delusional beliefs are trying to deal with problematic behavior. However, might such a therapist behavior also be problematic? MOTR helps the therapist to address problematic patient behavior in an unproblematic, adaptive way. In this section, MOTR is introduced and its application to schizophrenia treatment will be illustrated in three exemplary domains (medication compliance, delusional beliefs, and negative symptoms).

A central tenet of MOTR building is that each problematic behavior of a patient has at least one unproblematic, acceptable superordinate purpose or motive (Caspar, 2011). If therapists have an idea of the superordinate motive of a problematic behavior (i.e., its instrumentality), they have an increased chance to proactively address this acceptable purpose without reinforcing the problematic behavior. When looking for an unproblematic motive one infers motives up in an instrumental hierarchy (in which concrete instrumental behaviors are on the bottom), and once one has arrived at a higher level asks "Is this motive unproblematic?". If the motive is still problematic, one keeps asking "And to which superordinate motives does this motive serve?" until one reaches an unproblematic motive. But as motives become less and less specific when approaching the level of general needs, one does not go higher than necessary to avoid spoiling resources by lacking correspondence to the individual motives of a particular patient. For example, a patient might reject medication. An acceptable superordinate motive could be to experience oneself as being autonomous. Thus, one can look for complementary therapist behaviors such as proactively offering many degrees of freedom in therapy sessions. If the superordinate motives are saturated or even oversaturated by a therapist independent of the problematic means (patient experiences himself as autonomous), the problematic behavior is not needed anymore by the patient (rejection of medication in order to increase autonomy no longer necessary) and by being proactive and non-contingent in time to patient behavior, the therapist does not (unintentionally) reinforce the problematic behavior, which might happen when reacting on a behavioral level (forcing to take medication).

In addition to reducing problematic patient behavior, MOTR aids the therapist to satisfy patient's basic needs by being responsive to motives and behaviors, which are acceptable from

the outset. Revealing the individually most important topics and motives, a case conceptualization also leads the way to complementary offers in the most valuable currency for this patient, and helps to prevent spoiling resources by attempting to serve all needs in an undifferentiated way. For example, when a patient has a pronounced need for orientation and control, the issue of being an independent decision-maker may be of particular importance for this patient, and is seen as unproblematic motive, the therapist creates situations in which the patient can experience himself as decision-maker.

CBTp Techniques for Relationship Building From a MOTR Perspective

Currently, the primary CBTp techniques for building and maintaining the therapy relationship are normalizing and (emotional) validating (e.g., Lincoln, 2006). From a MOTR perspective, both techniques are motive-oriented in many but not all therapy situations. Normalizing conveys to the patient that many other people have similar experiences. First, this is likely to satisfy the need for affiliation, as one is part of a group of many similar human beings. Second, normalizing implies that one is not "crazy" or "abnormal," preventing further threats to self-esteem and also preventing a threat for autonomy ("I'm crazy and will be in a ward for the rest of my life"). Last not least, normalizing may help to satisfy the need for orientation and control, because the information that even psychotic symptoms are rather normal in fact provides orientation. With regard to validation, similar motive-oriented consequences for patients are likely. Particularly, validation means that patient and therapist do not argue about the truth of a delusional belief or the authenticity of voices. In contrast, the therapist understands the emotional and behavioral reactions of the patient and communicates this understanding and empathy. This is a corrective experience for many patients as they are no longer forced to defend their view of the world or conceal it in order to protect their self-esteem and need for orientation. In line with this, the effect of normalizing and validation compared to educating supported psychological treatment motivation in an analog study (Lüllmann and Lincoln, 2013). However, if the maintenance of a delusional belief of a patient has a strong instrumentality for self-esteem (e.g., grandiose or erotomanic delusions, voice of God, etc.), a standard normalizing approach would be adverse according to MOTR because it endangers an important instrumentality of the behavior (e.g., a therapist saying "Many people think that they have a special connection to God, this is normal" is likely to threaten the need for self-esteem enhancement and/or attachment of a patient).

Medication Compliance

The behavior "refuses medication" might primarily serve to satisfy the need for autonomy, as in the example in the previous section. However, another patient might refuse medication in order to evoke additional sessions with a therapist or a closer contact with caregivers, to satisfy his need for attachment. Yet, another patient who beliefs he is persecuted outside the ward might refuse medication to prolong his hospitalization, in order to satisfy his need for security. Furthermore, another patient might "forget" taking medication in order to avoid being reminded of being ill, which in turn protects self-esteem. And yet another patient may simply want to avoid negative side effects. Thus, one problematic behavior can serve very different motivational purposes. In addition, a problematic behavior can be multiply determined (e.g., serving autonomy *and* affiliation).

MOTR suggests different therapeutic stances and interventions, depending on the instrumentality of the problematic behavior. With regard to autonomy and control, satisfying the Plan "exercise control" by broadening the opportunity for decision-making in other domains can be expected to weaken the motivational basis for not taking medication. In contrast, a dispute of the pros and cons of medication each time the patient rejects medication would be a positive reinforcement of the patient behavior (C+), because he or she experiences herself as in control which would be in line with the basic need (given that the medication is not forced). When the problem behavior is instrumental for attachment (evoking more caregiver contact by refusing medication), regular and non-contingent short contacts would be derived from the MOTR approach in order to saturate the motivational basis for rejecting mediation.

Maintenance of a Delusional Belief

In line with the cognitive model of psychosis (Garety et al., 2001), the maintenance of a delusional belief is likely to satisfy the need for orientation and control in many patients. In addition, the direct cognitive disputation of such a belief can be seen as threat for the self-esteem. In that sense, "typical" therapeutic strategies such as psychoeducation or persuading patient into being insightful are problematic therapist behaviors for many patients, as they pose a direct threat to the self-esteem and to the need for orientation and control. However, if a patient has a first episode, no elaborated delusional beliefs and a deprived need for orientation and control, then psychoeducation and the facilitation of a biopsychosocial problem model is expected to be very helpful, according to MOTR. Thus, MOTR enables the therapist to make informed decisions when to use which intervention.

If the maintenance of a delusional belief is multiply determined (i.e., is instrumental for two or more superordinate motives) and has an instrumentality for self-esteem (e.g., grandiose delusion), MOTR would suggest that the therapist supports the self-esteem in each session. In such a way, MOTR would satisfy the self-esteem motive independent of grandiosity delusion thus paving the way for direct interventions regarding the delusional belief or other helpful interventions. When the need for orientation and control is satisfied by the maintenance of a delusional belief, MOTR would suggest that the therapist helps the patient to develop an intrinsic motivation to challenge his beliefs (e.g., with a four-field-schema).

Negative Symptoms

The effects of pharmacological and psychotherapeutic interventions on negative symptoms are small (Elis et al., 2013; Chue and Lalonde, 2014). Is MOTR for schizophrenia able to address these treatment difficulties? First, using MOTR could support therapists to maintain a good therapy relationship even

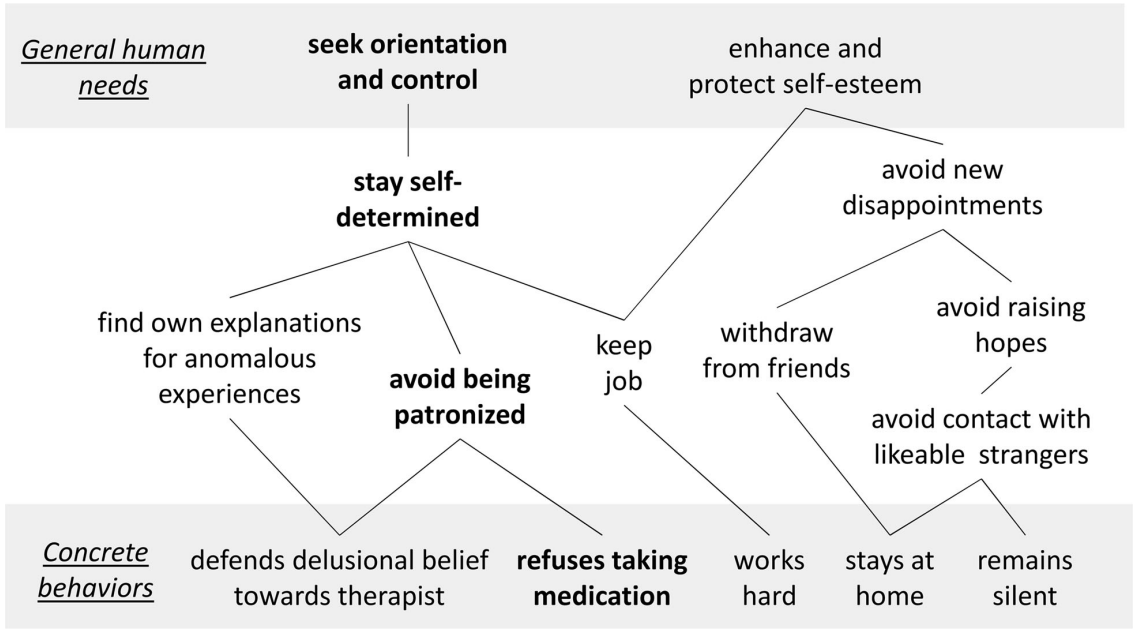

FIGURE 1 | A hypothetical Plan structure.

in face of severe negative symptoms such as blunted affect or alogia. When there is only minimal non-verbal or verbal feedback from the patient, therapists have an even higher demand for framework that guides therapeutic action in order to meet the needs of a patient, with MOTR being such a framework. Second, if future research should reveal that negative symptoms also have an instrumental aspect, MOTR might help to satisfy the motivational basis of negative symptoms.

Summary

MOTR has a potential to guide therapists to find an unproblematic way to deal with problematic patient behavior and to optimize the conditions for effective psychological and pharmacological interventions for schizophrenia. A prerequisite for MOTR is an understanding of the individual motives of each patient. If therapists have no concept of the individual structure of motives, they are not able to use MOTR. Plan Analysis offers a framework for developing such an understanding (Caspar, 1995, 2007) and will be outlined in the next section.

Inferring the Instrumentality of Experience and Behavior Using Plan Analysis

The concept of Plan Analysis provides a psychological framework that helps to capture the instrumentality of problematic and unproblematic treatment-related behavior for superordinate motives (Caspar, 1995, 2007). The basic units of Plan Analysis are Plans[1] which consist of a goal or purpose (e.g., exercise control) and a means (e.g., refuse medication). Plans are hierarchically nested within each other and can be graphically depicted as Plan structure, with basic human needs at the top and concrete behaviors at the bottom (for an example, see **Figure 1**). Grawe (2000) assumes four basic human needs: (1) orientation and control, (2) affiliation, (3) enhancement of self-esteem and (4) pleasure/avoidance of pain. *Approach* Plans motivate behavior which establishes congruent experiences (e.g., call friends → maintain close relationships), whereas *avoidance* Plans motivate behavior which prevents painful experiences (e.g., withdraw → avoid disappointments).

In the example in **Figure 1**, the patient works hard in order to keep his job. His Plan "keep job" serves to stay self-determined, and this Plan serves to maintain orientation and control. When this patient loses his job, for instance due to an exacerbation of schizophrenia, the Plan "keep job" is blocked. Under such circumstances, other Plans that serve the purpose of staying self-determined gain importance. In this case, the Plan structure is scarce regarding means for staying self-determined—that is, the Plan structure is *rigid*. The only remaining means for this patient is refusing to take medication in order to maintain his need for orientation and control. Besides rigidity of Plan structures, *multiple determination* is a prevalent property of Plans. In the example in **Figure 1**, the Plan "keep job" serves two superordinate Plans—staying self-determined and enhancing self-esteem. Losing the job, for instance because of schizophrenia, is accompanied by deprivation of *both* of the basic needs for autonomy and self-esteem, according to this Plan structure. In this view, problematic behaviors of patients, such as refusing medication, are goal-oriented and instrumental for satisfying their needs (e.g., staying self-determined), even though they might (as a negative side effect) undermine therapy outcome—at least unless

[1]Written in the upper case following the tradition of (Miller et al., 1960) serving to highlight that their use of Plans differs from the common use, mainly in that they consider most Plans to be non-conscious.

TABLE 1 | Sources of negative emotions from a Plan Analysis perspective.

Type	Description	Example
Change in environment	The Plan structure, that is the totality of means for satisfying basic needs, does not fit to changes in the environment or to a new environment	An individual with first-episode psychosis is not able to satisfy his need for autonomy within the restricted setting of a secure ward with his usual Plan "Decide on appointments for yourself," due to a predefined weekly schedule
Loss of individual abilities	The means for a purpose (e.g., skills) are no longer available	Neuropsychological deficits accompanying schizophrenia impede studying and block the Plan "graduate"
Rigid Plan structure	An important Plan has only a single (or too few) means for its realization	The Plan "Heighten self-esteem" is exclusively realized with the means "Stick to conviction of being loved by Jodie Foster" (erotomanic delusion)
Conflicting Plans	The means of a Plan endangers another important Plan	The Plan "Conceal hearing voices" endangers the Plan "Seek help when distressed"
Dominance of avoidance Plans	A high number of avoidance Plans reduce the degrees of freedom for realizing approach plans	The Plans "Avoid stress" and "Avoid a new psychotic episode" hinder the approach Plan "Try to make new friends"

the therapeutic offer takes them into account. It is crucial to infer the Plan structure of each patient individually, because the means which patients develop and use to satisfy their common basic needs can differ tremendously. Similarities within a group of patients—to which the term *prototypical Plans* refers—can nevertheless speed up the process of inferring Plans, but it needs to be plausible that a commonly found Plan makes sense also to this individual patient.

How to infer Plans? Patient reports are a valuable but not an exclusive source of information for hypotheses about Plans, particularly in patient with schizophrenia with reduced introspective and neuropsychological abilities (e.g., metacognitive capacities; Lysaker and Dimaggio, 2014). The use of multiple sources of information is highly important. In particular, there is a heavy weight on direct observation, especially of non-verbal behavior. Although hypotheses are constructed with the intention of coming as close as possible to patients' actual Plans, one has to keep in mind that they are constructions rather than a reality. Helpful rules for inferring Plans are "always grounding hypotheses in multiple evidence" and "continually revising hypotheses based on new information" (see Caspar, 2011 for details).

Emotions and Plan Analysis

From a Plan Analysis perspective, negative emotions signal that important Plans and basic needs are threatened or blocked, positive emotions that they are favored (Caspar, 2011) and are valuable diagnostic information. In general, five types of sources of emotions are assumed in Plan Analysis, which are described and illustrated in **Table 1**.

Schizophrenia is often accompanied by a loss of individual abilities and changes in the environment (i.e., hospitalization, job loss, etc.). Under such circumstances, the flexibility and resilience of the patient's Plan structure is particularly important. The more the structure is rigid or includes conflicting Plans, the more patients have problems satisfying their basic needs and experience negative emotions (see **Table 1**). Then, Plans might be in effect even though they have severe short- or long-term side effects, such as endangering the therapy relationship or even threating life (when a patient kills himself as a last demonstration of autonomy). For example, a loss of individual abilities might block most of the Plans related to self-esteem. Under such circumstances, the remaining Plans such as "maintain paranoid delusion" are particularly important for the patient, even though they can severely disturb the therapy relationship, highlighting the utility of MOTR for many patients with schizophrenia.

Although an individual Plan Analysis for each patient is necessary, findings from basic schizophrenia research should be taken into account to inform individual Plan Analyses were appropriate. In the next section, the instrumental perspective of Plan Analysis is used to review the literature of psychological mechanisms of the development and maintenance of schizophrenia.

Need for Orientation and Control

Epstein (1990) assumed that there is a basic human need for orientation and control that helps individuals to make sense of their experiences and informs them about the degree of control they have in an environment. A deprived need for orientation and control is often signaled by anxiety. Orientation and control are psychological processes that are central to various models and findings from basic schizophrenia research and will be discussed in the next paragraph.

Cognitive Model of Psychosis

The cognitive model of positive symptoms of schizophrenia by Garety et al. (2001) as well as the more symptom-specific cognitive model of persecutory delusions by Freeman et al. (2002) or the cognitive model of auditory hallucinations (Mawson et al., 2010) propose that anomalous experiences or unspecific arousal motivate a search for an explanation or "meaning" (i.e., an appraisal process). The search for meaning in the cognitive models is influenced by emotional processes and cognitive biases. When individuals select a "threat belief" due to their search for meaning, a persecutory delusion develops (Freeman et al., 2002). The cognitive models stimulated further research and are also used for case formulations in CBTp (for a review, see Freeman and Garety, 2014). From an instrumental perspective, the key process of the models—"search for meaning"—is a Plan that serves the basic need for orientation and control. Accordingly, each attempt to challenge a delusional belief that serves the motive for orientation and control implies the risk of threatening an important Plan. Without offering an alternative explanation that is compatible to

the Plan structure of a patient at first, this challenge is likely to result in anxiety, in attempts to protect the belief and in an alliance rupture.

Cognitive Biases

Cognitive biases such as jumping to conclusions (Fine et al., 2007) or bias against disconfirmatory evidence (BADE; Moritz and Woodward, 2006) influence the selection of an explanation for anomalous experiences, according to the cognitive models of psychosis (Garety et al., 2001). From a Plan Analysis perspective, cognitive biases might not solely express neuropsychological deficits but also be instrumental for satisfying the need for orientation and control and for avoiding conflictual views, being confronted with overdemanding complexity, and more.

Anxiety

Mounting evidence suggests that negative emotions play a central and causal role in the development and maintenance of positive symptoms such as delusions and acoustic hallucinations (Hartley et al., 2013; Marwaha et al., 2014). Studies with intensive longitudinal assessments revealed that increases in anxiety can trigger paranoid ideation in patients with schizophrenia (Thewissen et al., 2011). This effect is corroborated by experimental studies in sub-clinical populations, which suggest that anxiety can trigger paranoia (Lincoln et al., 2010; Westermann and Lincoln, 2010). Indirect evidence for the causal role of emotions in the development and maintenance of schizophrenia comes from pilot interventions studies that targeted worrying (Foster et al., 2010) and insomnia (Myers et al., 2011) without focusing on psychotic symptoms, but nevertheless reduced psychotic symptom severity. Taken together, the increase of anxiety is likely to trigger psychotic symptoms.

From a Plan Analysis perspective, anxiety might reflect a threatened or blocked need for orientation and control. Plans that increase orientation or facilitate control are expected to be especially relevant for experience and behavior in a state of anxiety, even if they are not adaptive on the long run. These Plans might include excessive worrying, acceptance of delusion-like spontaneous interpretations, retaining existing delusional interpretations that offer orientation and cognitive biases (e.g., jumping to conclusions). Moreover, helpful Plans which could serve as resources such as sleeping in order to prospectively regulate one's emotions (Westermann et al., 2013) might be blocked.

Need for Enhancing and Protecting Self-Esteem

Findings from basic clinical and psychotherapy research highlight the relevance of self-esteem for positive symptoms and therapeutic alliance in schizophrenia. Decreases in self-esteem can precede paranoid ideation in daily life according to studies with intensive longitudinal assessments (Thewissen et al., 2011). In experimental studies with sub-clinical samples, the effect of social exclusion on paranoid ideation was mediated by decreases in self-esteem (Kesting et al., 2013) and paranoid interpretations of social exclusion protected the self-esteem on a short-term scale (Lincoln et al., 2014). Lack of insight is accompanied by *less* self-stigmatization and demoralization across one year in patients with schizophrenia (Cavelti et al., 2014), with stigmatization being associated with lower self-esteem (Link et al., 2001). There is also evidence for a positive association of patient's rating of the therapy relationship and their level of self-esteem in group interventions (Lecomte et al., 2012). Finally, prototypical Plans such as "Repair the self-esteem" were present in six of seven patients with schizophrenia in a qualitative study (Hellener, 1997).

Blocked or threatened Plans that serve to satisfy the need for self-esteem enhancement might be relevant for many individual Plan structures. In particular, rigid Plan structures (only limited means for enhancing self-esteem), conflicting Plans (the means of one motive such as affiliation block the means of another motive such as self-esteem) and a predominance of avoidance Plans (protection of self-esteem limits the opportunities for increasing self-esteem) are likely to be part of individual Plan structures of many patients with psychotic disorders. For example, the satisfaction of the need for self-esteem enhancement can depend on a rigid Plan structure of a patient, which includes solely the Plans "keep job" and "maintain belief of being loved by Jodie Foster." When this patient is hospitalized, the Plan "keep job" is blocked. Under such circumstances, other sources for self-esteem enhancement should be established (e.g., validation by the therapist, social skills training, etc.; compare to Gassmann and Grawe, 2006) prior to a challenging the maintenance of the delusional belief, which is the very last means for protecting self-esteem.

Other Basic Human Needs

Need for Affiliation

Attachment insecurity is associated with positive and negative symptoms with a small to medium effect size (Gumley et al., 2014). In line with this, attachment avoidance is accompanied by lower therapeutic alliance (Berry et al., 2007) and insecure attachment is a risk factor for disengagement from mental health services (Tait et al., 2004). Thus, Plan Analysis with patients with schizophrenia should focus on attachment related Plans in detail.

Need for Pleasure/Avoidance of Pain

Mounting evidence suggest that emotion regulation difficulties are related to psychotic symptoms (e.g., Westermann and Lincoln, 2011) and schizophrenia in general (O'Driscoll et al., 2014). For instance, the generally adaptive emotion regulation strategy cognitive reappraisal is less frequently used by patients with schizophrenia compared to controls (O'Driscoll et al., 2014), and findings from a study with sub-clinical samples suggest that reappraisal might be even maladaptive for delusion-prone individuals under social stress (Westermann et al., 2012). In addition, Owens et al. (2013) report a negative correlation between the therapy relationship and difficulties in emotion regulation in patients with schizophrenia and related disorders. Thus, demands in the therapeutic relationship should not threaten emotion regulation strategies unless alternatives to them can be offered or developed. The inclusion of Plans for emotion regulation that serve the basic need for pleasure and avoidance of pain might be important in individual Plan structures.

It needs to be emphasized that, although plausible in a particular frame of reference, Grawe's four "basic needs" are not

exclusive at all. When truly inferring in an inductive bottom-up manner, one finds different needs with different individuals. For example, seeking for meaning appears for many patients as an independent need which goes far beyond seeking orientation, as outlined above.

Summary and Outlook

The assumption that unproblematic and problematic behaviors are instrumental for satisfying the needs of a person is the basis for MOTR. A good therapy relationship can be built and maintained by (1) being responsive and proactively satisfying regarding the important *unproblematic*, acceptable patient behaviors and Plans and (2) being unresponsive to *problematic* behaviors but responsive and proactively satisfying regarding the superordinate acceptable motives to which problematic behaviors hypothetically serve. A prerequisite for MOTR is an understanding of individual motives of a patient, for instance by using Plan Analysis. Plan Analysis has to be carefully and continuously conducted for each patient and can include and integrate findings from basic clinical research if appropriate for a specific patient. Findings from basic research suggest that many patients with schizophrenia have suboptimal Plan structures with regard to autonomy and self-esteem. When a patients' Plan structure does not fit to a new environment or a loss of individual abilities or both (as it seems often to be the case in schizophrenia), patients make frequent and intensive use of problematic behaviors that endangers the therapy relationship due to a lack of alternative Plans. MOTR can guide therapists to build and maintain a good therapy relationship despite such problematic behaviors.

Implications for Psychotherapy

The main advantage of MOTR in schizophrenia treatments is expected to be that evidence-based interventions from different fields such as pharmacotherapy, CBT or family therapy can be applied more effectively. However, Plan Analysis has more potential than only guiding in-session therapist behavior. Plan Analysis can enrich a case formulation and inform a therapist about patient resources, appropriate skills trainings, and the reasonable sequence of interventions. For example, if the Plan "maintain belief that the voice comes from an angel" serves the need for affiliation and self-esteem, and the patient has only few other means for satisfying these needs, one should include interventions for building up affiliation resources and self-esteem enhancement in the treatment plan. An accordingly staged treatment plan could be: (1) activating and validating patient resources in order to build up a therapy relationship, (2) skills training for enriching the rigid Plan structure for self-esteem and affiliation (e.g., social skills training) and cognitive disputation of automatic thoughts that reflect conflicting Plans, (3) cognitive disputation of the auditory hallucination related delusions (if they are still maintained), and (4) relapse prevention.

Currently, more and more specific interventions for schizophrenia are being developed and evaluated. These interventions target emotion-related processes such as worrying or insomnia, are directly derived from basic research and are a valuable contribution to the treatment of schizophrenia (Foster et al., 2010; Myers et al., 2011). However, not all "negative" emotions stem from psychopathological processes such as worrying or sleep deprivation due to insomnia. In order to understand the generation of emotions that might trigger psychotic symptoms in a more generic manner, one can make use of Plan Analysis, because it captures recurring emotions on a broader scope. For example, if a patient with schizophrenia experiences negative emotions due to Plans related to a comorbid social phobia, the therapist can address this source of distress by offering the patient exposure therapy (without having to wait on the first treatment manual for exposure therapy in patients with schizophrenia with comorbid social phobia).

Implications for Pharmacotherapy

When psychiatrists are able to identify their patient's needs and to adapt to them, the instrumentality of the problem behavior "refusal of antipsychotic medication" is less likely to be overlooked. Vicious circles of problematic patient and problematic therapist behaviors could be prevented or stopped (e.g., therapist tries to coerce patient to being insightful in order to take medication, patient refuses medication in order to experience himself as autonomous, and so on). If future empirical research corroborates the hypothesis that there are prototypical Plan structures for patients with schizophrenia, short MOTR trainings for psychiatrists would be feasible and beneficial that do not require psychiatrist to conduct a complete Plan Analysis for each patient.

Research Implications

A research agenda for MOTR for schizophrenia encompasses three main domains. First, the hypothesis that motivational constructs such as blocked or threatened Plans are relevant to the therapeutic relationship in addition to other variables such as symptom severity or neuropsychological deficits has to be tested. Second, individual Plan Analyses of patients with schizophrenia are necessary in order to empirically determine the validity and reliability of Plan Analysis in schizophrenia. Possibly, such studies will reveal prototypical Plan structures that help to inform future research and trainings. Third, randomized controlled trials are necessary to test whether treatments as usual (e.g., pharmacotherapy, CBTp, etc.) enriched with MOTR are more effective than treatments as usual without MOTR. In addition, such intervention studies would investigate whether therapists that adopt MOTR with patients with schizophrenia are more comfortable and experience themselves as less helpless when using MOTR, because they are able to see the underlying acceptable human needs of their patients' problematic behaviors and can thus avoid vicious circles of problematic behaviors (see Schmitt et al., 2003). Thus, MOTR has the potential to contribute to the mental health of therapists and other care providers.

Taken together, MOTR has the potential to improve both pharmacological and non-pharmacological treatment for schizophrenia by enabling therapists to proactively adapt to their patient's motives and to preventing problematic behavior. The approach makes use of (current and future) findings from basic and psychotherapy research and is generic in this respect, but at the same time guides therapeutic action precisely and flexibly in a patient oriented way.

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