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Metacognitive Training Modified for Negative Symptoms (MCT-N)

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1. Metacognitive Training Modified for Negative Symptoms (MCT-N): A Feasibility study

2. Metacognitive Training for Negative Symptoms

3. Authors: Linda Swanson 1,2,4, Matthias Schwannauer 1, Tim Bird 1, Emma Eliasson 1, Audrey Millar 2, Steffen Moritz 3, Helen Griffiths 1

4: Addresses:

1: University of Edinburgh, UK, Section of Clinical and Health Psychology, School of Health in Social Science, Edinburgh, EH8 9AG

2: NHS Lothian, UK, Psychology Department, Royal Edinburgh Hospital, Edinburgh, EH10 5HF

3: University Medical Center Hamburg-Eppendorf, Germany, Department of Psychiatry and Psychotherapy, Hamburg, 20246

4: Region Sörmland, Sweden, Centre for Clinical Research Sörmland, Eskilstuna, 631 88,

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8. Abstract

Objective. Although patients often prioritise the treatment of negative symptoms, few psychological interventions targeting negative symptoms exist. This study attempts to fill this gap by piloting a modified Metacognitive training programme, specifically targeted at negative symptoms (MCT-N), with a group of patients with prominent negative symptoms.

Method. We adopted a mixed methods case series design, providing detailed quantitative data on changes over time, to focus on potential mechanisms underlying the intervention, in combination with qualitative interviews.

Results. The intervention showed good feasibility as demonstrated by the attendance rate, the positive feedback from participants and the multidisciplinary team, and the improvements on negative symptoms observed following the intervention. Multilevel modelling showed that depression, internalised stigma, and reflective functioning explained the variance in negative symptoms.

Discussion. The pilot study indicated that the intervention has high feasibility and that improvements in negative symptoms can be partially explained by improvements on depression, stigma, and reflective functioning.

Key messages for practitioners:

- Negative symptoms can be improved with interventions targeting depression, internalised stigma, and reflective functioning
- Metacognitive Training for Negative Symptoms may be an promising intervention to improve negative symptoms

Keywords: Negative Symptoms, Metacognitive Training, depression, stigma, mentalisation

9. Main body

Introduction

Whilst clinicians tend to focus on positive symptoms as primary treatment targets in schizophrenia, patients prioritize the treatment of depressive and negative symptoms (Moritz, Berna, Jaeger, Westermann, & Nagel, 2016). Persistent negative symptoms are experienced by approximately 20-40% of individuals diagnosed with schizophrenia (Sarkar, Hillner, & Velligan, 2015). Current research indicates that negative symptoms are independent from positive symptoms, depression, cognitive dysfunctions, and disorganization (Galderisi, Mucci, Buchanan, & Arango, 2018). However, neither medication nor existing psychosocial interventions have proven to be efficacious in reducing negative symptoms (e.g. Fusar-Poli et al., 2015; Veerman, Schulte, & de Haan, 2017; Correll & Schooler, 2020). Consequently, Lutgens, Garipey, & Malla (2017) highlighted the need for better understanding of treatment mechanisms underpinning psychological interventions that directly target negative symptoms. Psychological conceptualisations suggest that negative symptom expression can in some cases be understood as a response to adverse experiences (Aleman et al., 2017). For example, Beck, Rector, Stolar, & Grant's (2009) cognitive model suggests that negative symptoms emerge from a process where individuals adopt coping strategies of 'shutting down' the cognitive-affective experience. This allows individuals to cope with overwhelming or aversive situations in the short-term, but leads to a reliance on negative symptoms including social withdrawal, avolition, and diminished expression to reduce exposure to, and the impact of, negative experience in the longer-term. From an attachment framework, Griffiths and Macleod (2019) suggest that negative symptoms may be seen "as responses involving emotional and social withdrawal that emerge from threats to self-security" (p. 62). If negative symptoms can be partially understood within cognitive and

developmental frameworks, it may be possible to develop theoretically driven interventions for their treatment.

A cognitive model of negative symptoms

Negative symptoms are associated with low expectations of future success (Cox et al. 2016), asocial beliefs (Grant & Beck, 2010), a reduced sense of self-efficacy (Bentall et al., 2010), negative self-concepts (Lincoln, Mehl, Kesting, & Rief, 2011), defeatist performance beliefs (Campellone, Sanchez, & Kring, 2016), and self-stigma (Horselenberg, van Busschback, Aleman, & Pijnenborg, 2016). The cognitive model therefore proposes that negative symptoms might be caused and maintained by dysfunctional beliefs arising as a consequence of repeated failures and setbacks. These appraisals might include negative beliefs about social affiliations; low expectations of pleasure, success and acceptance; defeatist beliefs about performance; and a perception of limited resources (see Beck, Himmelstein, Grant, 2019). The self-perception, and perceived self-efficacy, of individuals diagnosed with schizophrenia may also be influenced by self-stigmatising views of their mental illness. It might be that these factors result in hypervigilance to perceived criticism (Rector, Beck, & Stolar, 2005). Longitudinal studies have shown support for the model as defeatist performance attitudes and asocial beliefs are found to predict future negative symptoms (Luther et al., 2015; Thomas et al., 2017; Granholm, Holden & Worley, 2018).

Metacognition and psychosis

Metacognition was initially referred to as the capacity to think about and monitor one's mental processes (Flavell, 1979). However, the definition has broadened in contemporary research (Moritz & Lysaker, 2018), ranging "from discrete processes involving noticing specific thoughts and feelings to more synthetic acts in which information is integrated into complex representations of the self and others" (García-Mieres, 2020, p. 170). This has given

rise to interventions targeting metacognitive processes, where some have been developed for psychosis (e.g. Metacognitive Training (MCT) (Moritz & Woodward, 2007); Metacognitive Reflection and Insight Therapy (MERIT) (Lysaker & Klion, 2017)) whilst others have been modified for this population (see Lysaker et al., 2020; Weijers et al., 2020; Moritz, Klein, Lysaker, & Mehl, 2019).

Metacognitive Training (MCT) is based on the premise that cognitive biases play a role in the development and maintenance of psychotic symptoms which can be alleviated by targeting underlying cognitive processes (Pos et al., 2018). The aims are to gain insight and to learn practical strategies to manage distressing symptoms (Schneider & Andreou, 2014). Metacognitive training has been shown to reduce delusions (Liu, Tang, Hung, Tsai, & Lin, 2018) and positive symptoms (Philipp et al., 2019), and improve cognitive insight (Birulés et al., 2020) and biases (Sauvé, Lavigne, Pochiet, Brodeur, & Lepage, 2020). Preliminary evidence also suggests effects on quality of life (Moritz et al., 2014) and illness insight (Lopez-Morinigo et al., 2020).

Several authors highlight the links between negative symptoms and compromised capacity for self/other mental state processing (Gumley, Taylor, Schwannauer, & MacBeth, 2014; Harder, 2014; Griffiths and McLeod, 2019). There is evidence that suggests a link between metacognition and negative symptoms as limitations in complex metacognitive processes predict negative symptoms in first episode psychosis (Austin et al., 2019) and in more chronic samples, even after controlling for defeatist beliefs, affect recognition, and neurocognitive functioning (Lysaker et al., 2015). Metacognitive deficits are also associated with concurrent and future negative symptoms when controlling for verbal memory and education (Faith et al., 2020; Lysaker et al., 2020). Interestingly, self-reflection in itself has been found to mediate the relationship between neurocognition and negative symptoms

(especially for deficits in capacity to communicate about internal states, so called diminished expression) whilst interpersonal cognitive differentiation (i.e. the ability to construe one's experiences as either similar or different from others' experiences) has been found to mediate the pathway between self-reflectivity and negative symptoms (García-Mieres et al. 2019; 2021). This suggests that negative symptom reduction may at least partially depend on improved metacognitive capacity, and that a metacognitive intervention specifically targeting negative symptoms may be beneficial. We therefore adapted MCT for negative symptoms to assess the acceptability and feasibility of the intervention, examine variable change over the course of the intervention, and carry out a preliminary investigation of putative mechanisms of change.

Methods

Design

We adopted a mixed methods case series design providing detailed quantitative data on changes over time to allow a focus on potential mechanisms underlying the intervention combined with qualitative interviews. Similar designs have previously been applied to intervention development for individuals with severe and complex mental health problems. (Greaves, Camic, Maltby, Richardson, & Mylläri, 2012; Mairs, Lovell, Campbell, & Keeley, 2011; Heriot-Maitland, Vidal, Ball, & Irons, 2014).

Participants, sample size, settings, and ethics

Eligible participants were over the age of 16 with a diagnosis of schizophrenia, schizoaffective or non-affective psychosis in a Scottish National Health Service (NHS) board. Exclusion criteria were: evidence of severe organic brain dysfunction or a learning disability; difficulty with the English language; visual and/or hearing impairment; or being unable or unwilling to

provide written informed consent. We recruited a sample size of 15 participants. The study, which ran between March 2016 and February 2018, received appropriate ethical approval from South East Scotland Research Ethics Committee (reference: 16/SS/0046) and NHS Lothian Research and Development office.

Intervention

The original MCT intervention was adapted to negative symptoms by incorporating psychoeducation and strategies to target the cognitions suggested in the cognitive model (Beck et al., 2009) to be implicated in the development and/or maintenance of negative symptoms (see table 1). Although some of the strategies have traditionally been used to target positive symptoms, it is assumed that the same reasoning styles lead to negative symptoms through the dysfunctional cognitions discussed previously (e.g. jumping to conclusions in regards to social rejection and a dysfunctional attribution style reinforcing social withdrawal). MCT-N consisted of eight sessions in total, delivered by the main author (LE) (who was trained in MCT) individually as there is evidence indicating that this approach may lead to stronger effect sizes than delivery in a group format (Liu et al., 2018). The order of the sessions was randomised using an online random sequence generator; as a new intervention, the order of sessions was not pre-supposed as they were designed to be stand-alone, specifically targeting particular cognitions. The developer of MCT (Professor Moritz) approved the modification.

Outcome Measures

This study used a combination of interviews and self-rated questionnaires to assess negative symptoms. The primary outcome measures were the Brief Negative Symptom Scale (BNSS) (Kirkpatrick et al., 2010) (total score used) and the Positive and Negative Syndrome Scale (PANSS) (Kay et al., 1987) (with the PANSS negative factor proposed by Wallwork et al. (2012)). The BNSS was chosen as it has little overlap with depression (Strauss et al., 2012)

and is developed to measure negative symptoms as defined by the NIMH consensus development conference (i.e. blunted affect, alogia, anhedonia, asociality and avolition) (Kumari, Malik, Florival, Manalai, & Sonje, 2017).

Two measures were used to assess metacognitive capacity: the abbreviated version of the Metacognition Assessment Scale (MAS-A) (Semerari et al., 2003) (ICC=.89, Lysaker et al., 2005) and the Reflective Function Questionnaire (RFQ) to measure self-rated reflective ability (Fonagy & Bateman, 2016).

In addition, the Calgary Depression Scale for Schizophrenia (CDSS) (Addington, Addington, & Schissel, 1990) was used to measure depression (see Schennach et al., 2012 for reliability and validity) whilst the Personal Belief about Illness Questionnaire (PBIQ) (Birchwood, Mason, Macmillan, & Healy, 1993) was used to measure clients' view of their condition and the impact this has on their future, social status, and social marginalisation (see Acosta, Aguilar, Cejas, & Gracia, 2013 for psychometric validation). The Quality of Life Enjoyment and Satisfaction Questionnaire (Q-LES-Q-18) was chosen to measure quality of life as the questionnaire has shown high reliability, validity, and stability of test-retest ratings in patients with severe mental illness (Ritsner, Kurs, Gibel, Ratner & Endicott, 2005). Finally, the Global Assessment of Functioning (GAF) (APA, 1987) was used for assessing a person's psychological, social and occupational functioning (see Jones, Thornicroft, Coffey, and Dunn, 1995).

Procedure

The primary researcher approached mental health teams who referred interested patients. Written consent, relevant demographic information, and baseline measures were completed before beginning the intervention (see table 2 for the timing of measurements). Exit interviews were held after completing the intervention where a standardised interview

schedule (with open-ended questions) was applied to minimise variations in questions asked whilst retaining enough flexibility to assess individual experiences (Patton, 1987). Interviews were recorded with a digital audio recorder; as four participants did not want to be recorded, their answers were written down.

Analysis

Quantitative data. SPSS (version 23), R (version 3.4.3) and Excel (for Mac 2011) were used for the statistical analysis. Non-parametric tests (Wilcoxon Signed Rank) were used to evaluate changes at pre, post and follow-up analysis due to the limited sample size and the repeated-measure nature of the data (Field, 2009). Missing data on questionnaires was replaced with case-mean substitution if fewer than 20% of the items were missing as this has been found to be a robust way of handling data missing on an item level (Fox-Wasylyshyn & El-Masri, 2005). For measures that were not administered each session (i.e. RFQ and PBIQ), the score of the last measurement was used for the session-by-session analysis during the active treatment phase unless the measure was missing or excluded. In line with recent developments relating to the analysis of case series data (Collins & Sayer, 2001; Singer & Willet, 2003; Twisk, 2010), we also employed multilevel modeling (MLM). As MLM can manage missing data and at varying time points across individuals (Baek et al., 2011), it is particularly appropriate where the aim of the study is to assess change over time and across cases. In addition, MLM does not, unlike most other statistical analyses, assume that observations are independent which is unlikely when analysing data over time for the same individuals. Recent studies have provided evidence of the efficacy of MLM when applied in case series (e.g. Moeyaert, Ferron, Beretvas, & Van den Noortgate, 2014; Rindskopf & Ferron, 2014; Shadish, Kyse, & Rindskopf, 2013). The visual slope was used to explore trends (i.e. the average slope, direction of the dependent variables and individual variance

across time).

Qualitative data. Thematic analysis (Braun & Clark, 2006) was used to analyse the qualitative data. The primary researcher transcribed the interviews and read transcripts multiple times for familiarity with the material and to generate an overview of the responses (Mairs et al., 2011). The recordings were then analysed with thematic analysis conducted according to a standard format (i.e. exploring the feasibility of the intervention and potential mechanisms of change). Themes were developed, labelled, and reviewed to assure that they were representative of the dataset. This analysis was undertaken by the primary researcher, and discussed with other research collaborators (E.E. and H.G.).

Results

Sample characteristics

The research study was conducted over 16 months with a total of 45 referrals where 18 individuals (40%) agreed to take part (see table 3 for sample characteristics). The most common reason for declining to take part was not wanting to be recorded. Three participants were excluded as they were unable to give informed consent due to paranoid delusions and/or severe cognitive difficulties. Ten of the 15 participants completed all eight sessions, four participants attended between 2-6 sessions, whilst one participant only completed baseline measures. The reasons for discontinuing the intervention seemed to be chaotic lifestyle due to substance abuse, difficulties with concentration as a side-effect of medication changes, significant life events, and severe depression.

Qualitative Results

All 10 completers agreed to take part in qualitative exit interviews. Interviews ranged in length from 2 minutes 9 seconds to 8 minutes 36 seconds (Mean = 3 minutes 42 seconds).

Two themes were identified: acceptability of the treatment and mechanisms for coping better post intervention.

Acceptability

Participants made both positive and negative comments about the acceptability of the intervention.

Positive

All participants were able to identify positive aspects of the intervention. For example, one participant stated: *“It was all relevant because of my negative symptoms”* (P7). Another commented that the effort to engage had been worthwhile: *“Hard work sometimes but I got a lot from it. I think I have learnt from it, so it’s been good”* (P5)

Several participants commented on psychoeducational aspects ($n= 5$):

“It was insightful because I didn’t really understand what psychosis was”. P3

“I understand my illness more now and I know that it is just my mind playing tricks which makes the psychosis feel less real”. P10

Despite the highly structured nature of the intervention, several participants ($n= 6$) commented on the benefits of engaging therapeutically with a clinician:

“It helped me. I got my feelings out. I would recommend it to other people”. P1

“It helped me to express myself, that [the therapist] listened to me and knows where I am coming from”. P9

Negative

Overall, there were fewer negative than positive comments, subthemes were more idiosyncratic and often related to research procedures (e.g. three participants said the most negative aspect was completing questionnaires which might explain the high number of

missing data in the sample overall as participants declined to participate in interviews or fill in questionnaires). In terms of acceptability, one participant felt that the intervention was not relevant as they did not agree with their diagnosis of schizophrenia: *“Helpful but paperwork and computer said psychosis where I have trauma and no psychosis”* (P8). One participant (P9) reported that the computer (used to deliver the intervention) made him feel “paranoid” at times. A third participant commented: *“It is not going to speed up discharge...”* (P2).

Changes in terms of coping after taking part in the intervention

Most participants said that they had reflected more on their own thinking after taking part in the intervention, with many observing changes in thinking, particularly about the self:

“It made me think about things about myself that I hadn’t noticed before” P6

“It has helped me a lot. It made me think about myself in a different way” P4

“I thought about my negative ways in the past, and how I have changed them”. P1

Frequently, participants ($n=7$) mentioned that awareness of unhelpful thinking patterns had lead to the development of adaptive coping strategies.

“I learned that I can do things to make me think and feel differently” ... “I am less self-critical and kinder to myself now.” P6

“I enjoyed it. I learned a lot about myself. It was also giving me coping mechanisms for when I am in trouble mentally.” P4

Observations about unhelpful thinking patterns (e.g. expected social rejection, devaluation of relationships, or expected failure) were reported by four participants to have had a direct impact on their everyday functioning:

“I learned that I can actually do things together with other people, it is all in my head, that I need to do things just on my own...” P4

“I am not thinking as negatively now as before ... I am more objective in my ability to motivate myself to do things which means that I am more active now”. P7

“I am trying a bit harder to socialise”... “It’s helping with my social confidence. That makes me feel good” ... P5

Quantitative results

Variable change over time for completers

Table 4 illustrates variable scores at baseline, post-intervention, and follow-up. A statistically significant decrease in negative symptoms over the course of the intervention and at follow-up was found as measured by the BNSS (with large effect sizes post intervention and at follow-up) but not by the PANSS. Reflective functioning was the only other variable to show significant change post intervention; this continued to improve at follow-up. In addition, the analysis indicated that internalised stigma as measured by PBIQ decreased to a significant level at follow-up only.

Modeling symptom change using multilevel modeling

Four models were tested. First an unconditional means model revealed that the intercept was significant ($b = 24.65 (3.40)$, $t(97) = 7.24$, $p < 0.001$) and that there was variation between individuals ($b = 12.61$, 95% CI 8.53, 18.63). The Intraclass Correlation (ICC) was 0.73, indicating that multilevel modeling was appropriate for the data. Analyses revealed a significant reduction in symptoms over time ($b = -1.61$, $t(0.30) = -5.32$, $p < 0.001$). Allowing slopes to vary did not significantly improve model fit ($F(4, 6) = 4.41$, $p = 0.11$), suggesting that there was little variation in participants’ symptom reduction over the course of treatment. Neither mentalizing or personal beliefs about illness were found to be significant predictors of symptom change, nor were interaction effects significant, although model fit was improved when the predictors were added (see Table 5). However, a significant interaction

effect was detected between depression and negative symptoms ($b = 0.08 (0.04)$, $t(92) = 2.05$, $p = 0.04$).

Discussion

The primary aim of the research study was to evaluate the acceptability and feasibility of MCT adapted for negative symptoms. A secondary aim was to examine variable change over the course of the intervention and to identify mechanisms of change in negative symptoms.

Acceptability and feasibility of the intervention

The intervention appeared to be both acceptable to participants and feasible to implement.

The dropout rate of 33% during the active phase of therapy is within the range of studies of other cognitive interventions for negative symptoms (e.g. 43% and 25% in Klingberg et al (2011); 23% in Velligan, Maples, Roberts, & Medellin (2015)) and standard MCT (e.g. 26,5% in Briki et al., 2014; 27% in Ochoa et al., 2017). A meta-analysis (Fernandez, Salem, Swift, & Ramtahal, 2015) of the dropout rate for CBT for various mental health disorders which covered more than 20,000 participants found that the weighted average attrition rate during treatment was 26%. Given that we recruited from a population with chronic and treatment resistant difficulties, this provides a favourable comparison. Following completion, all subjects were able to identify aspects of the intervention that they valued, including receiving psychoeducation on psychosis, skill development (including metacognitive ability), and the therapeutic relationship. It is possible that the feasibility of the intervention was indirectly affected by the research design as it has been suggested that a large number of questionnaires in trials as well as repeating the measurements frequently might lead to excessive patient drop-out (Vickers, 2006).

Post-intervention change

MCT-N led to significant improvements on negative symptoms measured with the BNSS.

This is in accord with other studies (Klingberg et al., 2011; Grant, Huh, Perivoliotis, Stolar, & Beck, 2012; Staring, Ter Huurne, & van der Gaag, 2013, Velligan et al., 2015) that show negative symptoms respond to psychological interventions. In our study, there appeared to be symptomatic reduction over the course of the intervention, requiring relatively little resource (eight sessions compared to 51 sessions in Grant et al. (2012) and 20 sessions in Klingberg et al. (2011)).

Significant changes were also observed in self-reported reflective function post-intervention (which is similar to the results of the meta-analysis by Lopez-Morinigo et al., 2020) and internalised stigma at follow-up. This specificity is consistent with our intention to offer an intervention targeting particular cognitions and mechanisms hypothesised to drive the development and maintenance of negative symptoms. It is possible that the improvements in negative symptoms and self-reflection were driven by interpersonal cognitive differentiation as suggested by García-Mieres et al. (2019) due to the intervention's relational focus.

The findings are also supported by the qualitative results, which highlight the importance of psychoeducation and the development of metacognitive coping strategies. It is possible that the lack of change on some variables reflected difficulties with some of the assessment tools. For example, GAF might have been too crude a measure to detect psychosocial changes in this population (Robertson et al., 2013). Though the PANSS was long considered the gold standard assessment tool, it is now generally considered to be outdated as the latent structure of negative symptoms seems to be best represented by a 5-factor model (Strauss, Ahmed, Young, & Kirkpatrick, 2019). The lack of significant findings may also be due to the fact that

the PANSS does not assess anticipatory and consummatory anhedonia (Daniel, 2013), both mechanisms specifically targeted by MCT-N.

Mechanisms of change

The MLM analysis suggested that whilst depression was the strongest single predictor of variance in negative symptoms over the course of the intervention, a model involving the interaction of reflective functioning and time provided the best fit. In this study, negative symptoms as measured by the BNSS and depression were not closely correlated, replicating previous studies (Kirkpatrick et al., 2010; Strauss et al., 2012). As there was no change in depression over the course of the intervention, the overall pattern of results precludes the conclusion that the intervention targeted depression as opposed to negative symptoms. The findings support previous observations that there may be considerable phenomenological interplay between depression and negative symptoms (Upthegrove, Marwaha, & Birchwood, 2017) with a systematic review suggesting that this relationship may be primarily between depression and an avolition-amotivation dimension of negative symptoms (Krynicki, Upthegrove, Deakin, & Barnes, 2018). Importantly, our results add to this literature, suggesting that targeting psychological processes generally believed to be associated with affective disturbance may reduce negative symptom expression. Specifically, our findings are consistent with proposals that negative symptoms may develop in part as a consequence of diminished capacity for self-other mental state processing (Gumley et al., 2014; Harder, 2014; Griffiths & McLeod, 2019). Those specific pathways are likely to involve cognitive-affective processes underlying both emotional dysfunction and negative symptoms. For example, Lincoln et al. (2011) demonstrated that self-concepts related to both interpersonal competence and dysfunctional beliefs interact with social cognition to influence negative symptoms. Our findings suggest that targeting mechanisms such as reflective functioning in

conjunction with interventions that develop strategies to address cognitive biases associated with negative symptoms may unlock promising new avenues for the treatment of these frequently intransigent difficulties.

Strengths and limitations

The triangulation of quantitative and qualitative results facilitated a thorough exploration of the feasibility of the intervention. The case series design allowed the evaluation of the intervention in ‘real world’ circumstances. Participants reported positive symptoms, emotional difficulties, substance abuse, and extrapyramidal symptoms alongside negative symptoms, and thus appeared to be a typical sample of individuals experiencing chronic problems that have demonstrated treatment resistance in standard care. Although it would have been preferable if an independent researcher had administered the outcome tools, the chosen measurements represented best practice in the assessment of depression and negative symptoms. As all participants received treatment as usual during the intervention and there was no control, we cannot conclude that change over time occurred as a result of MCT-N. It is also possible that the questionnaire administration in itself had an impact on the findings as research has found that completing quantitative measurements changed clients’ interpretation of mental health symptoms, resulting in improvement as well as deterioration (Truijens, Van Nieuwenhove, De Smet, & Meganck, 2021). However, it was encouraging that the qualitative data indicated that the metacognitive training was valued, and that participants reported that change had occurred as a result of this intervention. Although the results are preliminary, the study has clear clinical implications in that it adds to the growing evidence base that negative symptoms may benefit from psychological intervention, in this case an intervention that has the potential to be highly scalable.

The study is limited in regard to its small sample size. As with all small N designs, the risk of Type I and Type II error should be acknowledged. This limitation was partly mitigated by the repeated measures, permitting multilevel modelling. As described by Shadish et al. (2013), more research is needed to clarify the issue of power when using MLM for small N. However, the current study included data from 15 participants similar to the case series studies in the survey by Shadish & Sullivan (2011), where the maximum observed cases were 13 and the median was three. Furthermore, the current study focused on improvements in model fit in addition to the findings that reached statistical significance. MLM also had the advantage that it could manage data collected at various time points and missing data. Using this form of analysis allowed us to add to the growing evidence base indicating the suitability of applying multilevel modelling to case series design as it accounted for the nested and autoregressive nature of the data. This allowed us to identify potential mechanisms of change, including an exploration of how these psychological processes might interact.

Conclusion

The study shows that metacognitive training could be adapted to target negative symptoms, thereby holding the promise of a brief, structured and highly scalable intervention. Multilevel modelling allowed us to identify potential mechanisms such as reflective functioning, and how these seem to interact to influence negative symptom expression, facilitating the future refinement of the intervention to target specific psychological processes, including affective disturbance, that may underpin negative symptoms. The refined intervention should be systematically assessed in future research with a larger sample, utilising a more robust randomised controlled design by including a control group as well as an independent assessor.

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11. Tables

Table 1. Summary of the intervention

Session Introduction to negative symptoms

1

Psychoeducation on negative symptoms and how certain unhelpful cognitions might lead to/maintain these; strategies such as monitoring unhelpful cognitions and writing down enjoyable experiences.

Session Self-esteem (taken from the additional modules from original MCT)

2

Psychoeducation on self-esteem and how this might lead to/maintain negative symptoms; strategies such as becoming aware of social comparison, “joy diary”, cognitive defusion, and physical distraction.

Session Jumping to Conclusions (JTC) (modified from original MCT)

3

Psychoeducation on JTC and how this might lead to/maintain negative symptoms; strategies such as considering alternative interpretations.

Session Attribution Style (modified from original MCT)

4

Psychoeducation on how one-sided attribution styles might lead to/maintain negative symptoms; strategies such as considering multiple factors.

Session Cognitive Difficulties (modified from original MCT)

5

Psychoeducation on how cognitive difficulties in psychosis may lead to/maintain negative symptoms; strategies such as mnemonics and problem solving.

Session Social Cognition (modified from original MCT)

6

Psychoeducation on how difficulties understanding facial expressions might lead to/maintain negative symptoms; strategies such as gaining knowledge from environment/situation, self-observation, and gut feeling.

Session Mood (taken from original MCT)

7

Psychoeducation on how depression may lead to/maintain negative symptoms; strategies such as cognitive restructuring.

Session Stigma (taken from the additional modules from original MCT)

8

Psychoeducation on how stigma may lead to/maintain negative symptoms; strategies such as educating others about mental illness)

Table 2. Timing of outcome measures

Time points	BNSS/CDSS/GAF/ Q-LES-Q-18	MAS-A/ PANSS	RFQ	PBIQ
Baseline	X	X	X	X (+3X)*
Session 1	X			
Session 2	X			
Session 3	X			
Session 4	X		X	
Session 5	X			
Session 6	X			
Session 7	X			
Session 8 (Post)	X	X	X	X
Follow-up	X	X	X	X
12 weeks after				

The Brief Negative Symptom Scale (BNSS); The Calgary Depression Scale for Schizophrenia (CDSS); The Global Assessment of Functioning (GAF); The Quality of Life Enjoyment and Satisfaction Questionnaire (QLES-Q-18); The Metacognition Assessment Scale Abbreviated (MAS-A); Positive and Negative Syndrome Scale (PANSS); The Reflective Function Questionnaire (RFQ); The Personal Belief about Illness Questionnaire (PBIQ)

* PBIQ was administered after the sessions (3 in total) that focused on self-stigma, depression, or low self-esteem.

Table 3. *Sociodemographic Characteristics of Participants at Baseline*

Baseline characteristic		
	<i>N</i>	%
Gender		
Female	2	13
Male	13	87
Medication		
Clozapine	13	87
Risperidone	1	6.5
Amisulpride	1	6.5
Secondary education completed	7	47
Schizophrenia diagnosis	13	87
Schizoaffective diagnosis	10	67
Referred by:		
Psychiatrist	5	33
Key worker	4	27
Psychologist	4	27
Self-referral	2	13
Receiving in-patient care	10	67
Seen in the community	5	33
Recruited from Psychiatric Rehab	10	67
Recruited from Acute	5	33
Previous psychotherapy	10	67

Note. $N = 150$ ($n = 50$ for each condition). Participants were on average 42.6 years old ($SD = 11.53$). Three of the five patients recruited in Acute were transferred to the Psychiatric Rehabilitation Service.

Table 4. Wilcoxon sign test for completers pre and post

Variable	Median Pre	Median Post	Z	P	r	Median Follow- up	Z	P	r
Brief Negative Symptom Scale (BNSS)	22	16 (N=10)	-2.39a	.017*	-.75	9.5 (N=8)	-2.52a	.012*	-.89
Positive and Negative Syndrome Scale (PANSS) Negative symptoms	13	13 (N=9)	-1.34a	.182	-.45	13 (N=5)	-1.83b	.068	-.81
Quality of Life Enjoyment and Satisfaction Questionnaire (Q-LES-18)	58	57 (N=9)	-.06a	.953	-.02	54.5 (N=8)	-.31b	.75	-.11
Calgary Depression Scale for Schizophrenia (CDSS)	5	4.50 (N=10)	-.83b	.40	-.26	3.50 (N=8)	-1.27b	.20	-.45
Metacognition Assessment Scale Abbreviated (MAS-A)	12	12 (N=3)	.00c	1.00	.00	n/a	n/a	n/a	n/a
Reflective Function Questionnaire (RFQ)	157	192 (N=7)	-1.99b	.046*	-.75	203 (N=3)	-1.07b	.28	-.62
Personal beliefs about illness questionnaire (PBIQ)	34	37 (N=8)	-.52a	.60	-.18	36 (N=7)	-2.05a	.04*	-.77
Global Assessment of Functioning (GAF)	40	40 (N=10)	-.58b	.56	-.18	40 (N=8)	-1.00b	.32	-.35

a= based on positive ranks; b= based on negative ranks; c= no difference

*** $p < .001$, ** $p < .01$, * $p < .05$

Table 5. Summary parameters with Brief Negative Symptom Scale (BNSS) as dependent variable (whole sample)

	Model 1 (Unconditional means)	Model 2 (Effect of time)	Model 3 (Personal Beliefs about Illness)	Model 4 (Reflective functioning)	Model 5 (Depression)
Intercept	24.65 (3.40)***	29.81(3.64) ***	21.51 (10.91)*	30.36 (18.82)	28.38 (3.31)***
Time		-1.61(.30) ***	-2.76(.134) *	-1.21 (2.47)	-2.06 (0.29)***
Personal beliefs about illness questionnaire (PBIQ)			0.23 (0.29)		
PBIQ*time			0.03 (0.04)		
Reflective Function Questionnaire (RFQ)				0.01 (0.12)	
RFQ*time				-.002(0.02)	
Calgary Depression Scale for Schizophrenia (CDSS)					0.21 (0.23)
CDSS*Time					0.08 (0.04)*
-2LL (Unexplained variance)	814.06	772.42	674.90	585.47	743.50

Parentheses values = standard errors; ***p<.001, **p<.01, *p<.05

12. Figures

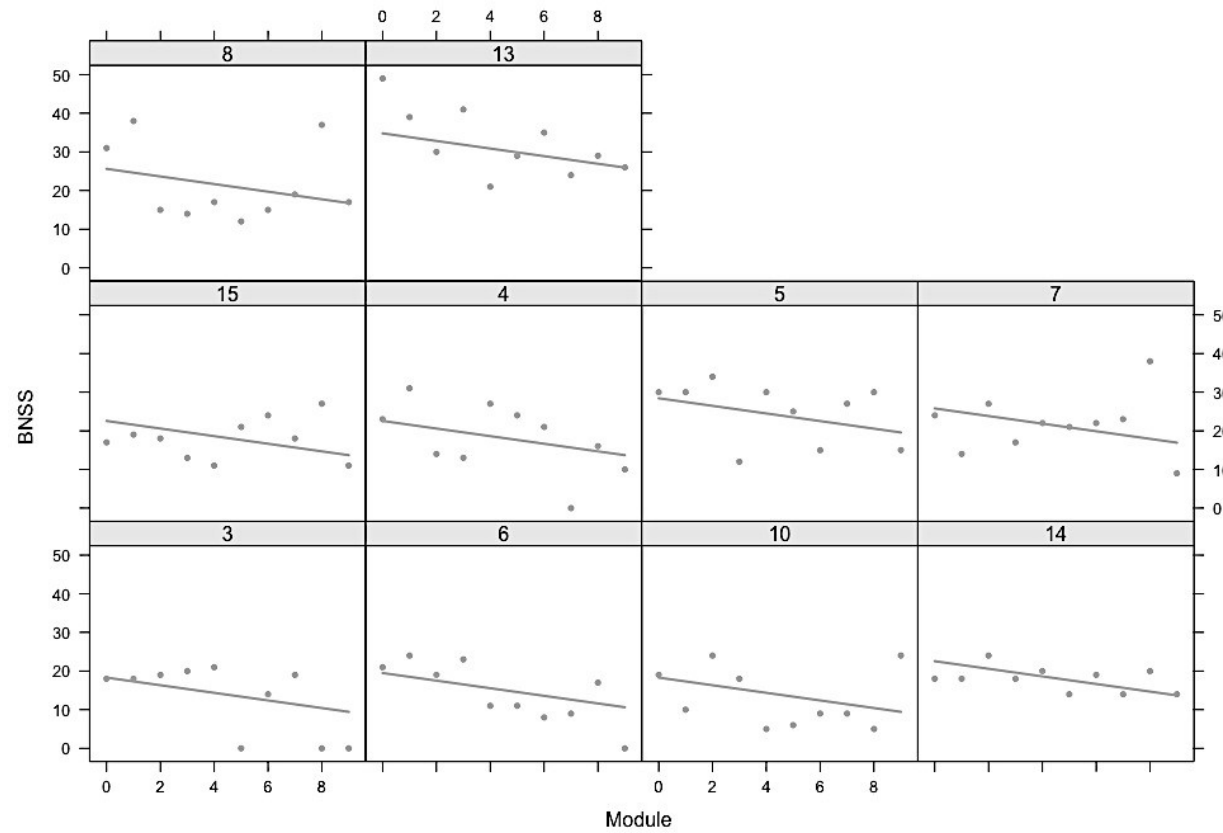


Figure 1. Improvements on negative symptoms as measured by Brief Negative Symptom Scale (BNSS) over time for completers