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COGNITIVE REMEDIATION THERAPY IN ANOREXIA
NERVOSA – IMPLICATIONS FOR TREATMENT
DEVELOPMENTS AND RESEARCH TRIALS.

Section A: Cognitive remediation - A systematic appraisal of the literature in anorexia nervosa and a comparison to major depressive disorder, obsessive-compulsive disorder and autistic spectrum disorder.

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Section B: Cognitive remediation therapy in anorexia nervosa: Patient neuropsychological and self-report outcomes and therapist qualitative feedback.

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Summary of the MRP portfolio

Section A is a systematic literature review which aimed to identify and appraise the evidence base on cognitive remediation therapy (CRT) for anorexia nervosa and to compare this to evidence from cognitive remediation and training approaches in conditions that share commonalities with anorexia, namely major depressive disorder, obsessive-compulsive disorder and autistic spectrum disorder. The aim was to see whether evidence and intervention characteristics from other conditions could inform the theoretical understanding and treatment developments of CRT for anorexia. The review outlines the evidence base across the conditions and concludes with a discussion of clinical and research implications.

Section B is a mixed methods study exploring CRT in an inpatient setting. Firstly, patient data before and after the intervention was analysed, hypothesising that CRT would be associated with improvements in neuropsychological and self-report measures. Secondly exploratory analyses were conducted, hypothesising that different intervention formats would be associated with different outcomes. Thirdly, therapists were interviewed about their experiences and perceptions regarding what CRT offers. Results from the patient data replicated some previous findings and, considered alongside the interview data, indicate that both individual and group CRT appear to be feasible intervention formats. Recommendations are made for future research trials.

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Glossary

AN-EXRP	Exposure and response prevention for anorexia nervosa
ANOVA	Analysis of variance
APA	American psychiatric association
ASD	Autistic spectrum disorder
BMI	Body mass index
CBT	Cognitive behavioural therapy
CC	Central coherence
CET	Cognitive enhancement therapy
CFS	Cognitive flexibility scale
CREST	Cognitive remediation and emotion skills training
CRT	Cognitive remediation therapy
EDE-Q	Eating disorder examination questionnaire
EDNOS	Eating disorder not otherwise specified
EDU	Eating disorders unit
eToM	emotional theory of mind
fMRI	functional magnetic resonance imaging
HADS	Hospital anxiety and depression scale
M	Mean
MDD	Major depressive disorder
MR	Motivational ruler
MRC	Medical Research Council
n	Number of participants
NICE	National Institute for Health and Care Excellence
NEAR	Neuropsychological educational approach to remediation

NNT	Non-specific neurocognitive therapy
OCD	Obsessive-compulsive disorder
OCPD	Obsessive-compulsive personality disorder
RCFT	Rey-Osterrieth complex figure test
RCT(s)	Randomised controlled trial(s)
SD	Standard deviation
TAU	Treatment as usual
ToM	Theory of mind
WSAS	Work and social adjustment scale

SECTION A

Cognitive Remediation - A systematic appraisal of the literature in anorexia nervosa and a comparison to major depressive disorder, obsessive-compulsive disorder and autistic spectrum disorder.

Word count: 7,983 (356)

Abstract

Research evidence for the effectiveness of cognitive remediation therapy (CRT) for anorexia nervosa has been gathering. Cognitive remediation and training approaches are also increasingly being implemented in other disorders including major depressive disorder, obsessive-compulsive disorder and autistic spectrum disorder that share commonalities with anorexia in both neuropsychological profiles and clinical presentations. This systematic literature review aimed to identify and appraise the current evidence base across all four conditions to see whether evidence from related conditions could be integrated into the theoretical understanding of CRT for anorexia as well as future anorexia treatment developments and research.

An electronic search was conducted using the PubMed and PsycInfo databases; the search terms used were anore*, depress*, obsessi* and compulsi*, and autis* combined with ((cognit*) and (remed* or train*)). Only published, peer-reviewed literature in English was considered, with no specific date parameters. Both individual and group programmes of cognitive remediation or training in adult clinical populations were included, amounting to 24 studies in total.

In summary, cognitive remediation approaches show promising evidence in associated improvements in areas of executive functioning and information processing. With regards to anorexia treatment developments, despite the existing evidence for CRT's effectiveness, further consideration is warranted in gauging CRT's specific effects. Furthermore, socio-emotional processing difficulties, which appear to be a commonality across these conditions, merit further attention as potential treatment targets. Questions also remain regarding how to tailor such interventions to meet individual needs, as different foci may be suitable for different pre-treatment presentations. Considering broad functioning and individual needs

may be a useful way forward for future research, treatment developments and clinical practice.

Keywords: anorexia, cognitive remediation therapy, executive functioning, cognitive style, systematic review

Anorexia nervosa and its treatment

The challenge of treating anorexia nervosa

Anorexia nervosa is a complex eating disorder with a serious course and outcome and relatively low rates of full recovery; there is frequent prevalence of other disorders such as mood and anxiety disorders and many cases are of an enduring nature (Steinhausen, 2009). Anorexia is characterised by the persistent restriction of energy intake which leads to significantly low body weight and by either an intense fear of weight gain or of becoming fat, or by persistent behaviours that interfere with weight gain (American Psychiatric Association [APA], 2013). The prevalence rate for anorexia has been estimated as 8 per 100 000 people, per year in the general population; for young females, the average prevalence rate is of 0.3 per cent (Hoek, 2006). It is estimated that 46 per cent of patients with anorexia recover whereas 34 per cent improve with partial or residual features of anorexia remaining, and 20 per cent remain ill at long term (Steinhausen, 2009).

The National Institute for Health and Care Excellence (NICE, 2004) recommends psychological treatment for anorexia, however the evidence for interventions is mainly classed as Grade C, meaning it is obtained from expert committee reports and clinical opinion, in the absence of randomised controlled trials (RCTs) with clear recommendations. The main aims of psychological treatment are to reduce risk, encourage weight gain and reduce other eating disorder symptoms. Recommendations are for efficacy studies of specific treatments.

Anorexia is particularly difficult to treat due to patients' ambivalence about change, in part due to the disorder's ego-syntonic nature. A systematic review of RCTs for severe and enduring anorexia highlighted the limited evidence for various treatment approaches (Hay, Touyz, & Sud, 2012), due to the difficulty of conducting clinical trials, in part owing to

patients' ambivalence about change, high drop-out rates (Bulik, 2014) and low treatment acceptance rates (Halmi et al., 2005).

The challenge of treating anorexia has prompted the development of novel approaches which aim to address difficulties with insight and the ensuing reticence to engage with psychological therapies. It is argued that novel treatments should target the maintenance factors of anorexia as opposed to core eating disorder concerns (Hay et al., 2012).

The maintenance of anorexia nervosa

A cognitive-interpersonal maintenance model of anorexia (Schmidt & Treasure, 2006; Treasure & Schmidt, 2013) suggests the involvement of both inter- and intra-personal factors in the development and maintenance of anorexia; it does not emphasise the role of weight and shape-related factors. Based on empirical evidence, the authors suggest four key maintenance factors: cognitive rigidity, emotion avoidance, pro-anorectic beliefs and responses of close others. Cognitive rigidity can lead to "all-or-nothing" type thinking, a strict attention to details and perfectionistic tendencies, whereas emotion avoidance manifests as avoidance of intense emotions and intimate relationships; both are intensified by food restriction and subsequent starvation. Pro-anorectic beliefs are positive beliefs about the value or function of anorexia and the responses of close others include expressed emotions such as criticism, hostility and emotional over-involvement. This review will focus on executive functioning, specifically cognitive rigidity, and how it is targeted in treatment.

Executive functions are cognitive control processes that regulate thought and action; three main aspects have been described, namely shifting between tasks, updating working memory (adding relevant and removing no longer relevant information) and inhibiting automatic responses elicited by the environment (Friedman et al., 2008). Neuropsychological research has highlighted two main areas of executive functioning difficulty in anorexia, namely set-shifting and weak central coherence. Set-shifting is the ability to move back and

forth between multiple tasks or operations; difficulties manifest as cognitive inflexibility (such as rigid approaches to problem solving) or response inflexibility (such as perseverative behaviours) (Lezak, 2012). Systematic reviews and published studies on large databases of set-shifting ability have shown that it appears to be consistent across eating disorder diagnoses, as assessed by different neuropsychological tasks (Roberts, Tchanturia, Stahl, Southgate, & Treasure, 2007; Tchanturia et al., 2011). These difficulties are most pronounced in people currently in treatment for anorexia, compared to individuals regarded as recovered (Tchanturia et al., 2012). Secondly, weak central coherence, or extreme attention to detail, has also been systematically reviewed in anorexia (Lang, Lopez, Stahl, Tchanturia, & Treasure, in press; Lopez, Tchanturia, Stahl, & Treasure, 2008): research suggests difficulties in global processing and more efficient performance in tasks that require attention to detail.

Both set-shifting and weak central coherence may be part of the risk factors for developing anorexia (Roberts, Tchanturia, & Treasure, 2010; Southgate, Tchanturia, & Treasure, 2005) and appear not to improve following weight gain (Green, Elliman, Wakeling, & Rogers, 1996; Roberts et al., 2007). In terms of clinical presentation, anorexia patients are often fixated with certain behaviours and routines, such as specific rules; an extreme detail focus and the aforementioned ambivalence towards change can impact on engagement with treatment (Tchanturia, Lloyd, & Lang, 2013). It is therefore important to develop interventions that target these difficulties, help patients to develop awareness of their thinking styles and to start practising alternative strategies for doing things; this has led to the development of cognitive remediation therapy for anorexia as an early intervention.

The review - aims, methods and plan

Cognitive remediation therapy (CRT) was originally developed for use in brain injuries (review, Cicerone et al., 2011) and was then further developed for psychosis (Wykes,

Huddy, Cellard, McGurk, & Czobor, 2011). Over the last decade, evidence has been growing for CRT for anorexia (review, Tchanturia et al., 2013a). Cognitive remediation and training approaches are also increasingly being implemented in other disorders, such as major depressive disorder (MDD), obsessive-compulsive disorder (OCD) and autistic spectrum disorder (ASD). As shall be discussed, these three conditions share some overlaps with anorexia, both in neuropsychological findings, clinical presentations and prevalence rates. No review to date has investigated the use of cognitive remediation across these related conditions, therefore this literature review aims to identify and appraise the current evidence base across all four conditions and to consider any similarities and differences in the use of such approaches. This review will consider whether evidence from other conditions could be integrated into the theoretical understanding of CRT for anorexia and inform future treatment developments and clinical practice.

This review will first present an overview of CRT for anorexia and outline the current evidence and latest developments. It will then explore cognitive remediation and training in MDD, OCD and ASD – for each condition, the main relevant neuropsychological findings and studies of cognitive remediation or training will be summarised; overlaps or differences compared to anorexia will be outlined and consolidated into a final discussion of clinical and research implications. The review will not specifically focus on the causal theories behind the neuropsychological difficulties discussed, but rather will focus on how these difficulties could be maintaining some of the features of these disorders and how the main characteristics and research findings from different treatment approaches could be related to anorexia.

An electronic search was conducted between September and November 2013 using the PubMed and PsycInfo databases and was updated in March 2014 (Appendix A). The search terms used were anore*, depress*, obsessi* and compulsi*, and autis* combined with ((cognit*) and (remed* or train*)). These search terms allowed for multiple spellings, plurals

and combinations. Only published, peer-reviewed literature in English was considered, with no specific date parameters. The titles, abstracts and full texts were screened and articles were also found via hand searches of reference lists. Both individual and group programmes of cognitive remediation or training in adult clinical populations were included and in total 24 studies were reviewed. The critical appraisal skills programme (CASP, 2013) was consulted to evaluate study quality and the review is supplemented by a Table (Appendix B).

It is noted that, as shall be discussed, high rates of co-occurrence of disorders have been found in people with eating disorders, the most common of which are mood disorders (Blinder, Cumella, & Sanathara, 2006). Although the review will explore each of the four conditions separately, it is acknowledged that participants in the research studies may have met criteria for more than one disorder and this limitation is considered in the discussion section below.

Cognitive remediation therapy for anorexia

CRT for anorexia is a brief, manualised intervention which consists of various cognitive flexibility and gestalt processing (“bigger picture”) cognitive exercises. It addresses the processes of thought, rather than the content, thus targeting cognitive processes and not core eating disorder features (Tchanturia, Davies, Reeder, & Wykes, 2010; Appendix C). These simple cognitive exercises aim to increase cognitive flexibility and the ability to switch between mental tasks. Individual CRT is delivered in ten sessions, twice-weekly, for 45 minute sessions. Patients complete the tasks and increasingly reflect on their thinking styles and strategies. The therapist gradually encourages reflection on how these strategies can be linked to examples from everyday life and also encourages practice between sessions with behavioural tasks. The patient and therapist also exchange end of therapy letters. CRT benefits from its specific and non-threatening material to encourage curiosity and reflectiveness at a metacognitive level and, as it contributes to establishing a therapeutic

relationship, it can be used as part of an introduction to further psychological treatment (Tchanturia et al., 2013a). Due to patients' physically compromised states and the aforementioned difficulties with engagement, CRT is a low-intensity intervention for use when patients are first admitted to an inpatient unit and are in the acute stages of anorexia.

Anorexia and CRT

Various published studies have reported evidence for the effectiveness of CRT for anorexia, namely three case studies, four case series, four RCTs and two qualitative studies (Appendix B).

Case studies and series. Three inpatient case studies first reported significant improvements in neuropsychological tests of set-shifting and positive patient feedback, specifically the benefits of developing an awareness of thinking processes and more flexible strategies, for example considering “the bigger picture” of a task or situation rather than just focusing on the finer details (Davies & Tchanturia, 2005; Pretorius & Tchanturia, 2007; Tchanturia, Whitney, & Treasure 2006). A preliminary case series (Tchanturia, Davies, & Campbell, 2007) then investigated the intervention (n = 4 inpatients) with assessments pre- and post-intervention and at 18 month follow-up, showing improvements in a cognitive flexibility neuropsychological task (medium to large effect sizes). A larger pilot case series followed (Tchanturia et al., 2008) investigating neuropsychological and self-report measures at baseline and post-intervention (n = 27 inpatients; 23 completers). Improvements were found in set-shifting and central coherence (medium to very large effect); the patients' mean BMI also significantly increased. There was also a significant decrease in self-reported symptoms of depression, but no significant changes in obsessive-compulsive symptoms. This study design does not however allow inference as to whether the improvements in cognitive performance were a direct consequence of CRT.

An outpatients case series (n = 7) found that CRT was associated with self-reported improvements in flexibility of thinking and in levels of perfectionism (Pitt, Lewis, Morgan, & Woodward, 2010). Finally, a larger case series was conducted (Abbate-Daga, Buzzichelli, Marzola, Amianto, & Fassino, 2012) which assessed CRT with 20 anorexia outpatients. Neuropsychological assessments found results consistent with those described above, namely that following CRT there were improvements in set-shifting (medium to large effect), despite the use of different neuropsychological tests. Also reported were a significant improvement in BMI, in general functioning and no drop-outs. Though acknowledging the small sample size and lack of control group, the authors argue that this study shows a replication and extension of previous evidence.

Randomised controlled trials. The first of four recent RCTs was in the context of severe and enduring anorexia. Dingemans et al. (2014) randomly assigned 82 patients to CRT plus treatment as usual (TAU; n = 41) or TAU only (n = 41). Assessments pre- and post-CRT and at six months follow-up showed that CRT was associated with significant improvements in quality of life post-CRT and in eating disorder symptoms at follow-up. Interestingly, moderator analyses showed that patients with poorer baseline set-shifting abilities benefited more from CRT and had better quality of life at follow-up. Neuropsychological performance in set-shifting and central coherence however improved significantly in both groups; the authors argue that this could be due to practice effects or nonspecific ingredients of treatment. It is noted that the TAU was an intensive programme including art therapy, social skills training, psychoeducation and cognitive-behavioral therapy. Conclusions are therefore limited, given the potential confounding effects of this intensive TAU programme.

A second RCT (Brockmeyer et al., 2014) assessed CRT's feasibility and efficacy, as assessed via effect size, by randomising 40 inpatients to tailored CRT (n = 20) or non-

specific neurocognitive therapy (NNT; $n = 20$); patients were offered a more intensive 30 sessions (45 minutes; 21 computer-assisted and 9 face-to-face over three weeks) and assigned computer-assisted homework in both conditions; there were 25 completers overall with drop-out due to discharge. The NNT focused only on attention, memory and deductive reasoning. The manual-based CRT was tailored and focused solely on set-shifting; as argued by the authors, central coherence was omitted to remove any potentially confounding factors with regards to the control condition. The primary outcome was performance on a computer-based task-switching paradigm assessed pre- and post-intervention. Overall CRT participants significantly outperformed the NNT group in set-shifting. Patient feedback was also more positive for CRT, for example with regards to whether the training matched their problems and whether they felt more flexible afterwards. The authors argue that specific tailored neurocognitive training is more effective (medium effect) and argue for the feasibility of CRT for anorexia. It is noted however that, due to the omission of the central coherence component, these findings are not entirely comparable to other studies.

An RCT in an outpatient setting also assessed the feasibility of using CRT with a focus on reducing drop-out rates in anorexia RCTs (Lock et al., 2013). The authors randomised 46 outpatients to 8 sessions of CRT or cognitive behavioural therapy (CBT) over 2 months, followed by 16 CBT sessions over 4 months. The authors report a lower drop-out rate in the CRT group (13 per cent) compared to the CBT group (33 per cent); they also found improvements in cognitive efficiencies in the CRT group compared to the CBT group at the end of the trial, as measured by performance on neuropsychological tasks. The authors suggest that CRT may reduce drop-out rates in the short term and that it appears to be an acceptable and feasible treatment for use in an RCT for anorexia treatment.

Furthermore, a recent RCT (Steinglass et al., 2014) compared CRT to exposure and response prevention for anorexia (AN-EXRP) which is a new approach that targets

maladaptive eating behaviour by addressing eating-related anxiety. Inpatients (n = 32) who were weight restored (BMI over 18.5) were offered 12 sessions of AN-EXRP or CRT and the outcome measure was caloric intake at a test meal which the authors found was higher in the AN-EXRP group; this improvement was also significantly associated with eating-related anxiety. However, due to the inpatients being weight restored, they differ significantly from participants in all the other studies.

Qualitative feedback. Studies have also explored patient qualitative feedback. Overall patients report improvements in their ability to think more flexibly, in “multi-tasking”, decision-making and a reduction in perfectionistic tendencies (Abbate-Daga et al., 2012; Davies & Tchanturia, 2005; Pitt et al., 2010; Tchanturia et al., 2007). Two studies have also explored patient and therapist feedback by analysing end of CRT letters which are exchanged at the final session of individual CRT. Firstly, the patient letters (n = 19 inpatients) were overall positive and high levels of satisfaction were reported (Whitney, Easter, & Tchanturia, 2008). Patients found CRT “refreshing” and appreciated that the focus was not on food; they found it helpful in reducing perfectionistic tendencies and rigidity and also appreciated their increased ability to implement skills in everyday life, for example replacing routine behaviours on the unit with reading or watching television. The second study (Easter & Tchanturia, 2011) explored 12 therapists’ end of CRT letters for 23 patients: therapists reflected on patients’ progress during CRT in reflecting on their thinking styles and challenging themselves through making small behavioural changes. The therapists commented on key aspects of the work undertaken and how the patients might continue to implement CRT concepts in the future. Therapists also reflected on the emotions experienced by patients during sessions such as enjoyment, humour, anxiety in challenging themselves, their confidence and self-esteem.

Further developments in CRT for anorexia

Group CRT. Following the development of individual CRT, the intervention was adapted to a group format. As argued by Genders and Tchanturia (2010), there is not only a need for group interventions due to the trend of shorter average lengths of stay in inpatient units but also due to the potential secondary benefits of a group format which could help to increase motivation and self-esteem and reduce social isolation. Group CRT is delivered weekly over four sessions and encourages the practice of global and flexible thinking with the addition of peer support and group facilitators. The group comprises psychoeducation, practical exercises, reflection and discussion and the planning of homework tasks (Appendix C).

A group CRT pilot (Genders & Tchanturia, 2010) investigated outcomes for 30 inpatients: at the first and last group sessions, patients completed a feedback form and self-report measures assessing cognitive flexibility, self-esteem and motivation to change (perceived importance to change and ability to change); data for both time points were available for 18 patients and a voluntary drop-out rate of 20 per cent was noted. Overall the analyses showed a significant improvement in self-reported ability to change and an improvement in cognitive flexibility. Patients reported finding the group useful in sharing their experiences and appreciated the use of practical tasks to demonstrate thinking and behaviour.

A second study aimed to assess the feasibility and acceptability of group CRT (Zuchova, Erler, & Papezova, 2013). Two weekly CRT groups were run (n = 14 and n = 20 inpatients) and as well as ten sessions on CRT exercises, on alternate weeks the other ten sessions focused on reflection, exploration of thinking styles and linking these to everyday life. Patients gave feedback via a questionnaire and reported appreciating the sessions and the focus away from eating disorder related concerns. The authors argue that group CRT also

gives the patients the opportunity to experience the therapeutic effects of group interaction without some of the emotional demands of other types of group therapy.

Cognitive remediation and emotion skills training (CREST). Research has shown that people with anorexia display some difficulties in emotional processing, especially in emotion recognition and emotion regulation, as well as difficulties in social interactions and relationships (Harrison, Sullivan, Tchanturia, & Treasure, 2009; Kyriacou, Easter, & Tchanturia, 2009). It is argued that both cognitive and emotional functioning could be considered in treatment, especially as it seems that socio-emotional difficulties are associated with more severe presentations (Harrison, Tchanturia, Naumann, & Treasure, 2012).

Cognitive remediation and emotion skills training (CREST) is a brief social cognition intervention (ten sessions) which incorporates some exercises from CRT (concepts of set-shifting and central coherence); similarly to CRT, it is not related to core eating disorder concerns and is a preparatory, low-intensity intervention. It addresses two of the maintaining features of the aforementioned maintenance model (Treasure & Schmidt, 2013), namely cognitive rigidity and emotion avoidance. It aims to target thinking styles, emotion recognition and the expression and regulation of emotion by using psychoeducation and skills-based strategies which allow for the reflection on and development of emotion-processing skills.

A pilot CREST case study (Money, Davies, & Tchanturia, 2011) and a qualitative study which analysed patient end of therapy reflection forms (n = 28 inpatients; Money, Genders, Treasure, Schmidt, & Tchanturia, 2011) suggested acceptability and feasibility of the intervention. A third CREST study (Davies et al., 2012) compared it to TAU and found that it was associated with improved central coherence and a larger change in performance on emotion-processing tasks. Finally, a very recent study (Tchanturia, Doris, & Fleming, 2014)

also found that CREST in group format was associated with a significant decrease in social anhedonia; changes in motivation to change approached significance.

Summary - CRT. Studies on CRT for anorexia report promising findings from neuropsychological, self-report and clinical measures. CRT appears to be associated with improvements in set-shifting abilities and in central coherence. It is also consistently reported that CRT seems to be an acceptable treatment from patients' perspectives and overall voluntary drop-out rates in published studies appear low (10-15 per cent; Tchanturia et al., 2013a).

Thus far, the RCTs on CRT have had somewhat varying foci in assessing feasibility and different types of comparison treatments, including non-specific cognitive training (Brockmeyer et al., 2014) and an exposure and response prevention intervention (Steinglass et al., 2014). Also explored has been CRT's association with improvements in quality of life and eating disorder psychopathology (Dingemans, et al., 2014). More research is needed with regards to the specific versus non-specific effects of CRT.

Of note are also the varying characteristics of patients involved in the studies, particularly in clinical measures and severity (notably BMI) due to the inclusion of inpatients with severe and enduring anorexia as well as outpatients and weight restored inpatients. Furthermore, many studies do not provide comprehensive information about other treatments that the inpatients may have received at the same time. Questions also remain with regards to the optimal "dose" or amount of CRT, with some studies using more intensive forms of the treatment (e.g. Brockmeyer et al., 2014).

Treatment developments, such as group CRT and CREST also show promising results in the more socio-emotional aspects of the anorexia presentation. As shall be outlined below, research into conditions related to anorexia may elucidate some of the questions related to cognitive remediation for anorexia and regarding treatment targets and characteristics.

Related conditions and cognitive remediation or training

Major depressive disorder

Anorexia and major depressive disorder (MDD). MDD is characterised by depressed mood, diminished interest or pleasure in most activities, feelings of worthlessness or guilt, and diminished ability to think or concentrate (APA, 2013). A recent study looking at prevalence rates among eating disorder inpatients found rates as high as 94 per cent for mood disorders, mainly unipolar depression, across all eating disorder types (Blinder et al., 2006).

MDD and neuropsychological findings. MDD is argued to be associated with broad difficulties in the aforementioned components of executive function (inhibition, shifting and working memory processing) that are not solely accounted for by slower processing speed (meta-analysis and review, Snyder, 2013). Compared to healthy controls, reduced neuropsychological functioning has been found in cognitive flexibility, attention and attentional switching, visual learning and memory (meta-analysis in first-episode MDD, Lee, Hermens, Porter, & Redoblado-Hodge, 2012).

In their review of research studies, Gotlib and Joormann (2010) discuss that, in line with cognitive theories of depression, there are differences (as assessed by experimental tasks) in cognitive processing compared to healthy controls which can be linked to emotional regulation difficulties. They argue that depression is characterised by specific patterns of biased processing of emotional material, including increased elaboration of negative information, difficulties disengaging from negative material, and difficulties with cognitive control when processing negative information. It is suggested that information processing biases are in part due to difficulties in inhibition processes and working memory as well as rumination around negative life events. Cognitive control, which is the ability to focus

attention on relevant stimuli and inhibit irrelevant stimuli, could therefore be a target for intervention.

Cognitive remediation is part of recent developments in the treatment of MDD. As it is thought that these neuropsychological difficulties are distinct from affective symptoms and current clinical severity (Snyder, 2013), rather than focus on mood symptoms, it is argued that treatments could target neuropsychological functioning as part of early intervention strategies, similarly to anorexia. Targeting these difficulties may not only help in restoring everyday functioning (Bowie et al., 2013) but it is argued that cognitive inflexibility may also hamper the effectiveness of cognitive restructuring in psychological therapy (Lee et al., 2012), again similarly to anorexia. One of the aims of cognitive remediation for MDD is therefore to exercise specific pathways with the goal of remediating specific areas of cognitive function (Porter, Bowie, Jordan, & Malhi, 2013) before further work on more emotional material can begin.

Depression and cognitive remediation studies. Six studies are described below that have used cognitive remediation approaches in MDD (Appendix B).

One of the first studies of cognitive remediation for MDD (Elgamal, McKinnon, Ramakrishnan, Joffe, & MacQueen, 2007) presented an intervention consisting of a computerised package of individual training sessions (twice-weekly, 45-60 minutes, over ten weeks) with the encouragement of informal practice in between sessions. The intervention used repetitive exercises in the areas of memory, attention, executive functioning and psychomotor speed and started with simple tasks in a single cognitive domain, with a progression to multi-domain tasks and finally more complex tasks requiring problem-solving skills. Participants were MDD patients ($n = 12$), one control MDD group ($n = 12$) who did not receive training and healthy controls ($n = 12$). Assessments post-intervention showed significant improvements in cognitive performance in the target areas mentioned above

which exceeded those found in age and gender-matched patients and controls. The authors argue that this study provides preliminary evidence for cognitive remediation as a viable intervention for MDD, particularly as the treatment gains were not attributable to improvements in mood.

Three studies of cognitive remediation for MDD used the “Neuropsychological Educational Approach to Remediation” (NEAR) which uses therapist-led “drill and practice” group activities as well as computer-assisted cognitive training via computer games which are tailored to the participant’s strengths and difficulties. It aims to promote motivation and learning by using principles such as errorless learning, positive reinforcement, participant choice, independent learning, and the contextualisation of learning. The first study (Naismith et al., 2010) delivered this cognitive training twice-weekly (one hour group sessions over ten weeks). Participants were 16 outpatients with depression (unipolar: $n = 14$; bipolar: $n = 2$). There were significant improvements (large effect) in the treatment group on tests of memory encoding and memory retention compared to controls. The cognitive remediation was however not associated with improvements in other areas of cognition, contrarily to Elgamal et al. (2007); this could be due to the differences in the training package or demographic characteristics, namely the age of participants. Furthermore, the MDD participants were inter-episode so not necessarily representative of patients currently experiencing MDD.

The second study (Naismith et al., 2011) compared the NEAR intervention to a wait list control group for 44 older patients with a lifetime history of MDD (but with a low depression severity at baseline). The intervention (weekly two hour sessions, over ten weeks) consisted of computer-based cognitive training and one hour of psychoeducation (on depression, anxiety and sleep, etc.). The training was associated with significant improvements in visual memory and verbal memory (medium to large effect), however it was again not significantly associated with measures of executive functioning and there were no

effects of the treatment on mood. The third study (Lee et al., 2013) assessed cognitive remediation (including psychoeducation) in patients with first episode MDD or psychosis, again with low baseline levels of depression. The 55 participants were block randomised to the cognitive remediation group (NEAR) or TAU. In total, 36 participants completed the study and assessments pre- and post-intervention showed that cognitive remediation was associated with improvements in immediate learning and memory; in particular, verbal learning and memory benefitted the most from the cognitive remediation. Of note, in both these studies it is difficult to exclude any possible effects of the psychoeducation component.

Another study assessed the efficacy and effectiveness of cognitive remediation on neurocognition, mood symptoms and general functioning via assessments at baseline and at ten weeks (Bowie et al., 2013). MDD participants (n = 33) were randomised to treatment (n = 17) or wait list (n = 16) conditions. The cognitive remediation intervention (weekly sessions, 90 minutes over ten weeks) consisted of computer-based exercises, reflection on the strategies used, transferring the skills learnt to everyday behaviours and daily cognitive exercises completed online as homework. The results were a significant time by treatment interaction for attention and information processing speed, and for verbal learning and memory. There were no significant changes in functioning but improvements in cognition predicted improvements in functioning; also, the amount of online exercises completed was associated with greater cognitive improvements. Finally, higher levels of perceived competence with regards to the computerised tasks were associated with larger cognitive improvement.

Siegle, Ghinassi and Thase (2007) describe a small preliminary study (n = 19) on cognitive control training for MDD. This is a neurobehavioural therapy which targets biological mechanisms thought to underlie psychological disorders. The authors argue that the inflexible and ruminative thinking styles in MDD may result from decreased attention

control and executive functioning as well as increased negative affect; the prefrontal cortex may specifically play a role by using executive control resources for emotion regulation. The aim of the intervention (six sessions of 35 minutes over two weeks) was therefore to use two computer-based tasks to activate the prefrontal cortex neural network to practice attention focus and executive control. Post-intervention, the authors found decreased negative affect and self-reported rumination compared to TAU ($n = 7$) as well as improved focus and concentration. There appears to be no published follow-up study to this preliminary one so conclusions are limited.

Summary - MDD. A recent review of cognitive remediation studies for MDD (Porter et al., 2013) and a systematic review for schizo-affective and affective disorders (Anaya et al., 2012) both argue that the preliminary evidence for this intervention merits further research, especially in the context of small sample sizes and heterogeneity between the studies. Though the focus of cognitive remediation in MDD is on improving attention, verbal learning and memory, which have been shown rather consistently, there are discrepancies with regards to improvements in executive functioning.

In relating the findings to anorexia, an interesting focus of cognitive remediation is the motivational aspect in the NEAR approach which places emphasis on principles such as errorless learning, positive reinforcement and the contextualisation of learning. In the Bowie et al. (2013) study, higher levels of perceived competence with the tasks were associated with larger cognitive improvements and Lee et al. (2013) also argue that, as a result of cognitive remediation, participants' self-efficacy beliefs may be strengthened in the context of improvements on the training tasks. As mentioned above, CRT for anorexia has a motivational component in using the tasks to encourage reflection in everyday life and in considering alternative strategies, and group CRT was associated with a significant improvement in self-reported ability to change (Genders & Tchanturia, 2010). MDD is

characterised by low self-esteem and a negative view of the self; this perceived increase in competency could, in and of itself, impact on changes in mood, though it is difficult to disentangle these effects. Furthermore, difficulties with the processing of emotional material (Gotlib & Joormann, 2010; Siegle et al., 2007) could be linked to the similar difficulties in anorexia described above, and as shall be discussed below, be further considered in terms of intervention foci, alongside targeting executive functions.

Obsessive-compulsive disorder

Anorexia and obsessive-compulsive disorder (OCD). The aforementioned study looking at prevalence rates among eating disorder inpatients found that they were as high as 56 per cent for anxiety disorders, across eating disorder types, and OCD was twice as likely in anorexia compared to other EDs (Blinder et al., 2006). OCD is characterised by obsessions, compulsions or both, where obsessions are intrusive, unwanted, recurrent and persistent thoughts, urges or images and compulsions are repetitive behaviours or mental acts that the individual feels driven to perform (APA, 2013).

Research has shown that obsessive-compulsive personality disorder (OCPD) traits are associated with a poorer prognosis in anorexia and that these traits may moderate outcome (Crane, Roberts, & Treasure, 2007). Childhood OCPD traits also show a high predictive value for eating disorder development and childhood perfectionism and rigidity are associated with higher rates of OCPD and OCD comorbidity in eating disorders (Anderluh, Tchanturia, Rabe-Hesketh, & Treasure, 2003).

OCD and neuropsychological findings. Neuropsychological research in OCD has highlighted inefficiencies in various areas though there are some conflicting findings. A recent meta-analysis (Shin, Lee, Kim, & Kwon, 2013) found difficulties in executive function, visuospatial memory, verbal memory, verbal fluency and processing speed; in particular they found that visuospatial memory difficulties were more prominent than

difficulties in executive function. It also appears that, compared to healthy controls, OCD participants display difficulties in verbal memory (learning and recall) and in non-verbal memory (immediate and delayed recall and recognition) (Segalàs et al., 2008).

Kashyap, Kumar, Kandavel, and Reddy (2013) however found that, compared to healthy controls, OCD participants predominantly had difficulties in executive functions, rather than memory, especially in strategising and organising stimuli and using cognitive resources to their maximum potential. They found difficulties in scanning, planning time, visuospatial working memory, conflict resolution/response inhibition, concept formation, decision-making and encoding of non-verbal memory; they argue that these memory difficulties are not due to encoded material being forgotten, but rather a difficulty in using organisational strategies to encode effectively. Dittrich and Johansen (2013) also argue that cognitive difficulties in OCD are mainly in executive function, namely set-shifting, response inhibition and decision-making as well as visuospatial memory. They argue that difficulties in decision-making may result from difficulties in adequately processing information in the context of strong emotional activation and that uncertainty and ambiguity may play a role in this.

A study investigating organisational strategies (Savage et al., 1999) used a complex figure test and found that participants with OCD used different organisational strategies to complete the test and recalled significantly less information on both immediate and delayed testing compared to healthy controls. The authors suggest that organisational strategies appeared to mediate non-verbal memory, in that the primary problem was in the encoding of information (rather than storage) and that this in turn had a secondary effect on immediate memory. It appeared that, when faced with a complex problem, participants with OCD directed their attention towards more trivial information at the expense of the overall context; as they failed to use global organisation, their memory was local and fragmented, leading to

doubt and uncertainty about information. The authors argue that cognitive training could improve memory and clinical symptoms in OCD, such as high levels of anxiety, in targeting this focus on irrelevant details.

OCD and cognitive training. Only two published reports of cognitive training for OCD were identified and are described below (Appendix B).

Buhlmann et al. (2006) investigated the effects of brief training on the organisation of visuospatial information. Participants with OCD ($n = 35$) received instructions that complex geometric figures can be broken down into simple and meaningful components and that a good strategy is to copy basic meaningful units first and then to fill in the remaining details. They used the Rey-Osterrieth complex figure test (Osterrieth, 1944) to test the effects of the training and found that participants in the training condition improved more in organisational strategies and memory abilities. They also found that OCD participants improved more in organisational skills and memory than controls, regardless of whether they received the training which suggests that when faced with a complex geometric figure, they initially had difficulty using effective organisational strategies, but then improved their use of strategies when copying the figure a second time, even without training. The authors argue that these results point to difficulties with the spontaneous use of organisational strategies during encoding and that people with OCD may therefore experience more difficulties in ambiguous conditions that require strategic processing.

A second study (Park et al., 2006) used a cognitive training program (nine one-hour sessions, twice-weekly for 5 weeks) for OCD patients that trained them in visual organisational strategies and in problem solving, whilst also encouraging links to everyday life and homework practice. The training started with easier patterns and difficulty was gradually increased; participants were taught to appreciate how different components of a complex pattern can be integrated into meaningful structures, to aid pattern construction and

organisation. Compared to controls, the treatment group showed improvements in visual memory and a decrease in clinical symptoms; improvements are suggested in both visual organisational strategies and in visual memory; there were no effects on verbal memory.

Summary - OCD. To date, two studies show improvements in visual organisational strategies and visual memory following training which provides strategies to break down complex figures into meaningful structures. The initial difficulties that participants have at effectively using organisational strategies could be related to anxiety in uncertain and ambiguous situations which leads to difficulties in encoding material and effectively carrying out tasks. This can be linked to the anorexia presentation in terms of processing information in the context of strong emotional activation and focusing on trivial details instead of the overall context. In CRT for anorexia, patients reflect on their typical strategies and consider alternatives, such as adopting more “bigger picture” strategies. From these studies in OCD, it appears that psychoeducation about strategies may be important in helping patients to practise these skills in sessions and in then feeling able to apply them when faced with uncertain situations in their everyday life.

Autistic spectrum disorder

Anorexia, autistic spectrum disorder (ASD) and neuropsychological findings.

ASD is characterised by difficulties in social communication and interaction including developing, maintaining and understanding relationships; it is also characterised by restricted and repetitive patterns of behaviour, interests or activities including inflexible adherence to routines and ritualised patterns of verbal and non-verbal behaviour (APA, 2013). A systematic review of the prevalence of ASD in eating disorders found high rates compared to healthy controls (Huke, Turk, Saeidi, Kent, & Morgan, 2013).

Women with anorexia display a greater number of self-reported autistic traits compared to healthy controls, especially in global thinking and inflexibility of thinking

(Tchanturia et al., 2013b). With regards to central coherence, people with anorexia do not seem to have superior local processing like in ASD, but they do seem to experience difficulties with central coherence (Harrison et al., 2012; Harrison, Tchanturia, & Treasure, 2011; Lopez et al., 2008), as in ASD where there are high levels of ability in tasks that require detail-focused processing (Happé & Frith, 2006). Furthermore, it is proposed that people with ASD have an “extreme male brain” profile with hyper-developed systemising abilities and under-developed empathising abilities (Baron-Cohen, 2002). A pilot study investigated self-reported empathy and systemising in anorexia compared to healthy controls, where the anorexia patients reported more traits associated with ASD, particularly in attention to detail and communication (Hambrook, Tchanturia, Schmidt, Russell, & Treasure, 2008).

As mentioned, people with anorexia also have difficulties in emotional processing and socio-emotional processing; in social interactions there also appear to be difficulties in alexithymia (i.e. difficulties in identifying and describing emotions) (Harrison et al., 2009; Kyriacou et al., 2009). A study of self-reported cognitive and socio-emotional abilities (Courty et al., 2013) found that participants with anorexia and ASD, as well as reporting a need for sameness, also report difficulties in understanding emotions and taking others’ perspectives. Difficulties appear to be in emotion regulation and awareness and in the recognition and understanding of others’ emotions. With regards to emotional theory of mind (eToM), which is the ability to infer what another person feels, Oldershaw, Hambrook, Tchanturia, Treasure, and Schmidt (2010) found that recovered anorexia patients performed well on eToM tasks and were also significantly better than patients currently in treatment at inferring emotions in themselves and others.

As mentioned, CRT was originally developed for psychosis. Eack et al. (2013b) argue that there are commonalities between ASD and schizophrenia in both social and non-

social difficulties, especially processing speed and emotional understanding. They argue that interventions for social and non-social cognitive difficulties in ASD should integrate neurocognitive and social-cognitive remediation to improve adaptive functioning and quality of life. Eack et al. (2013a) describe cognitive enhancement therapy (CET), also originally developed for psychosis, which targets both social and non-social information processing difficulties through the integration of computer-based neurocognitive training with group-based social-cognitive exercises; it uses repetitive practice, strategic training and homework assignments to apply CET to everyday life. It is a developmental approach as it focuses on key adult social-cognitive milestones such as perspective-taking. The authors argue that the most marked difficulties in high functioning ASD are cognitive flexibility, processing speed, working memory and visual learning as well as difficulties in social cognition such as emotional intelligence, especially emotion understanding and management; they argue that interventions could target these difficulties.

ASD and cognitive enhancement therapy. The only study to date on CET for ASD is a pilot trial which assessed feasibility (Eack et al., 2013c; Appendix B). The authors tested it with 14 adults with ASD. The intervention was delivered over 18 months and comprised 60 hours of computer-based neurocognitive training followed by a 45-session social-cognitive group programme (1.5 hours, weekly); participants also completed computer-based cognitive exercises (1 hour, weekly) and homework assignments. The study aimed to test treatment adherence and satisfaction as well as the intervention's impact on cognition and social adjustment. Overall, participants reported high levels of satisfaction and there was a high overall attendance at sessions; there were also highly significant and large effect size improvements in neurocognition (especially processing speed), cognitive style, social cognition (emotional understanding and management), functioning and adjustment. This

study provides preliminary support for CET though an extension and replication is needed, along with a comparison to a control condition.

Summary - ASD. So far there is only evidence from one CET pilot study in ASD which shows preliminary support. The focus on emotional material and skills can again be linked to the context of anorexia where there are difficulties with emotional processing and with relationships. However, in ASD there is a wide use of technology in interventions. In their review of cognitive training using technology in ASD, Wass and Porayska-Pomsta (2013) argue that technology-enhanced interventions, such as through the use of virtual reality, are useful in ASD but that, due to difficulties with the generalisation of knowledge and skills in naturalistic settings, interventions also need to help individuals to apply their knowledge in the real world context. This could also be applied to the context of anorexia where it is crucial to apply knowledge and skills to everyday life and to encourage social interaction, for example with the use of group activities.

Discussion and recommendations

Research implications

To date, the studies on cognitive remediation and training have small sample sizes, low statistical power and many are not randomised trials with the control of potentially confounding variables. There are also many differences both between and within the four conditions and variations in terms of comparison treatments. More research is needed with regards to the specific and non-specific effects of these interventions. Other than the direct effect of the cognitive remediation exercises, other factors also merit more attention such as the motivational component. Furthermore, although most of the research studies reviewed reported rather strict inclusion criteria, co-occurrence of disorders is common, as discussed; although it may not be possible or appropriate to exclude research participants on this basis, researchers should report rates of prevalence of other commonly co-occurring disorders in

their samples, if possible, and perhaps aim to control for the potential impact of co-occurrence of disorders in their analyses.

Regarding CRT outcomes, further research could aim to replicate individual CRT studies using self-report, neuropsychological and clinical measures. Similarly, group CRT merits further research, especially on its social and motivational aspects. It would also be useful to compare the effects of individual and group CRT to see whether there are any differences in outcomes. Follow-up longitudinal studies could also further elucidate any long-term effects of CRT and consider broader outcomes such as work and social functioning and quality of life. Furthermore, the optimal length or amount of CRT merits further attention, particularly given the differences in length of treatment of cognitive remediation interventions in the related conditions. The heterogeneity of study methodologies needs to be addressed as well as the consideration of measures that may be more sensitive in gauging CRT's specific effects. This could occur alongside research into brain mechanisms implicated in the cognitive difficulties, such as brain imaging studies that have begun to investigate the effects of CRT on neurocognition (Fonville et al., 2013; Fonville et al., submitted).

Treatment development and clinical implications

Cognitive remediation and training approaches are used across conditions that share commonalities with anorexia. These interventions show promising evidence in terms of feasibility and are associated with improvements in various domains of executive functioning and information processing. Though the foci of cognitive remediation may be different in the context of MDD (mainly attention and memory), OCD (organisational strategies) and ASD (socio-cognitive skills), the approaches reviewed all use cognitive exercises and reflection to target disorder maintenance processes and aim to promote the use of new skills and knowledge.

As well as different foci, the interventions have different learning principles and delivery strategies. Firstly, especially in anorexia and MDD, it appears that motivation to change and perceived competence in ability to make changes may be of particular relevance. As mentioned above, group CRT was associated with improved self-reported perceived importance to change and ability to change. The qualitative feedback from patients also reflects an appreciation for in-session practice of skills and intra-session behavioural “challenges”. Though CRT for anorexia uses the exercises more as a tool for reflection, it may be that some patients would value the opportunity for more practise of these skills; patients’ ambivalence about change can be difficult to address and engagement in treatment may be facilitated by an increase in perceived self-efficacy and their role in their recovery, particularly due to the relationship between early engagement and treatment outcome (Tchanturia et al., 2013). As with any psychological therapy, therapeutic alliance appears to be important in understanding engagement and premature inpatient treatment termination in anorexia (Sly, Morgan, Mountford, & Lacey, 2013). CRT’s role in increasing motivation to change needs to be assessed further, especially in light of motivational interviewing also being increasingly used in anorexia as a client-centred directive method for encouraging intrinsic motivation to change by exploring ambivalence and considering readiness to change (Macdonald, Hibbs, Corfield, & Treasure, 2012); more evidence is needed regarding the effectiveness of such approaches (Kitson, 2012).

This review has also highlighted the frequent use of psychoeducation, especially in MDD and OCD, in learning skills to focus attention and manage uncertainty. CRT exercises are often used to explore aspects of everyday life such as specific routines that could be challenged; it may be that in-session reflections could also focus on how to apply CRT skills, for example in “seeing the bigger picture” rather than their usual strategies, such as attending

to minute details in a ritualistic manner when faced with more complex and anxiety-provoking situations.

Regarding intervention delivery, this literature review has highlighted the use of group activities, as opposed to individual treatment, and varying lengths of cognitive remediation programmes; this needs to be considered in the context of limited resources for psychological provision and the trend towards shortening the length of hospital admissions. Group activities may be particularly useful due to the importance of promoting social interactions and a reduction of social isolation in this group, in the context of frequent emotional processing difficulties.

Theoretical implications

Socio-emotional processing also appears to be a commonality across the conditions, especially the processing of emotional material; emotion avoidance is suggested as a maintenance factor for anorexia (Treasure & Schmidt, 2013) and people with anorexia often experience negative emotions as dangerous and unpredictable and can strive to avoid them (Fox, Federici, & Power, 2012). Emotional invalidation in early experiences can lead to assumptions about the acceptability of expressing emotions and negative beliefs about the self which result in difficulties in emotional functioning (Waller, Costorphine, & Mountford, 2007). Social-cognitive theories of emotional disorders argue that there is a complex interaction between an individual's internal factors and external factors: the diathesis-stress model proposes that external stressors are problematic for individuals with a relevant vulnerability and argues for the significance of specific events and individuals' interpretation and appraisal of these (Power & Dalgleish, 2008). Difficulties in cognitive-emotional processing, i.e. how an individual processes difficult events, can manifest as obsessions, intrusive thoughts and inappropriate expressions of emotion (Power & Dalgleish, 2008). Thus, as is the case in developments such as the CREST intervention, focusing on both

executive functions (“cold cognitions”) and emotional processing (“hot cognitions”) may be beneficial (Tchanturia et al., 2014).

It is also important to consider the role of social factors in both the development and maintenance of these difficulties. For example, childhood adversity is thought to play a causal role in depression, anxiety disorders and eating disorders, amongst others (Read et al., 2014). A neurodevelopmental model of anorexia has been proposed (Connan, Campbell, Katzman, Lightman, & Treasure, 2003) which, based on empirical evidence, suggests that genetic, biological, psychological and socio-cultural factors all contribute to anorexia susceptibility; in particular, they argue that genetic factors interact with early attachment experiences and lead to a poorly regulated stress response. The stress response is affected by social factors and by major transitions such as adolescence and can lead to difficulties in emotional, cognitive and social functioning. Further consideration could be given to the development of these difficulties, to build on the biopsychosocial understanding of this complex disorder. In fact, although this review focused on adult populations, CRT for adolescents (Pretorius et al., 2012; Wood, Al-Khairulla, & Lask, 2011) and family CRT (Lask & Roberts, 2013) are being developed and may be promising, though to date only case studies are available.

Conclusion

Further research is needed not only regarding CRT’s effectiveness, but on how it is developed and tailored to meet individuals’ needs. Different approaches or foci may be suitable for different pre-treatment characteristics and an avenue for future research and treatment developments could be to look at broad functioning and behavioural difficulties as opposed to strict diagnostic categories. More transdiagnostic considerations may also be beneficial, especially given the overlaps in conditions and similarities in associated difficulties.

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SECTION B

Cognitive remediation therapy in anorexia nervosa: Patient
neuropsychological and self-report outcomes and
therapist qualitative feedback.

Word count: 7,972 (627)

Abstract

Aims

Though cognitive remediation therapy (CRT) for anorexia nervosa shows promising evidence, questions remain regarding specific mechanisms of change. This mixed methods study aimed to explore both longitudinal patient data (neuropsychological and self-report measures, before and after CRT) and therapist experiences of delivering CRT and their perceptions regarding what it offers.

Participants

All patients had received treatment in a specialist inpatient unit. Complete data were available for both individual (n = 56) and group (n = 43) CRT; clinical audit data were also available. Semi-structured interviews of 11 therapists were analysed using thematic analysis.

Results

Statistically significant improvements were found in cognitive flexibility task performance for individual CRT (medium effect) and in self-reported cognitive flexibility for group CRT (medium effect). Three main themes were identified from the therapist interviews: “Anorexia and its treatment”, “CRT - its characteristics and delivery” and “CRT and its effectiveness”.

Conclusion

The quantitative findings replicated some previous results and the therapist interviews provided insights regarding not only CRT’s delivery but adaptations made according to individual need and complexity. Both individual and group CRT appear to be feasible interventions for future trials but questions remain around CRT’s specific effects.

Recommendations are made for future research studies on this complex intervention.

Keywords: anorexia nervosa, cognitive remediation therapy, outcomes, therapist experiences

Anorexia nervosa is a complex eating disorder with a serious course and outcome and relatively low rates of full recovery (Steinhausen, 2009). Evidence for psychological treatments is limited (Hay, Touyz, & Sud, 2012; National Institute for Health and Care Excellence [NICE], 2004) and is further hampered by the difficulty of conducting clinical trials, in part due to patients' ambivalence about change and high drop-out rates (Bulik, 2014; Halmi et al., 2005).

Research into neuropsychological profiles in eating disorders has proposed two main areas of difficulty in anorexia, namely set-shifting (Roberts, Tchanturia, Stahl, Southgate, & Treasure, 2007; Tchanturia et al., 2011, 2012) and weak central coherence (Lang et al., in press; Lopez, Tchanturia, Stahl, & Treasure, 2008). Set-shifting, a component of executive functioning, is the ability to move back and forth between multiple tasks or operations and difficulties manifest as cognitive inflexibility or response inflexibility (Lezak, 2012). Weak central coherence is extreme attention to detail manifesting as difficulties in global processing and better performance on tasks requiring attention to detail. Both these difficulties may be part of the risk factors for developing anorexia (Southgate, Tchanturia, & Treasure, 2005) and do not appear to improve following weight gain (Green, Elliman, Wakeling, & Rogers, 1996; Roberts et al., 2007). The cognitive-interpersonal maintenance model of anorexia, supported by empirical evidence, explores the development and maintenance of anorexia (Schmidt & Treasure, 2006; Treasure, & Schmidt, 2013). Cognitive inflexibility is seen as a maintaining factor as obsessive-compulsive traits can lead to individuals developing "all-or-nothing" type thinking and a strict attention to details. These traits are intensified by food restriction and starvation. Treatments could target such maintenance factors of anorexia, as opposed to core eating disorder concerns around food, weight and shape (Hay et al., 2012).

Cognitive remediation therapy for anorexia is a brief, low-intensity, manualised intervention that targets difficulties in set-shifting and central coherence. It consists of simple

cognitive exercises and encourages curiosity and reflection on thinking styles and how they relate to everyday life, including behavioural tasks as inter-session practice (Tchanturia, Lloyd, & Lang, 2013; Tchanturia, Davies, Reeder, & Wykes, 2010). CRT comprises ten twice-weekly sessions (45 minutes) and can be used as a pre-treatment intervention to engage patients and prepare them for further psychological therapy. Various studies have been published that report evidence for the effectiveness of individual CRT for anorexia: a number of case series and randomised controlled trials (RCTs) show promising evidence (Abbate-Daga, Buzzichelli, Marzola, Amianto, & Fassino, 2012; Brockmeyer et al., 2014; Davies & Tchanturia, 2005; Dingemans et al., 2014; Lock et al., 2013; Pretorius & Tchanturia, 2007; Steinglass et al., 2014; Tchanturia, Davies, & Campbell, 2007; Tchanturia et al., 2008). The main findings are improvements in neuropsychological performance on set-shifting and central coherence tasks. These studies provide some evidence regarding feasibility and have begun comparisons to other treatments, but more research is needed to identify CRT's specific effects and its optimal length.

CRT has also been developed in group format; the four weekly sessions comprise psychoeducation, cognitive exercises, reflection and homework tasks. Group CRT also has the potential secondary benefits of peer support and group facilitation which could help to increase motivation and reduce social isolation (Genders & Tchanturia, 2010); the group is also an opportunity to experience the therapeutic effects of group interaction without some of the emotional demands of other group therapies (Zuchova, Erler, & Papezova, 2013). Two studies have explored group CRT outcomes: a pilot study reported an improvement in self-reported cognitive flexibility and statistically significant improvement in perceived ability to change in relation to their recovery (Genders & Tchanturia, 2010); the second study (Zuchova et al., 2013) assessed the intervention's feasibility and acceptability and reported positive patient feedback.

Two studies have also specifically explored patient and therapist feedback by analysing “end of CRT” letters which are exchanged at the final individual CRT session. Whitney, Easter and Tchanturia (2008) used a grounded theory approach to analyse letters by 19 inpatients. Overall, patients reported high levels of satisfaction and appreciated CRT’s “refreshing” focus away from food; they found CRT helpful in reducing perfectionistic tendencies, inflexibility and in increasing their ability to implement changes. The second study (Easter & Tchanturia, 2011) used the same approach to explore letters by 12 therapists for 23 patients. Therapists noted patients’ progress during the therapy, in reflecting on and then challenging their cognitive styles as well as their achievements in applying CRT through making small behavioural changes. These two studies provide an insight into patients’ and therapists’ experiences of CRT. The letters were naturalistic data and not from a self-selected sample, however as argued by the authors (Easter & Tchanturia, 2011), the therapist letters in particular were all similar in style and aimed to be motivational and positive.

Rationale for the study

In summary, there is preliminary evidence for CRT for anorexia, however avenues for further research could be to replicate the original findings for both individual and group CRT, using the same measures but extending the sample size using a new patient cohort. Furthermore, CRT is delivered in two different formats and feasibility research is required to inform whether one format or both in combination should be put forward in a trial. To date no direct comparison has been made between the two, either regarding quantitative outcomes or qualitative perspectives. Also, although studies have reported patient experiences of both formats, therapists’ perspectives have only been explored for individual CRT and it could be useful to explore their experiences of delivering both. Due to the limited evidence on CRT’s delivery, conducting a more in-depth study of therapist observations using interviews could also help to elucidate CRT’s active ingredients. There is a need to gauge CRT’s specific

effects and these insights, combined with quantitative outcome data, could inform practice and further the understanding of CRT at a theoretical level.

CRT research has begun to investigate its feasibility and effectiveness, but questions remain regarding mechanisms of change. The Medical Research Council (MRC) provides criteria for trials of complex interventions and outlines key issues for their development and evaluation (Craig et al., 2008; MRC, 2008; Appendix D): such evaluation should include steps to understand the change process as this could help to evaluate the intervention itself as well as inform the theories that underpin it, thus in turn helping to develop the intervention further. Therefore, quantitative data on CRT outcomes could be considered alongside qualitative data regarding the process of change.

Aims

This study had three main aims: The first aim was to extend previous findings by further exploring CRT's effectiveness in an inpatient setting. This entailed exploring longitudinal data related to individual and group CRT by analysing both neuropsychological and self-report data which had been collected but not previously analysed. It was hypothesised that individual CRT would be associated with improvements in neuropsychological (central coherence and set-shifting tasks) and self-report measures (cognitive flexibility, mood, motivation to change, work and social adjustment, and eating disorder symptoms). It was also hypothesised that group CRT would be associated with improvements in self-report measures, i.e. cognitive flexibility and motivation to change.

The second aim was to conduct exploratory analyses to see whether patients who received CRT had different clinical outcomes depending on CRT format and compared to patients who did not receive CRT. Exploratory hypotheses were that different formats of CRT delivery (individual, group or both) would be associated with different impacts on outcomes, in terms of self-report and clinical measures.

The third aim was to explore therapists' experiences of delivering the intervention in both formats, their perceptions with regards to what CRT offers and their thoughts relating to future research avenues in continuing to assess its effectiveness.

Methods

Participant data

Participants. All patients in this study received treatment in a specialist inpatient eating disorders unit (EDU) which accepts both local and national referrals for patients diagnosed with an eating disorder (see details of the treatment programme, Appendix E). There were no specific inclusion/exclusion criteria as the sample was from a service audit including all patients who were female, aged 18-60 years, with an eating disorder clinician diagnosis and no history of other major psychiatric disorders. To test the hypotheses outlined above, audit data for all EDU patients were merged with CRT data. Only patients with a completed admission (both admission and discharge data) were included.

In total, there are 300 inpatients in the dataset (October 2005 to August 2013). Diagnosis information (available for $n = 290$) is as follows: 95.5 per cent ($n = 277$) anorexia of which 64.8 per cent ($n = 188$) anorexia restrictive, 23.1 per cent ($n = 67$) anorexia binge-purge, 3.8 per cent ($n = 11$) anorexia subtype unrecorded, 3.8 per cent ($n = 11$) atypical anorexia, 1.3 per cent ($n = 4$) bulimia nervosa, 2.3 per cent ($n = 7$) eating disorder not otherwise specified (EDNOS) and .7 per cent ($n = 2$) "other". Regarding severity, 21.3 per cent ($n = 64$) were treated under the Mental Health Act; in terms of admission body mass index (BMI, defined as $\text{mass}/\text{height}^2$) severity, 18.4 per cent ($n = 55$) were in the anorexia range (15-17.5), 39.1 per cent ($n = 117$) in the severe range (13.5-15), 26.1 per cent ($n = 78$) in the critical range (12-13.5) and 10.4 per cent ($n = 31$) in the life threatening range (BMI < 12). See Table 1 for further demographic information.

Table 1

Demographic characteristics for patients who completed CRT

Characteristics	Individual CRT	Group CRT
	M (SD)	M (SD)
n	56	43
age	26.68 (8)	27.72 (10.3)
years with an eating disorder	10.2 (8.32)	8.98 (7.8)
age of onset	16.24 (3.6)	16.75 (5.2)
admission BMI	13.48 (1.21)	14.07 (1.54)
discharge BMI	16.41 (1.45)	16.52 (1.52)
length of admission (weeks)	26.07 (16.27)	22.69 (12.1)

Procedure. On the EDU, all patients routinely complete self-report audit measures on admission and discharge. Patients receiving CRT complete additional assessments (at the first and last sessions) i.e. self-report and neuropsychological (only individual CRT) measures (for data collection diagram, Appendix F; for measures and tests, Appendices G and H).

Neuropsychological measures. The Brixton spatial anticipation test (Burgess & Shallice, 1997), used to investigate cognitive flexibility, is a test of concept formation measuring the ability to recognise a rule regarding pattern variations across items (Lezak, 2012). Participants predict the movement of a blue circle which changes location (across a 5 x 2 grid); there are 56 trials in total and no time limit. The total number of errors (incorrect predictions) is used as a measure of set-shifting ability. A semi-computerised version of the test was used where trials are presented on a computer screen; the original instructions and scoring sheets (Burgess & Shallice, 1997) were used. A large published dataset (n = 601) is available in eating disorders (Tchanturia et al., 2011).

The Rey-Osterrieth complex figure test (RCFT; Osterrieth, 1944), used to investigate central coherence, is a visual perception organisation task that requires the participant to copy a complex figure onto a sheet of paper whilst information is recorded about how they proceed (Lezak, 2012). The figure is divided into 18 scorable units: the participant's strategy is tracked to calculate scores of order, style and an overall central coherence (CC) index (where a higher index indicates a more coherent strategy); it has previously been used in the eating disorders literature (e.g. Tchanturia et al., 2008).

Self-report measures. The cognitive flexibility scale (CFS; Martin & Rubin, 1995), previously used in eating disorders (Lounes, Khan, & Tchanturia, 2011), was used to measure cognitive flexibility. The 12 items measure three components of cognitive flexibility: awareness of options, willingness to be flexible and self-efficacy in being flexible. Total scores range from 0 to 72; higher scores indicate greater cognitive flexibility. This measure has shown high internal reliability and construct and concurrent validity (Martin & Rubin, 1995).

The hospital anxiety and depression scale (HADS; Zigmond & Snaith, 1983) assesses current anxiety and depression. The 14-item measure yields three scores: anxiety total, depression total and overall total. A cut-off score of ten is recommended as an indication of clinical level of distress, based on normative data. The HADS demonstrates good psychometric properties (Crawford et al., 2001).

The motivation ruler (MR; Miller & Rollnick, 2002), previously used in eating disorders (Genders & Tchanturia, 2010), assesses self-reported perceived importance to change and ability to change, in relation to certain aspects (e.g. self-esteem, recovery and how they cope with worry); it is a brief 2-item measure rated on ten point Likert scales where higher scores indicate greater importance or ability, respectively.

The work and social adjustment scale (WSAS; Mundt, Marks, Shear, & Greist, 2002) is a five-item scale used to assess functional impairment attributable to the eating disorder, in ability to work, home management, social leisure, private leisure, and the ability to form and maintain close relationships; the maximum score is 40 and higher scores indicate greater impairment. The WSAS has good test-retest reliability, internal consistency, and is sensitive to patients' perceptions of disorder severity; it has previously been used in eating disorders (Tchanturia et al., 2013).

The eating disorder examination questionnaire (EDE-Q; Fairburn & Beglin, 1994) measures patterns of disturbed eating behaviours. It is a 36-item measure of eating disorder symptoms and behaviours and an overall severity score can be obtained where a higher score indicates greater severity. The measure has good psychometric properties (Luce & Crowther, 1999).

Data analysis and power. A power calculation was not carried out prior to the study as the data were part of routine service practice and not for this specific study. However, effect sizes are given in the Results section and power is considered in the Discussion. SPSS for Windows version 19 (IBM, 2010) was used for statistical analyses.

Interviews

Participants. 11 CRT therapists were interviewed. To contextualise the interviews, therapists were asked for details (see Table 2) including years of experience in eating disorders and CRT and an estimate of cases or group runs. Therapists who had not delivered CRT in a particular format rated their perceived familiarity (out of ten, where ten is the highest) with that format.

Table 2

Therapists' characteristics

Current position	Experience in eating disorders and CRT (years)		Delivered individual CRT? (cases)	Delivered group CRT? (group runs)	Interview duration (minutes)
Assistant Psychologist	1	1	Yes (4)	No (4/10) **	31
Trainee Counselling Psychologist	.5	.5	Yes (5)	Yes (4)	24
Counselling Psychologist	15	2	Yes (10)	No (6/10) **	46
Counselling Psychologist	7	5	Yes (20)	Yes (20)	42
Assistant Psychologist	4	2.5	No (3/10) **	Yes (12)	37
Clinical Psychologist	5	3	Yes (5)	Yes (over 20)	27
Clinical Psychologist	2	1	Yes (5)	Yes (1)	37
Trainee Clinical Psychologist	7	2	Yes (8)	Yes (2)	35
Clinical Psychologist	2	.5	Yes (10)	No (2/10) **	34
Trainee Clinical Psychologist	7	5	Yes (6)	No (7/10)	30
Counselling Psychologist	1	1	Yes (7)	Yes (4)	59
M	4.6	2.1	8*	10*	36.5

Note. * = only when delivered; ** = perceived familiarity with that format

Methodology. A semi-structured interview schedule was developed (Appendix I). Questions centred on participants' thoughts regarding anorexia treatment, what CRT might specifically add, and regarding the two formats; therapists were also asked about future research endeavours and were given the opportunity to make any further comments. The questions were open-ended and minimal prompting was used to encourage clarification or examples.

Procedure. The individual interviews were conducted during one hour slots: therapists were given the information sheet and written informed consent was sought

(Appendix I); opportunities were given for questions. The interviews were recorded on a dictaphone and to facilitate the interview process, written notes were also taken. The interviews were transcribed verbatim and analysed using the NVivo 9 (QSR International, 2010) qualitative software analysis tool.

Thematic analysis as described by Braun and Clarke (2006) was used for analysis. This method allows for the summary of key characteristics within large bodies of data: patterns or themes of meaning can be identified, analysed and reported. A critical realist epistemological position was taken (Willig, 2008) and the aim was to report the experiences and reality of the participants. A data-driven, inductive method of analysis was used and the data were coded without a pre-existing frame (Braun & Clarke, 2006).

Boyatzis (1998) argues that thematic analysis is more of a process than a method for encoding qualitative information. The procedure outlined to generate themes and subthemes is to use a data-driven coding system to reduce the raw data and identify themes; the latter should then be compared across subsamples and the original material re-read and the themes revised if necessary (for codes, Appendix K and annotated transcript example, Appendix L). A research diary was used as part of the reflexive dialogue (Braun & Clarke, 2006) and a bracketing interview (Roulston, 2010) was conducted to gain some awareness of assumptions, beliefs and subjectivities (Appendix N). To ensure validity of the themes identified, a random selection of a third of the data (three interviews) was given to an independent researcher for an audit of the findings. This was an opportunity to scrutinise the data coding to ensure consistency and an accurate reflection of the raw material (Boyatzis, 1998; Joffe & Yardley, 2004); following a discussion, the themes were finalised. Informal feedback was also sought from some of the therapists who were interviewed, who felt that the themes represented their perspectives.

Ethical considerations

The patient data had been collected as part of routine clinical practice on the EDU; ethical approval had been granted by an NHS Research Ethics Committee. Patients had been consulted and measures to be completed were reduced following their feedback about time and effort required. Patients are made aware of the voluntary aspect of participation and their right to withdraw, that their data are anonymised and confidential and that findings may be published.

For the interviews, full ethical approval was sought and granted by the Salomons Centre Ethics Panel and two NHS Trusts (Appendix J). Therapists were approached and given a minimum of 24 hours to consider their participation and opportunities to ask questions. All project data were anonymised and stored securely.

Results

CRT outcomes

For the statistical tests below, Kolmogorov-Smirnov normality tests were conducted and parametric or non-parametric tests conducted accordingly (see Table 3).

Table 3

Results of the Kolmogorov-Smirnov normality tests

Individual CRT variables	p	Group CRT variables	p
BMI Time 1	.200	BMI Time 1	.200
BMI Time 2	.200	BMI Time 2	.073
Brixton errors Time 1	.000	CFS total Time 1	.069
Brixton errors Time 2	.000	CFS total Time 2	.200
RCFT order Time 1	.002	MR importance Time 1	.002
RCFT order Time 2	.000	MR importance Time 2	.015
RCFT style Time 1	.000	MR ability Time 1	.200
RCFT style Time 2	.000	MR ability Time 2	.082
RCFT CC index Time 1	.000		

RCFT CC index Time 2	.002
CFS total Time 1	.200
CFS total Time 2	.143
HADS anxiety Time 1	.001
HADS anxiety Time 2	.200
HADS depression Time 1	.091
HADS depression Time 2	.129
HADS total Time 1	.031
HADS total Time 2	.200
MR importance Time 1	.022
MR importance Time 2	.097
MR ability Time 1	.063
MR ability Time 2	.050
WSAS total Time 1	.200
WSAS total Time 2	.177
EDE-Q global Time 1	.200
EDE-Q global Time 2	.161

Individual CRT. In total, $n = 80$ inpatients were offered CRT and $n = 56$ (70 per cent) completed. Of the 24 (30 per cent) who did not complete CRT, 11 (13.75 per cent) were prematurely discharged. No information is available for the other 13 (16.25 per cent): CRT could have been completed but with no Time 2 assessment, or not completed (approximate voluntary non-completion rate of 16 per cent). Some additional data are missing which could be due to patients not returning questionnaires or being discharged before a Time 2 assessment was possible. Paired tests are reported below (Table 4) for patients who completed an individual CRT assessment (Time 1 and Time 2).

Individual CRT was associated with a statistically significant improvement in performance-based cognitive flexibility ($p < .000$; $d = .71$, medium effect); the improvement in central coherence approached statistical significance ($p = .058$; $d = .28$, small effect). There were improvements in mood symptoms (anxiety: $p < .13$, $d = .36$, small effect;

depression: $p < .008$, $d = .4$, medium effect; HADS total score: $p < .008$, $d = .4$ medium effect) and in BMI ($p < .000$; $d = 1.26$, very large effect). There were no significant changes in self-reported cognitive flexibility ($p < .245$), work and social adjustment ($p < .406$), eating disorder symptoms ($p < .148$), perceived importance to change ($p < .480$) or ability to change ($p < .648$).

Group CRT. In total, $n = 60$ inpatients attended the group and $n = 43$ (71.6 per cent) completed it. $n = 15$ did not complete it (approximate voluntary non-completion rate of 25 per cent) and data are missing for two patients which could again be due to non-completion of measures. Paired tests are reported below (Table 5) for patients who completed the group CRT assessment (Time 1 and Time 2).

Group CRT was associated with a statistically significant improvement in self-reported cognitive flexibility ($p < .031$; $d = .4$, medium effect) and perceived ability to change approached statistical significance ($p < .095$; $d = .43$, medium effect). There was no significant change in perceived importance to change ($p < .623$) and a significant change in BMI ($p < .0000$; small effect).

Table 4

Summary of paired tests for Individual CRT

	n	Time 1 M (SD)	Time 2 M (SD)	t / Z	p	d
BMI	56	14.2 (1.34)	15.91 (1.4)	-9.16 (P)	.000 *	1.26 very large
Brixton errors	50	13.54 (5.84)	9.38 (6.01)	-5.45 (NP)	.000 *	.71 medium
RCFT order	50	2.1 (.74)	2.24 (.75)	-1.2 (NP)	.230	.19 small
RCFT style	50	1.45 (.47)	1.58 (.47)	-1.49 (NP)	.134	.28 small
RCFT CC index	50	1.36 (.44)	1.48 (.44)	-1.89 (NP)	.058	.28 small
CFS total	41	44.3 (10.45)	45.9 (12.6)	-1.18 (P)	.245	.14 negligible

HADS anxiety	23	14.1 (5.99)	12.04 (5.5)	-2.49 (NP)	.013 *	.36 small
HADS depression	23	12.04 (6.62)	9.53 (6.22)	2.93 (P)	.008 *	.4 medium
HADS total	23	26.13 (12.2)	21.56 (11.1)	-2.66 (NP)	.008 *	.4 medium
MR importance	21	7.42 (2.58)	7.88 (2.26)	-.7 (NP)	.480	.19 negligible
MR ability	21	5.33 (3.21)	5.57 (2.96)	-.46 (NP)	.648	.08 negligible
WSAS total	22	25.27 (10.5)	24.09 (11.7)	.85 (P)	.406	.11 negligible
EDE-Q global	20	3.13 (1.51)	2.7 (1.62)	1.51 (P)	.148	.28 small

Note. M = mean; SD = standard deviation; * = statistically significant; (P)/(NP) = parametric/non-parametric; d = effect size

Table 5

Summary of paired tests for Group CRT

	n	Time 1 M (SD)	Time 2 M (SD)	t / Z	p	D
BMI	52	15.65 (2.03)	16.06 (1.75)	-4.09 (P)	.000 *	.22 small
CFS total	25	43.20 (8.46)	46.64 (9)	-2.29 (P)	.031 *	.4 medium
MR importance	25	8.6 (1.78)	8.46 (1.58)	-.49 (NP)	.623	.08 negligible
MR ability	25	5.04 (2.58)	6.1 (2.45)	-1.74 (P)	.095	.43 medium

Note. M = mean; SD = standard deviation; * = statistically significant; (P)/(NP) = parametric/non-parametric; d = effect size

Comparison of outcomes. To compare outcomes between patients who completed individual CRT only (n = 58), group CRT only (n = 41), or both (n = 19), exploratory statistical analyses were conducted. Table 6 shows data for clinical and self-report measures across different formats of CRT: the mean scores are presented for Time 1 (admission) and Time 2 (discharge); the difference between the scores is also included.

Overall there were no discernible trends in the data between the groups in terms of outcomes or baseline differences. Due to small sample sizes and lack of statistical power, it was not possible to conduct further statistical analyses or draw firm conclusions, however effect sizes are provided to show the differences in outcomes between the groups.

Originally, an analysis had also been planned to compare patients who had received any form of CRT compared to no CRT; this was however not possible due to the heterogeneity of the sample of participants who had not received CRT, in terms of admission-specific information and clinical measures. Therefore it was unfortunately not possible to compare the two groups, or to create a pseudo-control group.

Table 6

Comparison of clinical and self-report measures across different formats of CRT

		BMI	EDE-Q total	WSAS total	MR importance	MR ability	HADS anxiety	HADS depression	HADS total
Individual CRT only	n (pairs)	58	10	6	10	10	2	2	2
	T 1 M (SD)	13.69 (1.26)	3.75 (1.86)	22.83 (8.18)	7.9 (2.51)	6.2 (2.44)	14 (5.65)	13.5 (10.6)	27.5 (16.26)
	T 2 M (SD)	16.39 (1.42)	1.81 (1.63)	17.5 (11.64)	8.2 (1.81)	7.5 (2.06)	10 (4.24)	6 (5.65)	16 (9.89)
	difference	2.7	-1.94	-5.33	.3	1.3	-4	-7.5	-11.5
	d	2.03	1.17	.58	.14	.61	1.13	1.25	1.21
		huge	very large	medium	negligible	medium	very large	very large	very large
Group CRT only	n (pairs)	41	21	11	19	19	2	2	2
	T 1 M (SD)	14.51 (1.88)	3.68 (1.47)	30.36 (6.88)	8.47 (2.03)	5.26 (2.49)	12 (5.65)	8 (1.41)	20 (7.07)
	T 2 M (SD)	16.75 (1.4)	2.96 (1.4)	26.72 (6.03)	8.57 (1.21)	6.52 (1.34)	10 (1.41)	8 (0)	18 (1.41)
	difference	2.24	-.72	-3.64	.1	1.26	-2	0	-2
	d	1.37	.51	.59	.06	.65	.69	0	.55
		very large	medium	medium	negligible	medium	medium	negligible	medium
Both CRT formats (individual and group)	n (pairs)	19	12	9	12	12	0	0	0
	T 1 M (SD)	13.71 (.81)	3.86 (1.8)	26.8 (10.64)	7.67 (2.38)	5.21 (2.6)			
	T 2 M (SD)	15.99 (1.63)	3.21 (1.58)	25.11 (11.03)	8.75 (1.48)	6.5 (2.23)			
	difference	2.28	-.65	-1.69	1.08	1.29			
	d	1.82	.4	.17	.57	.56			
		huge	medium	small	medium	medium			

Interview data

The thematic analysis of the interviews identified three main themes and subthemes (see Table 7). Each is presented below with participant quotes to illustrate (where ‘PX’ indicates each participant number). See Appendix M for the thematic map.

Table 7

Themes and subthemes

Themes	Subthemes
“Anorexia and its treatment”	“How Anorexia patients present - factors affecting engagement in psychological work”
	“Treating Anorexia - how the therapeutic process can begin”
“CRT - its characteristics and delivery”	“CRT - A safe and gentle therapy”
	“CRT as an introduction to therapy, reflection and experimentation”
	“CRT and its delivery formats - a tailored intervention versus a group experience”
“CRT and its effectiveness”	“The therapist’s confidence and role in promoting CRT”
	“CRT - an early intervention at the start of inpatient treatment”
	“How much CRT? Questions around meeting individuals’ needs and how to combine the delivery formats”
	“Gaining insights, learning and celebrating small successes”
	“Research and testing - how to capture CRT’s contribution to treatment”

Theme 1: “Anorexia and its treatment”. The first theme relates to therapists’ thoughts relating to anorexia patients’ typical presentation on an inpatient unit and what seems to help treatment, including the characteristics of the patient-therapist relationship and targets for treatment.

“How Anorexia patients present - factors affecting engagement in psychological work”. With regards to how anorexia patients present, the vast majority of therapists spoke of the resistance and motivation to change as areas to be considered for treatment and how best to engage patients in therapy. They commented on patients’ cognitive inflexibility, high levels of perfectionism and social difficulties which not only maintain the disorder but appear to be appropriate targets for intervention. Patients’ difficulty in managing emotions was also reflected on, particularly their reticence to engage in psychological work, as well as the competitiveness that can emerge in patient groups which needs to be worked with and managed. Finally, the patients’ low weight, especially at admission, was considered due to its impact on cognitive ability and concentration levels; therapists reported the difficulties of undertaking psychological work in the context of compromised physical states and the steps taken to engage patients in whatever psychological work they can manage.

We know that therapeutic engagement with this client group is very difficult... [...] this patient group who are very very severely compromised nutritionally, [...] cognitively they’re not functioning at all at their usual capacity, strongly driven with rigid routine, can’t think of alternative perspectives, have to follow this narrow single minded focus, umm, and so we need to work with that before we can do anything else... (P4)

“Treating Anorexia - how the therapeutic process can begin”. Treating anorexia was seen as a very complex task however overall there was a consensus on the importance of a strong therapeutic relationship and on tailoring the work to focus on patients’ goals, thus

increasing motivation, building trust and increasing the sense of achievement and self-esteem. It was felt that a collaborative style, within a bounded framework, enables exploration of what the origins of the disorder may be and in engaging the patient. It was also discussed that low key interventions early in treatment can be helpful in starting this work, particularly due to the aforementioned reticence to change; some therapists emphasised a more experiential style of learning as well as group work with other patients to enable some of this work to begin.

For me, the main components are something that tries to [...] work on people's motivation to change... [...], that tries to help people make meaning of their experience. [...] And I think something about doing rather than talking, so components of treatment that get people to just do things a bit differently. (P8)

I've always thought there's something very important about [...] modelling a relationship, [...] there's a degree of curiousness, curiosity, playfulness, but also kind of a willingness to engage with really serious matters (P11)

Theme 2: “CRT - its characteristics and delivery”. The second theme related to CRT's characteristics, its delivery formats and how therapists believe that it works. The therapists were also able to reflect on their confidence in delivering CRT and their role in promoting it.

“CRT - A safe and gentle therapy”. The therapists reflected on CRT's main characteristics, in particular its focus away from core eating disorder concerns including weight and food, and that it does not demand much personal exposure from patients, meaning that it is thought of as non-threatening. CRT is viewed as a different kind of therapy: it is safe, fun, gentle and the therapists stress the importance of collaboration and play which help patients to explore the concepts with lightness and, at times, laughter. The therapists also

commented on CRT's structure which is experienced as containing for both the patient and therapist.

It's not around food, it's not around body image, [...] it's more about how you think, how you look at the world, how you approach tasks [...] I think it just takes that bit of pressure off them and they can just [look at] functioning in a broader way. (P8)

I think, because of the puzzles and the activities, it's almost like, a, a way to do therapy without them even realising that they're doing it... [...] they wouldn't label it as therapy, I don't think... (P1)

It is very playful, very light, and it's a very gentle way of being able to look at something really serious. (P11)

“CRT as an introduction to therapy, reflection and experimentation”. With regards to how CRT works, therapists spoke of an opportunity to introduce patients to therapy and reflection, and for patients to learn about themselves; CRT was seen as a springboard for future work where the tasks were used as a tool for exploration and eliciting reflections. CRT was seen as an experiential piece of work where patients could consider alternative ways of thinking and behaving and practising them; in particular, the repetition of tasks was considered useful in consolidating new skills and in helping patients to practise flexibility, thus targeting disorder maintenance processes. Finally, therapists reflected on CRT allowing therapists to work with what each patient can manage, thus facilitating this process.

The tasks are a really good kind of starting point... [...] the more successful cases have probably been the ones where the tasks have been a platform for exploration. (P2)

CRT is [very] experiential, [...] some of the other groups can sometimes be a little bit dry [...] whereas in CRT [we are] doing tasks, we're doing different activities, [...] and they kind of get to learn about their thinking style as well as what they're thinking.

(P5)

“CRT and its delivery formats - a tailored intervention versus a group experience”.

The therapists were invited to reflect on the CRT’s two formats and to think about what each format may bring to anorexia treatment (see Table 8).

Table 8

Individual vs. Group CRT

“Individual CRT - flexibility within a manualised intervention”	“CRT and group processes”
<ul style="list-style-type: none"> • tailoring the work to the individual • the benefit of creativity with the tasks to suit each individual patient • the therapist modelling flexibility in the sessions, for example with the use of the tasks • therapists recognising the variations in delivering CRT, mainly due to individualisation and therapist style • therapists sometimes bringing in other models into CRT to illustrate certain points • working from the manual is seen as both an advantage and as restrictive: it is a helpful tool however it can be restrictive, mainly in terms of what can be explored within the structure • therapists felt it may be safer for patients to open up in an individual setting. 	<ul style="list-style-type: none"> • patients can learn from others and share the work with others, thus also getting support with tasks in the session and with homework • the group can allow patients to discuss their thinking styles, thus normalising some of their experiences • the group can be an additional opportunity for patients to experience social activities and can boost self-esteem • therapists commented on the inevitable comparison to others in the group and the competitive aspects • therapists have to manage group dynamics and processes which can be difficult • less individual tailoring or focus is possible in the group.

Individual CRT:

Although it's standardised and it's the manual, once you get familiar with it you realise that you can individualise it hugely. [...] Sometimes you'll use the ethos of it rather than the actual exercises that are in the manual, [...] and] I might do really playful things with people. [...] I found [the manual] quite constraining to begin with [...]but now] I can see that they need [the structure ...]. I do think there's something about having a physical manual that you both look at, that makes the whole thing less threatening. (P3)

Group CRT:

From my experience, CRT, one of the really helpful things is that it brings a kind of language to, to, other groups that we run... [...] we hear language that is used in CRT [...] coming into different groups and also the dining room. (P5)

The pros are the shared sense of homework, [...] so they could build up a good kind of, that sense of camaraderie and talk to each other in between about how they're getting on, and I know there's times when that's happened, there's a little buzz around for a couple of days. (P3)

“The therapist's confidence and role in promoting CRT”. CRT therapists reflected on their confidence in delivering the intervention and how important it was to understand its rationale, to then be able to introduce it to patients in a way that highlights its key characteristics and to engage them in the work; for example, therapists may present CRT as a fun distraction during what can be a difficult time on the unit. The therapists also commented that the small number of sessions was often an incentive, especially at the start of a patient's admission and that, despite patients' reluctance to engage in psychological work, they were able to ask some more difficult questions through CRT. Finally, therapists reflected on their own initial scepticism about CRT and how they had then seen the merits of the intervention.

Very often you can get people sitting there thinking ‘how is this going to help?’ really... [...] I was really sceptical myself, umm, but it’s not until you actually start doing it and you start working with it and using it and then you see how it’s quite helpful and how it does work. (P2)

I think as a therapist, on a very personal level, [...] when we’ve got somebody coming into the room who really really struggles to speak or engage in anything [...] it gives you something to focus on, ‘I’ve got a tool, I’ve got a bit of a toolkit’ [...] Some people are reticent to engage with it, umm, and it takes [...] a lot of enthusiasm on the part of the therapist, because sometimes they can think these exercises are a bit pathetic, and pointless and stupid. [...] That's when I do a lot more work with somebody about being really curious as to how their mind’s working, [...] then eventually you get them on board. (P4)

Theme 3: “CRT and its effectiveness”. This theme encompasses who therapists felt CRT should be offered to, questions around what the optimal CRT “dosage” may be, and finally about outcomes and future research endeavours.

“CRT - an early intervention at the start of inpatient treatment”. All the therapists interviewed felt that CRT could be offered to anyone, that anyone can engage with it in their own way and no interviewee could think of any contraindications or detrimental effects. Generally, the therapists emphasised its use with more chronic and severely ill patients and highlighted its benefits in being an early and low key intervention, despite very low weights at the start of an admission. The therapists also commented on the timing of CRT, namely that it would generally be recommended as the first intervention that a patient engages in, before moving on to future work.

It’s designed to be easily accessible for people who are severely underweight and, umm, sessions can be tailored in terms of time for, for, if people are having problems

with paying attention for that amount of time, [...] umm... I can't think of anyone off the top of my head for now who it would be contraindicated for. (P9)

“How much CRT? Questions around meeting individuals’ needs and how to combine the delivery formats”. The therapists felt that there are different outcomes depending on CRT format; in particular, most therapists agreed that group CRT would raise patients’ awareness of their thinking styles, whereas perhaps more change would be possible through individual CRT which can be tailored and focused on one patient. They emphasised however that the formats can certainly be used in combination, especially as having both can help to consolidate the learning and skills. Regarding which format may be advantageous, therapists commented that this would depend on the individual and there was also no general consensus regarding which would be the optimal order to deliver the formats, i.e. one format before the other. With regards to patients receiving both, the majority agreed that the “dosage” required would depend on the individual and the complexities of each case.

I’ve worked with some people who after seven sessions or six sessions had really got it, they’d made changes, they, they were much more aware of their thinking, of their tendencies and so on, whereas others I’ve worked with, particularly ones with more comorbid illness like OCD, social anxiety, I think they, it, it seemed to be they needed a bigger dose [...] I guess they just had a more complex formulation, it felt like actually to have a big effect you needed a bit more. (P8)

“Gaining insights, learning and celebrating small successes”. The therapists interviewed firstly felt that CRT is an opportunity for patients to acknowledge their strengths as well as their difficulties and to celebrate successes with behavioural changes, however small. They felt that CRT allows patients to gain an insight into themselves and this learning can be used in future work. The therapists reflected on working within the limits of both what the patient can manage and what is possible within the structure of an inpatient unit,

particularly in terms of real-life testing. In terms of clinical outcomes, again the therapists felt that more actual change may be possible through individual CRT and that the group, which requires patients to open up, may be more difficult for some. Finally, the therapists wondered about CRT's long-term effects and thought about whether patients were able to maintain the gains achieved.

I think in the individual work I've done, people have been able to change more, to try more things differently... versus in the group, I think people have become more aware [...] by seeing other people's approach, by seeing other people's perspectives, [...] their awareness of their thinking styles might have increased, whereas [...] in the individual setting [...] it is more about [...] doing things, trying things out. (P8)

When somebody comes onto the ward, [...] it's very very limited what we can be asking somebody to do... so, it's a way of enabling small changes to happen very very early on in [...] treatment. (P4)

One thing I always wonder about is how much long term effect it has, umm, on people's actual functioning, [...] ...people do seem to make changes and [...] then you wonder how that translates into real life change later on, whether that can be sustained. (P8)

“Research and testing - how to capture CRT's contribution to treatment”. Finally, in terms of future research and testing, the therapists reflected on the practicalities of research, such as an RCT, and shared their thoughts about CRT formats, with no general consensus. To summarise, individual CRT may be more controlled, however due to therapist variations and the individualisation of the work, more standardisation would be required. It was also commented on that it would be important to clarify what CRT does, to then choose an appropriate treatment comparison; although therapists were clear on CRT's rationale and aims, there was no consensus with regards to what comparison treatment may be best to test

its unique effect. Some therapists felt that CRT could be tested as a ‘pre-therapy’, to assess its effect as an engagement tool and some also felt that, whatever control group is chosen, it would be need to a non-specific, structured and manualised intervention. Finally, a few therapists also commented on how much change would be realistic to be expected after this short intervention, especially in the context of nutritionally compromised patients and complex presentations.

For me there’s a slight sort of tension [...] CRT shakes up that rigidity a lot but you have to make the treatment quite rigid in order to test it... [...] How do you do [CRT] as a rigid standardised trial? How do you standardise playfulness and flexibility? (laugh) [...] I would hate to think that CRT wouldn’t perform well in a trial because of all that was seeped out of that when it got standardised. (P3)

I think maybe in individual format it’s easier to deliver it, kind of, as the manual says, maybe in a group, managing the group dynamic, [...] how safe people feel in the group environment and [...] that introduces a lot of potential confounds. (P8)

Discussion

Summary of CRT outcomes

Individual CRT was associated with a statistically significant improvement in performance-based cognitive flexibility and the improvement in central coherence approached statistical significance: these results with 50 pairs replicate the findings from the original case series ($n = 23$ pairs; Tchanturia et al., 2008) in terms of primary neuropsychological outcomes, mood symptoms and improvements in BMI. There were no significant changes in self-reported cognitive flexibility ($p < .245$), work and social adjustment ($p < .406$), eating disorder symptoms ($p < .148$), perceived importance to change ($p < .480$) or ability to change ($p < .648$). The approximate voluntary non-completion rate was 16 per cent, roughly comparing to previously reported rates of 13-14 per cent

(Brockmeyer et al., 2014; Dingemans et al., 2014; Lock et al., 2013; Tchanturia et al., 2008); Abbate-Daga et al. (2012) reported 0 per cent drop-out, however this was in outpatients.

The group CRT results, with 25 pairs, also extend the findings from the original study ($n = 18$ pairs; Genders & Tchanturia, 2010). There was a statistically significant improvement in self-reported cognitive flexibility and improvements in perceived ability to change approached statistical significance. This is contrary to findings from the pilot study where ability to change was significant and cognitive flexibility was not. There was no significant change in perceived importance to change ($p < .623$) and a significant change in BMI ($p < .0000$; small effect). Genders and Tchanturia (2010) reported a drop-out rate of 20 per cent whereas in this sample the rate was 25 per cent. These differences in outcomes, specifically with regards to cognitive flexibility and ability to change, merit further testing with a larger sample.

As discussed, the planned comparison across CRT format (individual, group or both) did not show any discernible trends and it was not possible to draw conclusions from these exploratory analyses. Statistical power may have been an issue: for a medium effect size, a minimum of 50 participants would be required for 80 per cent power (Clark-Carter, 2010; Appendix O).

Overall, exploring both neuropsychological and self-report data was an advantage, especially in the context of performance-based versus subjective reports; for example, though the Brixton test and CFS complement each other, they may not be interchangeable (Lounes et al., 2011).

Therapists' experiences

Three main themes were identified from the interviews and some subthemes were closely related to previous findings (Easter & Tchanturia, 2011; Whitney et al., 2008), especially regarding what helps treat anorexia and how CRT targets key maintenance

processes. Therapists expressed their thoughts about CRT's place within the wider treatment context, namely as a springboard for future work in enabling patients to engage in psychological work even in physically compromised states. This study also provides additional insights into how the two CRT formats not only work in combination, but also in terms of perceived different processes of change and outcomes. The therapists were also very open about the challenges they face in delivering CRT, promoting engagement with it, managing complex group dynamics, and in working with both the patients' and their own initial scepticism. Therapists felt that, due to CRT's adaptability to different presentations and complexity, it can be offered at the beginning of inpatient treatment, which is not always possible with other psychological therapies. One question that remains unanswered however is what the optimal amount would be and what intervention would be an appropriate comparison in a trial. What appears clear from the interviews is that the positive emotional atmosphere and encouragement to have fun is appreciated and was seen by some as a key ingredient. In fact, it may be that control interventions could contain elements of playfulness and fun, to control for this element of CRT; alternatively, interventions with playfulness but without cognitive elements could be compared to cognitive tasks without as much playfulness. Finally, one of the most noteworthy points for reflection from these interviews is the individual tailoring reported by therapists; this merits future research as it could not only inform future developments of CRT to meet patients' needs, but also needs to be considered in the context of standardisation in research trials.

The interviews complement the quantitative outcome data as they provide an insight into experiences of delivering CRT. The interview method had not previously been employed and was an opportunity to explore therapists' accounts independently of the patient-therapist context. Thematic analysis was chosen for data analysis; although the aim of this study was to extend current knowledge from the previous studies, the interview data

were not coded onto previously identified themes as it was important to see whether any new themes would emerge from this method, compared to the analysis of letters. This study also had a sample of therapists with varied levels of experience and professional levels; this was not the case in the Easter and Tchanturia (2011) study where most were researchers.

Furthermore, the involvement of an independent researcher may help to ensure the validity of the findings and the bracketing interview was useful in considering subjective interpretation of interview data.

The mixed methodology using patient data and therapist interviews is an advantage. It is argued that triangulation through different data collection methods can be more suited to exploring different levels of the same phenomenon as they can help to clarify the formulation of the problem (Todd, Nerlich, & McKeown, 2004). The outcome data, providing more empirical information, is complemented by the interview data which enquired into subjective meanings in a particular socio-cultural context (Yardley & Marks, 2004). For example, it became evident through the interviews that therapists identified a possible conflict between CRT's therapeutic properties in the context of clinical use compared to a research context. Most of them valued the flexible, playful and creative nature of CRT and some expressed uncertainty with regards to how this strength can be maintained in a standardised trial where therapists may have to adhere to a manual structure more closely.

Limitations

This study was carried out within the context of routine clinical practice and a randomised design was not possible. Furthermore, unfortunately due to the nature of data collection, no neuropsychological data are available for group CRT; this could be addressed in future. Moreover, in terms of comparing the different CRT formats, a control group would have been beneficial, as well as more baseline measures of pre-CRT functioning; such exploratory analyses could further inform the current evidence base.

Regarding the interviews, it is acknowledged that the semi-structured interview schedule, though comprising open-ended questions, nevertheless meant that the structure of the questions may have led the interviews; future studies could use a case study approach, thus inviting therapists to reflect in depth about particular cases, which may further elucidate specific CRT effects. Interviews with former patients may also be fruitful.

Research and clinical implications According to the MRC criteria (Craig et al., 2008; MRC, 2008), interventions are considered complex if there are a number of interacting components and if a degree of tailoring is permitted. It is suggested that, due to strict standardisation potentially not being appropriate, a certain level of flexibility could be allowed if process analyses are included alongside quantitative measures. Process evaluations can be useful in assessing the quality of the implementation and to clarify causal mechanisms and contextual factors that may explain some of the variation in outcomes. Regarding fidelity, protocols should be clear on how much adaptation is acceptable and any variations should be recorded; for evaluation purposes, randomisation, adequate sample sizes and long-term follow-up are recommended. It is also important to be aware of the limitations of the measures and to therefore combine evidence from different sources: as mentioned, the Brixton test and CFS both assess cognitive flexibility but may not be interchangeable (Lounes et al., 2011). Finally, other interventions that patients receive, such as treatment as usual in addition to the intervention being tested, must be documented.

Regarding clinical implications, given the individual variation described in the interviews, it would be important to consider each patient's experience of the CRT process, to ensure that any benefits of receiving the therapy are optimised. Furthermore, given the potential differences between individual and group CRT, professionals and services should consider whether their patients would benefit from receiving one over the other, or whether offering both would be optimal.

Conclusion

Results from this study replicate most of the previous CRT findings with larger samples. Individual and group CRT both appear to be acceptable and feasible interventions for use in future trials. Individual CRT is associated with improvements in performance-based cognitive flexibility whereas group CRT may be more associated with self-reported cognitive flexibility and perceived ability to change.

Research into CRT aiming to compare it to other treatments will require carefully chosen measures, both quantitative and qualitative, sensitive enough to gauge CRT's specific effects. This study highlights the importance of considering neuropsychological, self-report and clinical measures linked directly to the treatment, as well as qualitative data about the CRT process and how it enables change. CRT trials should also aim to evaluate it whilst striving to maintain its playful, creative and flexible nature which may be CRT's key ingredient in facilitating change.

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SECTION C

Appendices of supporting material.

Appendix A - Literature search criteria and methods

An electronic search was conducted between September and November 2013 using the PubMed and PsycInfo databases and was updated in March 2014 (week 3). Search terms: anore*, depress*, obsessi*, compulsi*, and autis* combined with ((cognit*) (AND (remed* OR train*))). These search terms and boolean operators allowed for multiple spellings, plurals and combinations. A general search of internet databases was also conducted.

The titles, abstracts and full texts of the identified records were screened and reference lists of relevant papers were also cross-checked for additional articles not identified via the original searches. Following initial screening, using the criteria listed below, a selection of records were followed-up; through this process, a selection of relevant articles were more thoroughly reviewed as part of the Literature Review (see Table A1 below).

Criteria for inclusion of studies:

- cognitive remediation or training interventions
- studies in Anorexia Nervosa, major depressive disorder, obsessive-compulsive disorder and autistic spectrum disorder; no studies in other disorders (e.g. Schizophrenia)
- adult clinical populations only
- individual and group programmes; no solely self-help or web-based programmes
- both quantitative and qualitative studies
- only published and peer-reviewed literature in the English language

Search term combinations used in both PubMed and PsycInfo, specifically related to Cognitive remediation and training:

- (anore*) AND ((cognit*) AND (remed* OR train*))
- (depress*) AND ((cognit*) AND (remed* OR train*))
- ((obsessi*) AND compulsi*) AND ((cognit*) AND (remed* OR train*))
- (autis*) AND ((cognit*) AND (remed* OR train*))

Table A1

Literature search

	Database	Total records screened (*)	Total records followed-up (*)	Articles reviewed (**)
Anorexia	PubMed	62	21	15
Nervosa	PsycINFO	59	20	
MDD	PubMed	1,238	12	6
	PsycINFO	51	6	
OCD	PubMed	86	2	2
	PsycINFO	141	6	
ASD	PubMed	166	6	1
	PsycINFO	265	6	
Total		2,068	79	24

Note: *may include duplicate records; ** = includes articles subsequently identified through hand searches.

Appendix B - Summary table of the reviewed studies

Table B1

Summary Table of studies included in the Literature Review (in chronological order for each condition and in note form)

Anorexia Nervosa		
Study aims and design	Participant and intervention characteristics	Summary of measures and results
Davies & Tchanturia, 2005 (United Kingdom) Case report of CRT for anorexia	n = 1 female inpatient - age: 21 years - BMI (Time 1): 14.7 - duration of illness: 8 years - history of depression, obsessive-compulsive - disorder and anorexia CRT: 10 face-to-face sessions over a 4- week period, with two 3-weekly sessions and two twice-weekly sessions (25 minutes)	Pre- and post- intervention, and at 2 and 6 months follow-up; self-report and neuropsychological tests - significant improvements on set-shifting neuropsychological tests - BMI (at 2 month follow-up): 18.1; BMI (at 6 months follow-up): 16.5 - positive qualitative feedback from the patient
Tchanturia, Whitney, & Treasure 2006 (United Kingdom) Case report of CRT for anorexia	n = 1 female inpatient - age: 42 years - BMI (Time 1): 13.7 - duration of illness: 18 years CRT: 10 face-to-face sessions over an eight-week period. Sessions of approximately 40 minutes.	Improvements in neuropsychological set shifting tasks. BMI at Time 2: 13.9 Overall positive qualitative patient feedback.

Pretorius & Tchanturia, 2007 (United Kingdom)	n = 1 inpatient -age: 31 years - first episode of anorexia and first admission to an inpatient unit - duration of illness: 9 months BMI (Time1): 13.8	Clinical improvements (e.g. BMI increase) and overall positive patient feedback.
Tchanturia, Davies, & Campbell, 2007 (United Kingdom) preliminary case series to investigate the use of CRT in anorexia	Case report of CRT for anorexia CRT: 10, twice-weekly, 30-min sessions. n = 4 female inpatients age: 21-42 years duration illness: 7-24 years age onset: 14-18 years previous admissions: 1-3 BMI: 11.7 to 18.2 CRT: 10 sessions of 45 minutes	Assessment pre- and post-intervention, and at 18 month follow-up; neuropsychological and self-report measures; also patient feedback letters analysed at the end of CRT - improvements in neuropsychological task performance (medium to large effect sizes); gains maintained at follow-up - treatment acceptable to patients - qualitative feedback generally positive towards CRT - feedback then used to modify the exercises and treatment manual, based on patient comments.
Tchanturia, Davies, Lopez, Schmidt, Treasure, & Wykes, 2008 (United Kingdom)	n = 27 inpatients; n = 23 completed the intervention; drop-out of n = 4 (no further information available) age: M = 28.8 years (SD = 9.2); median age of onset: 15 years (14-17); duration of anorexia: M = 13.1 years (SD = 9.6); IQ: M = 112.7 (SD = 6.5) BMI: M = 14.3 (SD = 1.4) CRT: 10 individual sessions of CRT (45 minutes), twice a week	Assessments at baseline and post-intervention: battery of neuropsychological tests (set-shifting and central coherence tasks); self-report measures assessing obsessive-compulsive symptoms, anxiety and depression; clinical measures) and clinical (BMI) measures; also administered a treatment satisfaction questionnaire after the intervention. - improvements on set-shifting tasks (medium to very large effect sizes)

		<ul style="list-style-type: none"> - improvements on central coherence tasks (small to large effect sizes) - BMI significantly increased to $M = 16.1$ ($SD=1.5$); $p < 0.001$, $d = 1.25$ - significant decrease in depression symptoms ($p=0.01$); no statistically significant changes in obsessive-compulsive symptoms or anxiety.
Whitney, Easter & Tchanturia, 2008 (United Kingdom)	<p>qualitative data analysis: grounded theory approach</p> <p>Analysis of patient letters (n = 19 inpatients)</p>	<p>8 higher order themes identified.</p> <p>Patients found CRT “refreshing” and appreciated that the focus was not on food; they found it helpful in reducing perfectionistic tendencies and rigidity and also appreciated their increased ability to implement skills in real life.</p>
Qualitative study: patients’ experiences of CRT.		
Genders & Tchanturia, 2010 (United Kingdom)	<p>n = 30 inpatients (n = 2 males)</p>	<p>Self-report measures completed at the first and last group session; also patient qualitative feedback form.</p>
Pilot of group CRT for anorexia - development and acceptability	<p>age: $M = 28.4$ years (range 14-60 years)</p> <p>BMI: $M = 16.4$ (range 14.4 to 22.4; only one patient was weight restored)</p> <p>NART: (predicted full scale IQ) $M = 108$ (range 92-129)</p> <p>4 group sessions, run on a weekly basis</p>	<ul style="list-style-type: none"> - only patients who completed measures at the first and last session (n = 18) were included in the data analysis; 20 per cent voluntary drop-out - no significant improvement in self-reported cognitive flexibility - significant improvement in self-reported ability to change - patients reported finding the group useful, acceptable; a positive experience; facilitators reported the group being enjoyable and easily deliverable.
Pitt, Lewis, Morgan, & Woodward, 2010 (United Kingdom)	<p>n = 4 outpatients</p> <p>CRT delivered twice-weekly, ten sessions</p>	<ul style="list-style-type: none"> - assessments pre-and post- CRT. - improvements in self-reported flexibility of thinking after individual CRT; mixed results for self-reported perfectionism; overall positive patient feedback: most found CRT stimulating and increased flexibility in thinking in their everyday life.
Case series: aim to evaluate the use of CRT to reduce self-reported perfectionism		

Easter & Tchanturia, 2011 (United Kingdom)	qualitative data analysis: grounded theory approach	11 higher order themes identified. Three distinct stages of the intervention were commented on, namely reflecting on and challenging cognitive styles, then linking CRT tasks with everyday life situations and generating real life examples, and finally carrying out behavioural homework tasks and applying CRT to everyday life. They also reported that the majority of patients found the intervention useful and had little difficulty completing the tasks.
Qualitative study: therapist experiences of delivering CRT.	Analysis of 12 therapists' end of CRT letters for 23 patients	
Abbate-Daga, Buzzichelli, Marzola, Amianto, & Fassino, 2012 (Italy)	n = 20 anorexia-restrictive Outpatients age: M = 22.5 (SD = 3.9) age of onset: median = 16.65 years (SD = 2.21) illness duration: median = 5.85 years (SD = 3.87) years of education: M = 12.15 (SD = 2.23) BMI: M = 16.24 (SD = 1.09) weight: M = 43.41 (SD = 3.51) 10 sessions of CRT; 45 minute sessions (Italian version of the Tchanturia et al., 2010 CRT manual)	Assessments: psychiatric, neuropsychological and clinical measures pre- and post-CRT. Patient feedback collected (via end of treatment letters). - all patients completed CRT - neuropsychological performances changed after CRT: improvements in set-shifting especially (medium to large effect size); improvements in BMI, weight, general functioning, and in impulse regulation and interoceptive awareness - no improvement in perfectionism; no significant improvement in depressive symptomatology; no change in verbal domain - CRT experienced as useful and interesting by patients
Case series assessing the effectiveness of CRT in anorexia.		
Lock, Agras, Fitzpatrick, Bryson, Jo, Tchanturia, 2013 (USA)	RCT; n = 46 outpatients (11 per cent males) 8 CRT or Cognitive Behaviour Therapy (CBT) sessions then 16 sessions of CBT	Assessments pre- and post-intervention; neuropsychological tests of set-shifting and central coherence; self-report (e.g. eating disorder symptoms, self-esteem and mood) and clinical measures - lower drop-out rate in the CRT group (13 per cent) compared to the CBT group (33 per cent); larger improvements in cognitive difficulties in the CRT group compared to the CBT group at the end of the 2 months
RCT assessing the feasibility of using CRT to reduce drop-out rates in anorexia RCTs	BMI: M = 17.5 (SD = 1.2); age: M = 22.7 (SD = 5.9); duration of illness: M = 6.4 years (SD = 5.8) CRT: 8 sessions over 2 months; 1 hour sessions CBT: 24 sessions over 6 months	

Zuchova, Erler, & Papezova, 2013 (Czech Republic)	adult inpatients; 2 groups received the intervention (n = 14 and n = 20) (one male participant in the second group)	Patient feedback questionnaire after each session and facilitator observations; no neuropsychological testing
Group CRT for adult inpatients	10 CRT sessions, once a week, for 45 minutes	- patients reported appreciating the sessions and the different focus away from eating disorder related concerns.
Aim to assess the feasibility and acceptability of the intervention	- alternated between sessions on cognitive exercises and sessions on reflection, exploration of advantages and disadvantages or alternative thinking styles and bridging to everyday life - 20 sessions in total: 10 on CRT and 10 on reflection	- argue that it gave the patients the opportunity to experience the therapeutic effects of group interaction. - positive patient feedback.
Brockmeyer, Ingenerf, Walther, Wild, Hartmann, Herzog, Bents, & Friederich, 2014 (Germany)	n = 40 females with anorexia; inpatients receiving treatment as usual - randomisation to CRT (n = 20) or NNT (n = 20) - 30 sessions for both conditions: 21 computer-assisted and 9 face-to-face; 45 minute sessions over 3 weeks	- assessment pre- and post-treatment of cognitive set-shifting; also assessed attention, working memory and intelligence to control for potentially confounding difficulties (details available)
Pilot RCT of CRT - tailored CRT compared to non-specific cognitive training	- age - CRT:M = 23.63 (SD = 6.7); NNT:M = 26.65 (SD = 8.9)	- primary outcome: performance on a neuropsychological test (computer-based task-switching paradigm; details available)
CRT (set-shifting only) or non-specific neurocognitive therapy (NNT) focused on attention, memory and deductive reasoning	- BMI - CRT:M = 14.74 (SD = 1.6); NNT:M = 14.68 (SD = 1.7) - illness duration (years) - CRT: M = 7.89 (SD = 7.6); NNT: M = 6.82 (SD = 7.6)	- n = 25 treatment completers; drop-out due to discharge or transfer to another unit - no statistically significant baseline differences between the groups (in demographic and clinical measures)
Prospective, randomised controlled, superiority pilot trial	- CRT was manual-based and focused only on cognitive set-shifting (omission of the central coherence component); NNT focused on attention, memory and deductive reasoning; computer-assisted homework; CRT and NNT provided by the same therapists.	- at Time 2, CRT participants outperformed the NNT participants in cognitive set-shifting (p = 0.027;d = 0.62) - Patient feedback: training matched their problems: CRT: 80 per cent; NNT: 57 per cent'; felt more flexible after training: CRT: 60 per cent; NNT: 43 per

	- TAU included weekly individual and group psychodynamic psychotherapy, art therapy, behavioural and family interventions.	cent; felt more ready to tackle problems: CRT: 100 per cent; NNT: 100 per cent; would recommend to others? CRT: 90 per cent; NNT: 86 per cent
		- specific tailored neurocognitive training for anorexia appeared to be more effective than non-specific neurocognitive therapy (medium effect size)
Dingemans, Danner, Donker, Aardoom, van Meer, Tobias, van Elburg, & van Furth, 2014 (The Netherlands)	CRT versus treatment as usual (TAU) Randomisation of 82 patients to: CRT plus TAU (n = 41) or TAU only (n = 41)	Assessments pre- and post-CRT and at 6 months follow-up. - CRT associated with significant improvements in quality of life post-CRT and in eating disorder symptoms at follow-up. - CRT not associated with changes in neuropsychological performance in set-shifting or central coherence. - neuropsychological performance improved significantly in both groups - moderator analyses showed that patients with poor baseline set-shifting abilities benefited more from CRT, and had better quality of life at follow-up, than patients with no such difficulties at baseline.
RCT in severe and enduring anorexia (CRT plus TAU versus TAU only)		
Steinglass, Albano, Simpson, Wang, Zou, Attia, Walsh, 2014 (USA)	n = 32 inpatients (weight restored, i.e. BMI over 18.5) 12 sessions of AN-EXRP or CRT	Outcome measure: caloric intake at a test meal - caloric intake higher in the AN-EXRP group - improvement in caloric intake associated with eating-related anxiety.
RCT: comparison of CRT to an Exposure and Response Prevention approach	CRT to Exposure and Response Prevention for anorexia (AN-EXRP) is an approach that targets maladaptive eating behaviour by addressing eating-related anxiety.	Higher caloric intake at a test meal in the exposure group; this improvement was significantly associated with eating-related anxiety.

Major depressive disorder

Study aims and design	Participant and intervention characteristics	Summary of measures and results
Elgamal, McKinnon, Ramakrishnan, Joffe, & MacQueen, 2007 (Canada) Cognitive remediation therapy (CRT) for patients with MDD: aim to evaluate the feasibility of this cognitive remediation programme	n = 12 patients (7 women, 5 men) with MDD; outpatients age: M = 50.26 (SD = 6.41) control groups (age and gender matched): - n = 12 patients with MDD who did not receive training - n = 22 healthy controls group - Programme: PSSCogReHab - computerised intervention package which delivered computer-assisted cognitive retraining (CACR). - target domains: memory, attention, executive functioning, psychomotor speed. - individual training sessions over 10 weeks; 45-60 minute sessions; delivered twice weekly; participants encouraged to supplement the training with informal tasks in between sessions.	Baseline and post-intervention (10 weeks later); cognitive and clinical measures - improvement in cognitive performance following CRT - improvements exceeded those found in matched patients and in healthy controls - improvement on a range of tests of attention, verbal learning and memory, psychomotor speed and executive function - treatment gains not attributable to improvements in mood symptoms.
Siegle, Ghinassi, & Thase, 2007 (USA) Testing of a neurobehavioural therapy for MDD.	n = 19 Cognitive Control Training (CCT) n = 10 TAU Outpatients in a day treatment programme Inclusion criteria: unipolar depression and aged 18-55 years. 35 minute intervention over two weeks	Diagnostic interview, pre- and post-intervention assessments including self-report measures - n = 15 completed the intervention - after 2 weeks, the intervention was associated with decreased depressive severity and is well tolerated by participants - greater decreases in depressive symptoms and rumination compared to treatment as usual

	Computer-administered version of the Attention Control Training and adaptive Paced Auditory Serial Addition Test (PASAT).	- normalisation of disruption in brain mechanisms targeted by the CCT.
Naismith, Redoblado-Hodge, Lewis, Scott, & Hickie 2010 (Australia)	n = 16 outpatients; inter-episode participants (unipolar: n = 14; bipolar: n = 2) 14 females and 2 males; age: M = 33.5 (SD = 9.9)	Baseline and follow-up between week 1 and week 12.
Evaluation of a cognitive training programme in MDD.	wait list control design: allocation to treatment group or wait list then treatment n = 8 treatment; n = 8 wait list then treatment Neuropsychological Educational Approach to Remediation (NEAR): use of computer games tailored to participant's strengths and weaknesses; Delivered in a group setting; principles of motivation and learning; use of positive reinforcement, allowance for choice, independent learning, contextualisation of learning. Groups of 1 hour, twice weekly over 10 weeks; treatment fidelity assessed via treatment notes.	- no differences between groups in depression, anxiety or stress - significant interaction effect of time by condition - cognitive training associated with significant and large effect size improvements in memory, both encoding and retention (verbal memory) - cognitive training may promote neuroplasticity - cognitive training not associated with reduced levels of disability - no improvements in other areas of cognition.
Naismith, Diamond, Carter, Norrie, Redoblado-Hodge, Lewis, & Hickie, 2011 (Australia)	n = 44; age: M = 64.8 (SD = 8.5)	Assessments at baseline and follow-up.
Evaluation of the efficacy of a cognitive training for older people with MDD.	wait list control design: allocation to treatment group or wait list then treatment n = 24 immediate treatment; n = 20 wait list then treatment Cognitive training and psycho-education (1 hour of each, delivered weekly over a 10 week in group format).	primary outcome: memory task. secondary outcomes: other aspects of cognition and disability n = 22 completers for treatment group and n = 19 for control group - Cognitive training associated with significant improvements in visual memory and verbal memory (medium to large effect sizes); treatment not

	Multifactorial, i.e. both internal and external strategies. Psychoeducation: cognitive strategies - depression, anxiety, sleep, vascular risk factors, diet and exercise. NEAR approach (see Naismith et al., 2010).	significantly associated with measures of executive functioning and no effects of the treatment on mood. - Cognitive training could be a viable intervention for late-life depression.
Bowie, Gupta, Holshausen, Jokic, Best, & Milev, 2013 (Canada)	n = 33 participants with MDD diagnosis randomisation to treatment (n = 17) or wait list (n = 16) conditions	Assessments at baseline and 10 weeks after CR or wait list. Measures on neurocognition, mood symptoms, functioning, treatment process variables
Aim to evaluate the efficacy and effectiveness of cognitive remediation (CR) with supplemental internet-based homework.	weekly group sessions over 10 weeks; 90 minute sessions (3 participants per group) CR group: computer-based exercises (drill-based), strategic self-monitoring and “bridging” Homework: daily online cognitive exercises (two 20-minute intervals) from home as well as completion of strategic monitoring and bridging in logs.	- significant time by treatment interaction for attention and information processing speed, and for verbal learning and memory; no significant changes in functioning; improved cognition predicted improvements in functioning - amount of online exercises (number of minutes) associated with greater cognitive improvements - higher levels of perceived competence with regards to the computerised tasks were associated with larger cognitive improvement; evidence for improvements in cognitive difficulties for severe and treatment-resistant depression
Lee, Redoblado-Hodge, Naismith, Hermens, Porter, & Hickie, 2013 (Australia)	n = 55 participants block randomisation to either CR group or TAU (treatment as usual) group	Estimations of premorbid ability (WTAR); Baseline and follow-up measures - n = 36 completed the study (n = 7 first-episode depression and n = 11 psychosis in each condition) - CR effective in improving immediate learning and memory - verbal learning and memory benefit most from CR - CR also seems to improve psychosocial functioning
Aim to assess the effectiveness of cognitive remediation (CR) in patients with a first episode of major depression or psychosis.	CR over 10 weeks; once-weekly; 2 hour sessions - Therapist-led drill and practice group activities plus computer-assisted cognitive training - NEAR approach (see Naismith et al., 2010)	

- Adaptation: including of a psychoeducation component. Cognitive training tailored to each individual's neuropsychological profile.

- improved delayed learning and memory mediated the effect of CR on psychosocial improvements (though this requires further validation as only significant at trend level)
- cognitive and functional improvements were found even when controlling for the effects of diagnosis

Obsessive-compulsive disorder

Study aims and design	Participant and intervention characteristics	Summary of measures and results
<p>Buhlmann, Deckersbach, Engelhard, Cook, Rauch, Kathmann, Wilhelm, & Savage, 2006 (USA)</p> <p>Aim to determine whether difficulties in organisational abilities in OCD can be improved by a training procedure. (treatment conditions versus control condition)</p>	<p>n = 35 with OCD (17 females); n = 36 healthy controls (22 females); OCD considered to be participants fully symptomatic for OCD. Demographic and co-occurring diagnoses information available from the article.</p> <p>- treatment condition: n = 20 OCD group and n = 18 controls</p> <p>- control (no training) condition: n = 15 OCD group and n = 18 controls</p> <p>- Training group: participants received instructions that complex geometric figures can be broken down into simple and meaningful components; told that a good strategy, in general, is to copy basic meaningful units first and then to fill in the remaining details.</p> <p>- Non-training condition: participants looked at the figure for 1 minute; the organisational features or strategy were not pointed out.</p>	<p>- Rey Osterrieth Complex Figure (RCFT); copy accuracy and copy organisation plus recall and delayed recall</p> <p>- Taylor Complex Figure (used for training only)</p> <p>- participants in the training condition (both OCD group and controls) improved more in organisational abilities compared to the non-training condition</p> <p>- OCD participants improved more in organisational skills and memory than control participants, regardless of whether they received the training</p> <p>- suggestion of difficulties with spontaneous use of organisational strategies during encoding; therefore there may be a distinction between the failure to use a strategy compared to the inability to implement a strategy</p>

Park, Shin, Ha, Shin, Kim, Lee, & Kwon, 2006 (Korea)	n = 30 in total; n = 15 OCD group; n = 15 controls (age and gender matched) Random allocation to treatment or control group	Cognitive training associated with improvements in visual memory for OCD participants and decrease in clinical symptoms
Aim to test a Cognitive Training programme for OCD (Treatment versus control group)	Cognitive training programme: nine sessions (60 minute), twice a week for 5 weeks - training for visual organisational strategies: used a subtest of the K-WAIS (block design) as a training tool; started with easier patterns and gradually became more difficult; participants trained to appreciate how different components of a pattern can be integrated into meaningful structures - training for problem-solving strategies: problem-solving exercises and homework tasks.	improvements suggested in both the visual organisational strategies and in visual memory; no effect on verbal memory.

Autistic spectrum disorder

Study aims and design	Participant and intervention characteristics	Summary of measures and results
Eack, Greenwald, Hogarty, Bahorik, Litschge, Mazefsky, Minshew, 2013 (USA) Uncontrolled trial of Cognitive Enhancement Therapy (CET) for ASD – feasibility study	n = 14 adults with ASD (12 males) Age: M = 25.29 (SD = 5.72) Over 18months: 60 hours of computer-based neurocognitive training followed by a 45 session social-cognitive group curriculum (1.5 hours, weekly) CET coach pairs participate in computer-based cognitive exercises for 1 hour each week Homework assignments assigned.	Outcomes: treatment adherence, and satisfaction; impact on cognition and social adjustment - treatment adherence: 79 per cent completed the 18 months; 87 per cent overall attendance rate at sessions; high levels of satisfaction - highly significant and large effect size improvements in neurocognition (especially iprocessing speed), cognitive style, social cognition and social adjustment; largest improvements in social cognition (emotional understanding and management) and social functioning; social-cognitive gains generalised to improvements in adaptive function and social adjustment.

Appendix C - Cognitive remediation therapy (CRT) for anorexia nervosa

Please see below for additional information to that presented in the Literature Review section, including: an overview of CRT; an example of an Individual CRT session structure; the structure of Group CRT; the contents of the CRT manual used by clinicians; examples and descriptions of CRT exercises.

CRT manual: Tchanturia, K., Davies, H., Reeder, C., & Wykes, T. (2010). Cognitive remediation therapy for anorexia nervosa. London, UK: King's College London, University of London. (Accessible from: <http://www.national.slam.nhs.uk/wp-content/uploads/2014/03/Cognitive-remediation-therapy-for-Anorexia-Nervosa-Kate-Tchantura.pdf>)

Overview of CRT

CRT for anorexia is an intervention which addresses the basic processes of thought, that is how patients think, rather than the content, that is what patients think, thus directly targeting cognitive processes rather than core features of the disorder.

CRT is a manualised intervention: the manual consists of various types of cognitive flexibility and holistic processing tasks. These cognitive exercises are designed to improve the general functioning and meta-cognition of patients with anorexia. Cognitive flexibility tasks are completed by the patient with the therapist and the aim is to increase the patients' flexibility and ability to switch between various mental tasks.

An example of a 'switching' task is the Embedded Words task where the patient works through a list of words and simultaneously completes two or three different actions depending on the semantic nature of the word: for example, they may circle 'cold words' whilst simultaneously crossing out 'animal words' and ignoring words that relate to neither.

An example of a 'bigger picture' task is the "Complex Pictures task" where the patient describes a complex and unfamiliar figure or picture to the therapist. Describing the figure in terms of the global main shape is the easier and more suitable strategy for the task and the aim of

the task is to increase the patient's ability to see the whole, bigger picture rather than over-focusing on the details.

CRT in individual format is delivered in 10 sessions, twice a week, for about 45 minutes. It usually starts in the second or third week of their admission. Initially, patients are required to complete different types of tasks and to increasingly reflect on their thinking styles and strategies. The therapist then gradually encourages the patient to reflect on how these strategies can be linked to everyday life and to generate examples from personal experience. In later sessions, the patient is given behavioural tasks to practice in between sessions, to practice flexibility or holistic processing outside of the therapy setting. At the end of the therapy, the patient and therapist exchange goodbye letters.

CRT in group format is delivered in 4 sessions, twice a week, for 45 minutes. It comprises comprises psychoeducation, exercises, reflection and homework tasks, as well as to peer support and group facilitation. The group is run by two facilitators and is open to all patients in the service.

Training and regular supervision is provided by the Consultant Clinical Psychologist. Group supervision is also an opportunity to discuss cases and to assess consistency and adherence to the manual. All the CRT therapists are educated to at least a higher education level in Psychology – therapists include Psychology assistants, Clinical Psychology trainees and qualified Clinical and Counselling Psychologists.

Individual CRT - example of a session structure

1x Complex Pictures task

2x Illusion tasks

2x Stroop tasks

1x Estimation task

1x Card Stack task

3x Main Idea task

Group CRT - structure

Session 1 - Introduction to CRT and Bigger Picture Thinking

Session 2 - Switching

Session 3 - Multi-tasking

Session 4 - Summary and Reflections

Examples of CRT exercises

For each CRT Exercise, the manual provides instructions to complete the task and examples of possible questions and reflections on the tasks.

Complex Pictures	bigger picture and detail focus	describing pictures for someone to draw (without them having seen the picture)
Main Idea	bigger picture and detail focus	reading a letter and summarising it in a couple of sentences
Illusions task	bigger picture and detail focus also switching	looking at a visual illusion and describing what they can see
Switching Attention	switching	alternating naming, for example, animals and place names
Embedded Words	bigger picture and detail focus also flexible thinking	identifying particular categories of information amongst irrelevant information
Estimating	estimating and approximating	estimating, for example, the middle point along an unmarked line, or the middle of a shape such as a circle
Word Search	switching	identifying relevant information amongst irrelevant stimuli
How to Plant a Sunflower	bigger picture and detail focus	describing how a specific task, such as planting a sunflower, may be carried out

Appendix D - MRC criteria for trials of complex interventions

“Figure 1: Key elements of the development and evaluation process” (p. 980) in Craig, P., Dieppe, P., Macintyre, S., Mitchie, S., Nazareth, I., & Petticrew, M. (2008). Developing and evaluating complex interventions: The new Medical Research Council guidance. *British Medical Journal*, 337, a1655. doi: 10.1136/bmj.a1655

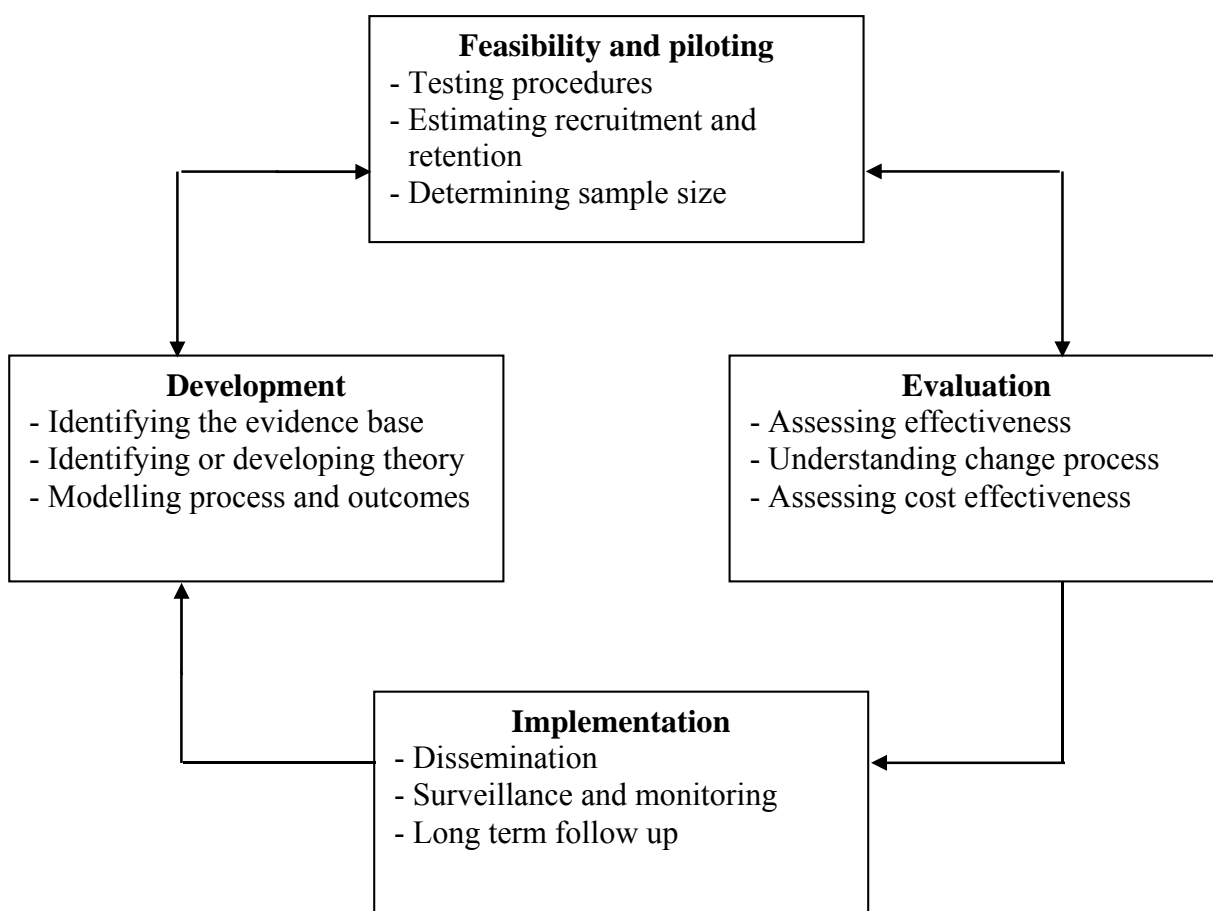


Figure D1: Key elements of the development and evaluation process of complex interventions according to MRC criteria (figure reproduced from Craig et al., 2008, p.980).

Appendix E - Inpatient eating disorders unit (EDU) treatment programme

The specialist inpatient EDU has 18 beds and accepts patients from many parts of the UK and locally. The Psychology team are formed of a Consultant, Clinical and Counselling Psychologists and a Psychology Assistant. They offer interventions including cognitive remediation and emotion skills training (CRT and CREST), Motivational Enhancement Therapy (MET) and Cognitive Behavioural Therapy (CBT). Psychology Groups Programme includes the Flexibility group (CRT), the Emotions group (CREST), Coping with worry group, Self-esteem group and Coping with excessive exercise group.

The multi-disciplinary team (MDT) includes: the Medical Team (Consultant Psychiatrists and Doctors); the Management Team (Specialist Clinical Lead and Ward Manager); the Nursing Team; the Psychology team (that provide individual and group psychological work as well as assessments); the Occupational Therapy Team (that provide individual sessions, reviews and group interventions); the Family Interventions Team; and access to a Dietician.

Treatment as usual includes:

- Individual care plans, daily weigh-ins and dispensing on any medication by the Nursing Team.
- Communal meals (three main meals and three snacks) every day in the dining room. Patients must stay in the dining room for the duration of the meal and are supported by members of the MDT. Each meal is followed by a rest period which is for one hour after main meals and 20 minutes after snacks. During this time patients must remain in the communal areas of the unit.
- Aims of the eating programme: to make eating as manageable as possible, to restore nutritional health safely, to establish a regular eating pattern, with a normal variety of foods and to gradually give the responsibility back to patients for feeding themselves. Eating programme divided into four main stages (1. a gradual re-introduction to eating; 2. gradual increase of meals throughout the day; 3. more substantial meal plans; 4. participation in trips to the canteen, cooking groups on the unit and buy and preparing meals).

Appendix F – Eating disorders unit (EDU) data collection diagram

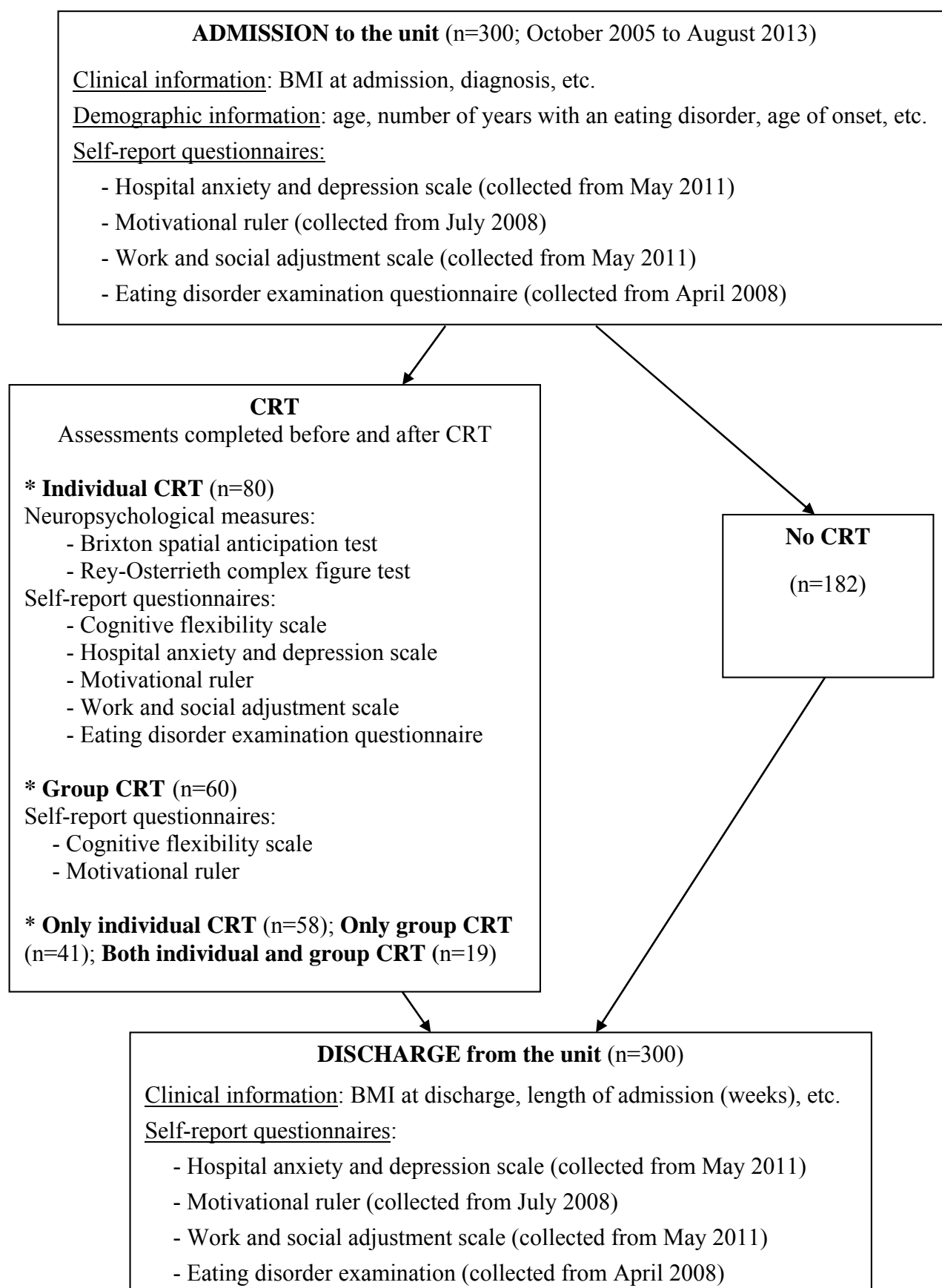


Figure F1: EDU data collection diagram.

Appendix G - Neuropsychological tests: Administration and scoring

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Appendix H - Self-report measures

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Appendix I - Testing Materials for the interviews

Information sheet (identifiable information removed)

Consent form (identifiable information removed)

Semi-structured interview schedule



Salomons Campus at Tunbridge Wells
 Department of Applied Psychology
 Faculty of Social and Applied Sciences

Major Research Project (MRP) - Salomons, Canterbury Christ Church University

Information Sheet

“Cognitive Remediation Therapy in an Anorexia Nervosa Inpatient setting.”

What is the project about?

You are invited to take part in a Major Research Project (MRP) which aims to focus on the impact of Cognitive Remediation Therapy (CRT) on patients' outcomes. CRT has been developed and piloted as a brief intervention for patients with Anorexia Nervosa and is either offered as an individual therapy or as a group therapy.

We will be looking at patients' self-report questionnaires and performance on neuropsychological tests to see whether CRT is an effective treatment and to see whether there are any differences in terms of outcomes between individual CRT, group CRT or both individual and group CRT.

Secondly, as well as understanding the clinical impact of CRT on patients, this project is also interested in understanding CRT clinicians' views of the intervention, in particular regarding the two formats it is delivered in and which format may be seen as better.

We are interested in exploring your views on CRT
 and your perceptions of both individual and group CRT.

What do I need to do?

Should you wish to participate, we will ask you to participate in an interview. This should take about one hour and will be an opportunity to discuss your experiences of delivering CRT and your thoughts about its two main formats and which intervention may work better.

Further information

In order to participate, we will ask you to complete a consent form however you will be able to withdraw from participation in the project at any time, without having to give a reason.

Your contributions in the interview will be recorded on a dictaphone and the file will be stored on an encrypted password-protected computer memory stick. The recording will be destroyed after completion of the data analysis; an anonymised interview transcript will be kept however this will contain no identifiable information.

This project will then be written up as part of a Doctoral Thesis and will include some anonymised quotes from the interviews. No identifiable information will be present in the write-up.

Should you have any questions or concerns, please do not hesitate to contact [Trainee] (Trainee Clinical Psychologist) on [email address].

This project is supervised by [Lead supervisor] (Consultant Clinical Psychologist, Eating Disorders, [NHS Trust]) and by [Second Supervisor] (Senior Lecturer Researcher, Salomons, Canterbury Christ Church University)



[NHS Trust logo]

Salomons Campus at Tunbridge Wells
 Department of Applied Psychology
 Faculty of Social and Applied Sciences

Major Research Project (MRP)
 Salomons, Canterbury Christ Church University

Consent Form

“Cognitive Remediation Therapy in an Anorexia Nervosa inpatient setting”

- I confirm that I have read and understood the Information Sheet for this Major Research Project (MRP).
- I understand that I have the opportunity to ask questions about this project.
- I understand that my participation is voluntary and that I can withdraw from participation in the interview at any time.
- I understand that my contributions in the interview will be recorded and stored securely on password protected devices.
- I understand that all information will be kept strictly confidential.
- I understand that the write-up of the project will include some anonymised quotes from the interviews but will contain no identifiable information.

Signature..... Date:

Should you have any questions or concerns, please do not hesitate to contact [Trainee] (Trainee Clinical Psychologist) on [email address].

This project is supervised by [Lead supervisor] (Consultant Clinical Psychologist, Eating Disorders, [NHS Trust]) and by [Second Supervisor] (Senior Lecturer Researcher, Salomons, Canterbury Christ Church University)

Major Research Project (MRP)
Salomons, Canterbury Christ Church University

Semi-structured Interview Schedule

“Cognitive Remediation Therapy in an Anorexia Nervosa Inpatient setting.”

1. What, in your experience, are the ingredients of the more successful treatments for Anorexia Nervosa?

Prompt: what works for whom, and how?

2. What does CRT bring that is not present in other treatments?

Prompt: What do you see as the active ingredients of the CRT intervention? (e.g. engagement? motivation?)

3. What do you see as the advantages and disadvantages of CRT in individual format?

What do you see as the advantages and disadvantages of CRT in group format?

4. Which format of CRT (individual or group) do you believe would be best suited in a randomised-controlled trial, to compare to other treatments for Anorexia Nervosa?

What intervention would you compare CRT to and why?

5. What do you think of the CRT “dosage” during treatment?

(By dosage we mean patients receiving either no CRT, either individual CRT or group CRT alone, or both individual and group CRT.)

6. Are there any patients for whom CRT is contraindicated or any phases of illness in which it is best not offered?

7. Finally, are there any further points or comments you wish to make?

Thank you for your time.

Appendix J - Ethics documents

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Appendix K - Thematic analysis codes

Below are the final codes used in NVivo to generate the subthemes and three main themes. Codes are presented for each theme and subthemes in descending order, over two columns.

Theme: “Anorexia and its treatment”**“How Anorexia patients present - factors affecting engagement in psychological work”**

resistance and motivation to change	difficulty managing emotions in anorexia
cognitive inefficiencies and rigidity	anorexia patients like a challenge
perfectionism in anorexia	clients wary of deep talk
difficult to treat anorexia	impact of low weight on thinking
social difficulties in anorexia	deep psychological work not possible with low weight
competitive nature and its impact	

“Treating Anorexia - how the therapeutic process can begin”

building a strong therapeutic relationship	tailoring interventions to each patient
increasing motivation to change	low key interventions at the beginning of treatment
working on personal goals	finding a way in with anorexia patients
building trust is important	learning from others in a group
respecting and maintaining boundaries	consistency is important
working on self-esteem	developing insight is an aim
understanding the anorexia's origin	meaningful discussion is important in treatment
identity work is important in anorexia	no clear national guidelines on what works for anorexia
collaboration in anorexia work	improvement of nutrition is important
use of behavioural experiments	

Theme: “CRT - its characteristics and delivery”**“CRT - A safe and gentle therapy”**

CRT is not disorder related	CRT is different to other therapies
CRT is not threatening	laughter in CRT sessions
CRT is safe	CRT is light
CRT is fun	CRT is collaborative
CRT is gentle	CRT is structured
play in CRT gets patients engaged	CRT does not demand personal exposure
CRT is containing	waiting for the client to bring up more personal things

“CRT as an introduction to therapy, reflection and experimentation”

CRT as a springboard for future work	CRT targets maintenance processes
introduction to therapy and reflection through CRT	repetition is useful in consolidating skills
tasks as a tool for exploration and eliciting reflections	experiential work is important
learning about the self through CRT	thinking about thinking through CRT
working with what the patient can manage	CRT facilitates communication
flexible thinking and considering alternatives	

“CRT and its delivery formats - a tailored intervention versus a group experience”**- individual CRT - flexibility within a manualised intervention**

tailoring the work in individual sessions	working from the CRT manual is restrictive
working from the manual is an advantage	therapist variations in delivering CRT
creativity with the use of the CRT tasks	bringing in other models into CRT
modelling flexibility in CRT sessions	may be safer to open up in an individual setting

- group CRT processes

learning from others in the group
 managing group dynamics and processes is important
 sharing the work with others in the group
 comparison to others in the group
 normalising within the group

support from the group
 experiencing social activities in the group
 group work can boost self-esteem
 less individual tailoring in the group
 group can improve social difficulties

“The therapist’s confidence and role in promoting CRT”

scepticism about CRT
 therapist confidence in delivering CRT
 understanding the rationale of CRT
 introducing CRT to others as fun and a distraction

delivering CRT is enjoyable
 confidence to ask difficult questions
 helpful for therapist's own thinking
 small number of sessions is a selling point

Theme: “CRT and its effectiveness”**“CRT - an early intervention at the start of inpatient treatment”**

CRT can be offered to anyone
 no contraindications or detrimental effects
 beneficial for chronic and severely ill patients
 early and low key intervention even at a low weight
 the timing of CRT in an admission – early/beginning

“How much CRT? Questions around meeting individuals’ needs and how to combine the delivery formats”

the formats work in combination
 format depends on the individual
 different outcomes from different formats
 resources in delivering therapy
 issue of repetition with the formats
 extend or reduce CRT?
 issue of the order of format delivery
 the formats back each other up

some patients need more than others
 having both individual and group helps to consolidate
 “dosage” depends on the individual
 need more CRT when “comorbid” difficulties
 tailor the session length to the individual
 group can be a starting point
 ideal would be both individual and group CRT

“Gaining insights, learning and celebrating small successes”

small changes are possible
 acknowledging strengths in CRT
 insight and learning gained in CRT
 working within the limits
 taking things further after CRT
 successes in CRT
 CRT can increase self-esteem

more depth in individual CRT compared to the group
 quality of the changes in CRT – first steps
 outpatients have more support for real life testing
 more change in individual CRT
 some patients need individual to open up about their thinking
 some patients find groups difficult

“Research and testing - how to capture CRT’s contribution to treatment”

what treatment to compare CRT to
 practicalities of research
 most representative or purer format of CRT
 CRT as pre-therapy
 expectations of CRT research
 questions over long term effects
 variations in treatment delivery

treatment needs to be standardised for research
 clarifying what CRT does
 individual CRT more controlled for research
 the group is complex to test due to group dynamics
 do individual before group testing in RCT
 control group needs to be structured and manualised

Appendix L - Interview transcript example - annotated

This has been removed from the electronic copy.

Appendix M - Thematic map



Figure M1: Thematic map of the themes and subthemes from the thematic analysis.

Appendix N - Research diary and bracketing interview

This has been removed from the electronic copy.

Appendix O - Definitions and calculations of effect sizes and statistical power

Information from: Clark-Carter, D. (2010). *Quantitative Psychological Research. The complete student's companion*. 3rd Edition. Psychology Press: East Sussex, UK

Effect Size

An effect size gives a measure of the magnitude of a result which is independent of the sample size. The formula used to calculate Cohen's d from the difference between two means is $d = \frac{\mu_2 - \mu_1}{\sigma}$ where μ_1 and μ_2 are the means and σ is the standard deviation.

Power

Statistical power is defined as the probability of avoiding a Type II error which is rejecting the research hypothesis when it is actually correct.

The probability of making a Type II error is represented by β . The power of a test is calculated by the formula $1 - \beta$; to avoid a Type II error, the level of power aimed for is as close to 1 as possible. A reasonable minimum level of power is considered to be 0.8.

Clark-Carter (2010) provides power tables to identify the appropriate sample size to reach a power of 0.8, depending on effect size. In the case of a between-subjects t -test, for a medium effect size of $d = 0.5$, with a one-tailed test and a significance level of 0.5, a minimum of 50 participants would be required to achieve a power of 0.8.

Appendix P - Summaries and letters for the Ethics panels

- Letter to the Salomons Ethics Panel and the two R&D Departments of NHS Trusts (identifiable information removed)
- Copy of the report to be sent with the letter (identifiable information removed); also enclosed is the Thematic Map (from Appendix M), for illustrative purposes.

[Logo]

[Trainee name]
Salomons Centre of Applied Psychology
Canterbury Christ Church University
Salomons Campus
Broomhill Road, Tunbridge Wells
Kent, TN3 0TG

[Address]
[Address]
[Address]
[Address]
[Address]

[DATE]

[To Salomons Ethics/R&D Department]

re: Study entitled “Cognitive Remediation Therapy in Anorexia Nervosa: Neuropsychological and self-report outcomes and therapist perspectives.”

Following completion of the above study, please find enclosed a copy of the study report and the Thematic Map of the results of the therapist interviews, for illustrative purposes. Also enclosed [NB: only in the case of an R&D Department] is a completed NHS end of study form, for your records.

Yours sincerely,

[Signature]

[Trainee name]

Report for Salomons Ethics Panel and R&D Departments of NHS Trusts

Title of the study: “Cognitive Remediation Therapy in Anorexia Nervosa: Neuropsychological and self-report outcomes and therapist perspectives.”

Study aims

This study on Cognitive Remediation Therapy (CRT) for Anorexia Nervosa (AN) aimed to explore patient data and therapist experiences to inform future clinical trials. Patient data had previously been collected (separate ethical approval) but had not yet been analysed. Ethical approval was sought to carry out semi-structured interviews of CRT therapists. In total, 11 therapists were recruited from both this site and one additional R&D site.

Results

Completed data were available for both individual (n = 56) and group (n = 43) CRT; clinical audit data from the service were also available. Individual CRT was associated with a statistically significant improvement in performance-based cognitive flexibility and group CRT was associated with a statistically significant improvement in self-reported cognitive flexibility. Unfortunately, exploratory analyses to compare self-report and clinical outcomes between different formats of CRT were not possible due to small and unequal sample sizes.

Three main themes were identified from the interviews via Thematic Analysis: “Anorexia and its treatment”, “CRT - its characteristics and delivery” and “CRT and its effectiveness” (see Thematic Map, enclosed). Therapists considered CRT’s place within the wider treatment context, namely as a springboard for future work in enabling patients to engage in early psychological work. This study also provides additional insights into how the two formats of CRT not only work in combination, but also in terms of perceived different processes of change and outcomes. The therapists were also very open about the challenges they face in delivering CRT, promoting engagement with it and managing complex group dynamics. Therapists felt that CRT’s adaptability to different presentations, complexity and need would mean it can be offered at the beginning of inpatient treatment, which is not always possible with other therapies. One question that remains unanswered is what the optimal amount would be and what intervention would be an appropriate comparison in a trial. What appears clear is that the positive emotional atmosphere and encouragement to have fun is appreciated and was seen by some as a key ingredient.

Conclusion

Results from this study replicate most of the previous CRT findings with larger samples and both individual and group CRT appear to be acceptable and feasible interventions for use in future trials. The therapist interviews provide insights into CRT delivery and the adaptations that are made according to individual need and complexity. CRT trials should aim to evaluate it whilst striving to

maintain its playful, creative and flexible nature which may be CRT's key ingredient in facilitating change.

Dissemination

Two manuscripts will be submitted for publication in peer-reviewed journals: one brief report paper on the CRT patient data (submission to *Neuropsychological Rehabilitation: An International Journal*) and one paper on therapists' experiences of CRT (submission to *The Journal of Health Psychology*). A book chapter on therapists' experiences of CRT is due for publication in November 2014 and the interview part of the project was also presented at an annual CRT for Anorexia Two Day Workshop in December 2013 (Institute of Psychiatry).

Appendix Q - Instructions for authors for article submissions

Instructions for authors for *Neuropsychological Rehabilitation: An International Journal*

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Last updated 11/03/2014

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