



Cognitive emotion regulation strategies, alexithymia and dissociation in schizophrenia, a review and meta-analysis



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HIGHLIGHTS

- Individuals with schizophrenia display more maladaptive use of CERS.
- Dissociation and alexithymia may influence CERS in schizophrenia.
- Conceptual ambiguity/overlap may exist between dissociation, alexithymia and CERS.
- There was poor methodological rigour displayed in the research literature.

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ABSTRACT

Aims: Many individuals with schizophrenia are reported to have maladaptive expression and processing of emotion. This may take the form of conscious and implicit processes. Potential regulatory processes underlying schizophrenia are reviewed. We aimed to estimate effect sizes, potential heterogeneity and publication bias across three areas of measurement: a range of cognitive emotion regulation strategies¹ (CERS), alexithymia and dissociation.

Method: Data were pooled from 47 case-control studies involving measures of experiential avoidance, attentional deployment, cognitive reappraisal, emotion management, dissociation and alexithymia. All studies were rated for quality, risk of bias and publication bias.

Results: The following effect sizes (*g*) were observed: emotion management: 0.96 [0.77, 1.14] and cognitive reappraisal: 0.49 [0.32, 0.66] were negatively associated with schizophrenia. Experiential avoidance: -0.44 [-0.59, -0.29], attentional deployment -0.96 [-1.18, -0.75], dissociation: -0.86 [-1.13, -0.60] and alexithymia: -1.05 [-1.45, -0.65] were positively associated with schizophrenia. Subgroups of dissociation and attentional deployment were also analysed. Meta-analyses revealed potential publication bias and heterogeneity in the study of CERS in schizophrenia.

Conclusions: A marked difference in the implementation of CERS is associated with schizophrenia compared to controls. Dissociation variables and alexithymia are also indicated and may be implicated in adaptive cognitive emotional regulation. Theoretical and research implications are discussed.

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¹ Cognitive Emotion Regulation Strategies is abbreviated as CERS throughout the paper.

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1. Introduction

Emotion regulation in schizophrenia may begin to shed new insights into the disorder (Kelleher & Cannon, 2014; Strauss et al., 2013) where mood instability may form a prominent feature of schizophrenia (Marwaha, Broome, Bebbington, Kuipers, & Freeman, 2014). Indeed, the DSM-5 (American Psychiatric Association, 2013) points out the lack of evidence separating schizoaffective disorder as a distinct nosological category separate from schizophrenia (Malhi, Green, Fagiolini, Peselow, & Kumari, 2008; Owen, Craddock, & Jablensky, 2007; Peralta & Cuesta, 2008). This is clinically relevant given that the severity of affective disturbance/mood pathology may inform prognosis and treatment (Barch et al., 2013).

There has also been a call to identify cognitive processes underlying psychological difficulties, in order to develop process-specific interventions rather than disorder specific ones (Emmelkamp et al., 2014). This appears particularly relevant to schizophrenia given the variance in symptom clusters and response to treatments between individuals (Van Os, 2009). We investigate the evidence for an underlying role of emotional regulation in schizophrenia and posit that alexithymia and dissociation need to be considered as potential influence on affective processes, which may inform future developments in psychological treatment.

1.1. Emotion regulation

Emotion regulation has been defined as a set of processes responsible for maintaining optimal homeostatic arousal in order to facilitate goal orientated functioning (Gross, 2001; Schore, 2003; Thompson, 1994). Several theories of emotion have identified core features of emotion generation and regulation (Arnold, 1960; Buck, 1980; Cicchetti, Ackerman, & Izard, 2009; Frijda, 1986; Lazarus, 1991; Levenson, 1994; Plutchik, 1980). The 'process model' (Gross, 1998) unifies the core

processes with a focus on cognitive emotion regulation. This temporal model consists of contextual antecedents (situation selection and situation modification), attention, appraisal, and response modulation. Contextual antecedents can be triggered by external or internal stimuli that need to be attended to in order for an emotional response to occur. Subsequent appraisal of the situation involves assessing the stimuli against prevailing factors (e.g. goals, social, cultural and familial influences, personality etc.) and current motivations. This elicits a response tendency with varying degrees of interaction between subjective experience, physiology and behaviour (Mauss, Levenson, McCarter, Wilhelm, & Gross, 2005).

Gross suggested five strategies relating to emotion regulation (CERS) that can be grouped into antecedent focused (situation selection, situation modification, attentional deployment, cognitive change) and response focused (response modulation) strategies. These strategies have adaptive and maladaptive qualities which need to be evaluated in relation to the context (Aldao, 2013). Studies of the use of these strategies by individuals with schizophrenia have used both global and individual measures of emotion management which enabled an integrated examination of regulatory strategies in relation to context.

Other models of emotion regulation emphasise the importance of implicit (automatic) emotion regulation (Gyurak, Gross, & Etkin, 2011). Implicit processing may relate to unconscious learning or memory related processing (Panksepp, 2003) and can be conceptualised as a secondary level of emotion regulation, possibly the result of effective practice and mastery (Mauss, Cook, Cheng, & Gross, 2007). In schizophrenia, implicit emotion processing mechanisms may be particularly relevant due to the disjuncture between individuals' subjective appraisal or awareness and their experience. We suggest that two further constructs: dissociation and alexithymia may be of relevance to emotion regulation in this context and may influence emotional regulation. We now describe CERS, dissociation and alexithymia in more detail.

1.2. Cognitive emotion regulation strategies

CERS (see Gross, 2006; Kring & Sloan, 2010 for an in-depth view) are mostly categorised in terms of maladaptivity and are as follows:

Contextual antecedents (situation selection/modification) involve selecting to enter or avoid an evocative situation thereby modifying the likelihood of an emotion.

Attentional deployment (rumination, worry, mindfulness) comes after situation modification in the emotion trajectory and tends to be activated when it is not possible to change or modify the situation. Individuals focus on aspects of situations in order to influence their emotions. Mindfulness has been postulated as an alternative adaptive learned strategy (Chambers, Gullone, & Allen, 2009) in which the individual engages in an awareness of affect and cognitive processes without engagement. It has been posited as self-regulation of attention (Bishop et al., 2006).

Cognitive change (reappraisal) involves changing how we appraise the external or internal situation or our capacity to manage the demands it poses, altering its emotion significance and emotion impact (Gross & Thompson, 1997).

Response modulation (experiential avoidance: suppression, distraction, or acceptance), occurs late in the process, the aim is to influence experiential, behavioural, or physiological reactions once they have been elicited. There are various strategies: expressive suppression (efforts to inhibit on-going emotion-expressive behaviour) (Gross, 1998), and experiential avoidance (efforts to inhibit the emotion experience itself). Distraction is a cognitive avoidance of distressing or unwanted events or experience.

More recently acceptance has been viewed as an adaptive response (Hayes, Luoma, Bond, Masuda, & Lillis, 2006). This is a metacognitive process utilising mindfulness to develop a distancing awareness of internal processes combined with an acceptance of the experience (Chadwick, Hughes, Russell, Russell, & Dagnan, 2009).

Adaptive emotion regulation involves choosing and implementing regulation strategies that are appropriate for the context, appropriate for how controllable the internal and external events are, and are in accordance with one's long-term goals (Berenbaum, Raghavan, Le, Vernon, & Gomez, 2003; Gross & John, 2003; Mennin & Farach, 2007). Such regulation often involves the following four steps: (1) pausing, (2) noticing, (3) deciding how controllable the emotion and situation are, and (4) acting in line with long-term goals (Kring & Sloan, 2010).

1.3. Emotion regulation in schizophrenia

Current neurobiological and psychosocial models conceptualise schizophrenia as a complex multidimensional disorder. The heterogeneity of schizophrenia is well established, with high rates of co-morbidity (Buckley, Miller, Lehrer, & Castle, 2009). This will inevitably result in variations in presentation and symptomatology. However it is likely that a wide range of emotional regulation difficulties are implicated.

Among negative symptoms, diminished emotion expression (previously referred to as affective flattening; DSM-IV) is considered core, suggesting individuals with schizophrenia experience less expansive and less intense emotions. Diminished emotional expression may also overlap with features of alexithymia. Individuals with schizophrenia may also display impaired emotion perception (Kring & Elis, 2013). In contrast they have also been found to experience higher levels of negative emotion than controls (Cohen & Minor, 2010) – this may relate more closely to hallucinations and delusions. It has been suggested that diminished emotion expression in schizophrenia may reflect overuse of suppression as a strategy (Ellgring, Smith, Flack, & Laird, 1998; Henry et al., 2007). Suppression may reduce the ability to identify emotion which may lead to maladaptive reappraisal of emotion (Van der Meer, van't Wout, & Aleman, 2009). However Henry, Rendell, Green, McDonald, and O'Donnell (2008) found no association between use of suppression and clinical ratings of diminished emotion expression.

Different cognitive theories of schizophrenia attempt to integrate emotion regulation within their models. Emotion dysregulation has

been related to cognitive biases (Garety & Freeman, 1999), deficits in Theory of Mind and emotion processing affecting social cognition (Green, Olivier, Crawley, Penn, & Silverstein, 2005). Attentional deployment strategies, experiential avoidance and cognitive reappraisal are clearly indicated in cognitive models, in the onset, maintenance and distress associated with positive symptoms (Bentall & Swarbrick, 2003; Birchwood, 2003; Freeman, Garety, Kuipers, Fowler, & Bebbington, 2002; Morrison, 2001; Morrison & Wells, 2007). Freeman and Garety (2003) conceptualised positive symptoms as arising directly through the influence of emotion on triggers, maintenance and distress. Subsequent appraisals are involved in maintaining the hallucinatory experience (Morrison, Haddock, & Tarrier, 1995) with interpretations of experiences associated with emotion responses (Goldstone, Farhall, & Ong, 2011; Morrison, Nothard, Bowe, & Wells, 2004; Morrison et al., 2012; Udachina et al., 2009). Wells and Matthews (1996) suggest a model, whereby metacognitive beliefs determine CERS used in relation to psychotic experiences. Attentional deployment strategies may activate metacognitive beliefs to the detriment of employing helpful cognitive reappraisal, thereby maintaining distress. The role of meta-cognitive beliefs, however, is only weakly associated with hallucination-proneness (Varese, Barkus, & Bentall, 2011). It has also been postulated that psychotic experiences evoke metacognitive beliefs (Goldstone, Farhall, Thomas, & Ong, 2013) relating more to maintenance than onset.

There have been calls for a greater focus on emotional distress rather than the reduction of positive symptoms with cognitive psychological treatments (Birchwood et al., 2007). While there are some cognitive treatments emphasising emotion regulation (Chadwick, 2006) it is still early in understanding the use of such strategies (Khoury & Lecomte, 2012).

There is now a large body of evidence for deficits across cognitive domains in schizophrenia (Schaefer, Giangrande, Weinberger, & Dickinson, 2013) especially processing speed, which is associated with maladaptive cognitive appraisal (Lysaker, Campbell, & Johannesen, 2005). The quality of cognitive appraisals may also be impeded by working memory deficits (Chambers et al., 2009; Garety et al., 2013). Deficits in executive functions have been reported in neuropsychological and imaging studies (Kerns, Nuechterlein, Braver, & Barch, 2008). A deficit in inhibitory systems has been implicated in emotion dysregulation in schizophrenia (Cohen & Minor, 2010). An altered neurodevelopmental trajectory in schizophrenia may impact on the processing of emotions and hence emotional regulation. Given the central role of metacognition, selective attention, working memory and inhibitory control, this suggests that individuals with schizophrenia may have maladaptive use of CERS.

1.4. Alexithymia

Alexithymia may play an important role in emotion regulation. Difficulties in identifying and describing one's own emotion state (Alexithymia: Sifneos, 1972), are suggested to be associated with maladaptive emotion processing, and have also been linked with poorer ability to mentalise (Moriguchi et al., 2006). High levels of alexithymia have been associated with impoverished emotion awareness which may be compromised by cognitive demands (Henry, Bailey, von Hippel, Rendell, & Lane, 2010; Herbert, Herbert, & Pollatos, 2011). Indeed, emotion awareness and specification may be a requirement for adaptive emotion regulation (Philippot, Baeyens, & Douilliez, 2006; van Rijn et al., 2011).

Where regarded as a learned behaviour (Darrow & Follette, 2014) it may reflect experiential avoidance of subjectively threatening emotions and also expressive suppression (Luminet, Rimé, Bagby, & Taylor, 2004). Given the prevalence of trauma histories and/or invalidating or understimulating environments this may possibly reflect an adaptive behavioural response for individuals with schizophrenia. Conceptualised in this form alexithymia may overlap with core negative symptoms.

Alexithymia measures have broken the construct down into subtypes (see outline of TAS and BVAQ below) with a suggestion of up to five separate alexithymia types (Moormann et al., 2008). Rather paradoxically, accurate completion of a self-report measure of alexithymia

necessitates, to some degree at least, the accurate identification and appraisal of emotions. As such these measures may be measuring an awareness of difficulties rather than actual ability (Müller, Bühner, & Ellgring, 2004).

Given the lack of clarity underlying the concept of alexithymia, its formal measurement appears to assess multiple processes. Therefore conclusive links to the process model are tentative at this stage.

1.5. Dissociation

This term is also used to describe a range of concepts within different theories (for a detailed overview see Braude, 2009; Van der Hart & Dorahy, 2009). Conceptualised along a continuum, it can be viewed as an adaptive coping strategy at milder levels (e.g. daydreaming) to being similar to a form of experiential avoidance.

At pathological levels, dissociative disorders are viewed as a disruption in the integration of “consciousness, memory, identity, emotion, perception, body representation, motor control, and behaviour” (American Psychiatric Association, 2013). As a psychological defense against overwhelming emotion or adverse experiences, this may be an adaptive early developmental response to on-going adverse experiences (Van Ijzendoorn & Schuengel, 1996) or, within the context of PTSD, a learned response to avoid integrating negative experiences in order to reduce emotional and physical pain (Brewin, Dalgleish, & Joseph, 1996; Briere, 2006). This suggests maintenance of ongoing avoidance of having or expressing particular feelings (experiential avoidance).

Three components of dissociation are often mooted and form the basis for measurement.

1. Absorption reflects a high level of focus on inner cognitive processes; self-focused attention (Vogel, Spitzer, Barnow, Freyberger, & Grabe, 2006) therefore reflecting an attentional deployment strategy. Absorption and depersonalisation may also contribute to the predisposition for hallucinations (Glicksohn & Barrett, 2003; Morrison & Petersen, 2003; Perona-Garcelan et al., 2008).
2. Dissociative amnesia is an inability to recall important autobiographical information, usually of a traumatic or stressful nature (American Psychiatric Association, 2013). It has been postulated as a deficit in memory retrieval, and also as an encoding deficit (Allen, Console, & Lewis, 1999) possibly mediated by inattention, absorption or anxiety.
3. Depersonalisation/derealisation relates to several symptom clusters: anomalous body experiences; emotional/physical numbing and temporal distortions with anomalous subjective recall (American Psychiatric Association, 2013). Dual mechanisms of emotional processing inhibition and self-focused attention have been postulated as underlying associated symptoms (Hunter, Phillips, Chalder, Sierra, & David, 2003; Sierra & Berrios, 2000).

Dissociation may be functional, providing a source of resilience against, a risk factor for, or a response to schizophrenia, mediating or maintaining symptoms (Morrison, Frame, & Larkin, 2003; Sar et al., 2010). Voice hearing in trauma disorders has been conceptualised as dissociative rather than psychotic (Brewin & Patel, 2010). Specifically, depersonalisation may predict voice hearing in psychosis (Kilcommons & Morrison, 2005; Perona-Garcelan et al., 2012). In their review, Longden, Madill, and Waterman, (2012) proposed an association between dissociation and voice hearing in psychosis in conjunction with cognitive and affective components of the experience.

The meta-analysis aims to clarify which aspects of emotional regulation differ between individuals with schizophrenia and healthy controls. Dissociation and alexithymia play a role in the individual's experience of affect and may influence the use of CERS. The degree to which these phenomena occur is not fully understood and are also investigated.

2. Method

2.1. Search method for inclusion of studies

Published and unpublished studies were considered, restricted to those written in English. No date restrictions were applied.

Search terms were compiled into three concepts (Appendix A). Searches were conducted using the following databases (concepts 2 and 3): Ovid MEDLINE, Ovid PsycINFO and Ovid Embase (all years to 01 May 2014). A broader search was completed on the following databases (concepts 1 and 2): The Cochrane Central Register of Controlled Trials (CENTRAL) and Google Scholar (all years to 01 May 2014).

References from related meta-analyses and from articles retrieved during the search were examined for additional studies.

2.2. Selection of studies

The first author screened titles and abstracts to determine which were eligible for inclusion. We were not blind to study authors, institutions, journal of publication or results. Any questions regarding eligibility were resolved by seeking additional information and through discussion with the other authors. Fig. 1. outlines a flow diagram of the systematic review.

Inclusion/exclusion criteria for the study:

- In terms of populations, we included studies recruiting adults, as well as from various demographic groups as long as the majority of the patients had a diagnosis of schizophrenia, schizoaffective or non-affective functional psychosis, clinically or according to diagnostic criteria.
- We excluded treatment studies without a healthy control group that would allow us to draw comparisons with the schizophrenia group. Studies with previously collected normative samples were excluded. Datasets referred to in several published reports were included once based on the fullest description given.

Flow Diagram

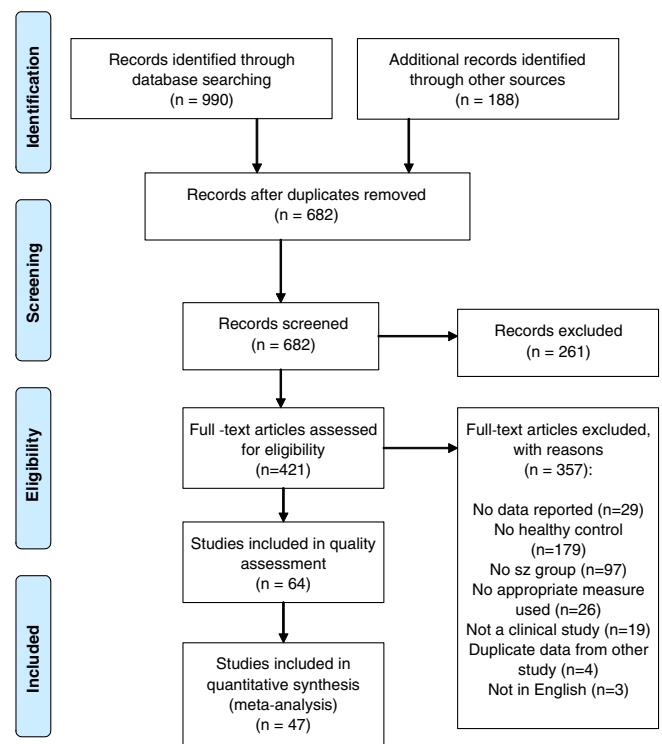


Fig. 1. Flow diagram of systematic review.

- We included a study if it reported base-line cross-sectional analysis on a measure of an emotion regulation strategy regardless of a study's specific aims.
- While grey literature was included in the literature search (dissertations, conference presentations and book chapters) to reduce publication bias these were omitted if the full study was not available.
- Miettunen and Raevuori (2012) and Ohi et al. (2012) conducted meta-analyses of the Temperament and Character Inventory (TCI) in relation to schizophrenia. Studies solely using the TCI were excluded from the meta-analysis.

2.3. Quality appraisal

Data regarding methodology was extracted independent of authorship and rated for quality independently by two review authors. Each study was assessed for quality against a checklist based on the Newcastle Ottawa Quality Assessment Scale (NOS) (Wells et al., 2011). Any disagreements were resolved by a third reviewer. There is, as yet, no internationally established quality assessment tool for case control studies, the NOS has not been validated (Stang, 2010). Thus, the tool we used aimed to help identify potential methodological weaknesses rather than provide a definitive quality score for each study.

The areas appraised were rated as good, fair or poor (Appendix B) with a graph summarising quality in Fig. 2.

The quality appraisal examined case definition, appropriateness of sample, selection of controls, definition of controls and how well the cases and controls were matched (Appendix C). Where data on matching was not clear, indices were calculated using chi-sq. and t-tests as appropriate to verify significant differences. Papers rated as poor on three or more criteria were removed from the table. After quality rating five papers were excluded from the meta-analysis.

2.4. Data extraction

Data regarding outcome measures was extracted into Review Manager 5.2 (RevMan, 2012) for analysis. We gave preference to data that involved the least manipulation, extracting raw values at endpoint (e.g. means, standard deviations) rather than calculated effect sizes (e.g. Cohen's *d*).

Where required data had not been published (17 studies), authors were contacted for additional data (i.e. missing data, subscale data and raw data where there were multiple eligible intervention groups) for analysis. As such data presented in this meta-analysis may differ from that published in the original papers. Seven authors did not respond, 3 studies were removed as the authors no longer had data or had incomplete data, 1 study was removed as data in the paper was calculated incorrectly and original data was no longer available.

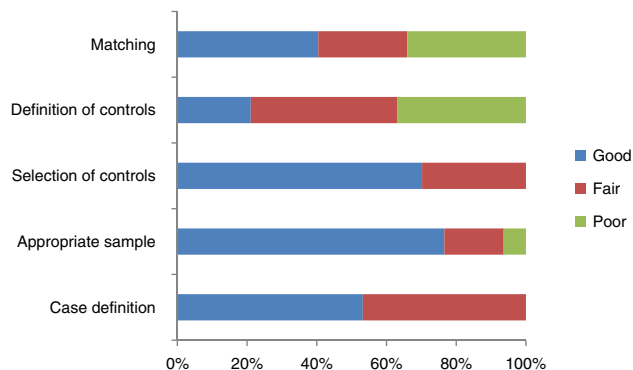


Fig. 2. Quality appraisal: review authors' rating of each quality item presented as percentages across all included studies.

2.5. Data synthesis

Standardised mean differences (SMD; Hedges' (adjusted) *g*) and 95% CIs were calculated for continuous measures and were combined by using inverse variance methods. Since all of the papers selected for meta-analysis involve group contrasts, Hedges' (adjusted) *g* appeared to be the most appropriate formula for the current meta-analysis as it is based on the standardised difference between two means. With small samples, Hedges' *g* provides a superior estimate of the standardised mean difference (to Cohen's *D*), but the superior performance fades as the sample size increases. Standardised mean difference for continuous outcomes also supports the analysis of studies varying in their measurement of outcomes. The method assumes that the differences in standard deviations among studies reflect differences in measurement scales and not real differences in variability among study populations (Higgins, 2008).

SMD method does not correct for differences in the direction of the scale as such, where appropriate mean values from one set of studies were multiplied by -1 to ensure that all the scales point in the same direction.

Random-effects models were used because studies included different measures and populations, as such interpreting the summary result as an estimate of the average effect rather than the common effect. Random effects models are generally considered to be more appropriate than fixed effects models when analysing behavioural, social and health science data (Field & Gillett, 2010).

The specific measures included in each analysis for each study are listed in Appendix B.

For all analyses, the area to the left of the 'line of no effect' indicates greater use of the strategy for the schizophrenia groups (favours schizophrenia).

2.6. Subgroup analysis

Within the primary analysis of emotion regulation strategies we also looked at defined subgroups of rumination and worry within attentional deployment and absorption, amnesia and derealisation/depersonalisation within dissociation. It was not possible to conduct subgroup analysis for any of the other constructs due to the absence of sufficient data.

2.7. Assessment of heterogeneity

Heterogeneity between studies was assessed using a chi-squared test of the null hypothesis (that all studies are evaluating the same effect) together with the I^2 statistic which describes the percentage of observed variance which is accounted for by true heterogeneity rather than sampling error (Higgins, Thompson, Deeks, & Altman, 2003).

A *p* value of 0.1 or less indicates significant heterogeneity when considering Chi^2 . We assigned adjectives of low, moderate, and high to I^2 values which were considered as low at 25%, moderate at 50% and high at 75%.

Sources of heterogeneity which may affect the meta-analysis included: study designs, different statistical methods/models used, sources of bias and study quality. The heterogeneity of the diagnosis of schizophrenia was also considered to affect the studies.

Where present, heterogeneity will be discussed qualitatively as moderator analysis was not possible within the remit of the data available.

2.8. Assessment of risk of bias in included studies

Two raters coded each included study using a classification scheme (see Appendix D) based on Cochrane Collaboration's tool for assessing risk of bias (Higgins et al., 2011). We judged whether each study was at low, high or unclear risk of bias in relation to selection bias, confounders and measurement bias. Disagreements were resolved through discussion and by seeking further information.

Potential risk of bias on other factors was deemed low as the data being reviewed reflected baseline data as opposed to outcome data. Also, the measures being used for many of the studies were not their primary outcome measure. It should be noted that none of the studies were blind.

Seventeen studies met all three methodological criteria at a low level of risk of bias. Twelve studies met two of the criteria at a low level and one where risk was considered unknown or high and were categorised as studies with moderate risk of bias. The final 18 studies met one or no risk of bias criteria at a low level and were considered high risk of bias. The ratings for each study are included in the characteristics table (Appendix B) with a graph representing risk of bias in Fig. 3.

2.9. Sensitivity analysis

We conducted the following sensitivity analyses to determine whether findings were robust to methodological decisions made throughout the review process.

1. Poor studies were omitted from the analysis.
2. To control for the influence of bias, we assessed and excluded studies at high risk of bias.
3. We assessed the impact of each study on the combined effect and reported where one study had a large influence on heterogeneity.

2.10. Publication bias

Publication bias (significant findings are more likely to be published) is a potential bias in meta-analysis (Field & Gillett, 2010; Rosenthal, 1995). The literature search aimed to find both published and grey literature; however only published studies met the criteria for inclusion. The measures assessed were not necessarily the primary outcome measures for the studies also reducing potential for publication bias. Studies of similar sample size make assessment for bias more difficult to assess. The studies were estimated for publication bias by funnel plot asymmetry, trim and fill (Duval & Tweedie, 2000) and Egger's regression test (Egger, Smith, Schneider, & Minder, 1997) to support inferences drawn from visual inspection of the funnel plot (Fig. 4). The funnel plot and statistics were calculated using comprehensive meta-analysis (Borenstein, Hedges, Higgins, & Rothstein, 2005). Where multiple effect sizes were used from individual studies, these were combined and effect sizes averaged. Direction of effect was corrected so they all went the same way. Publication bias for studies was statistically investigated across all studies due to weak power for statistical investigation on fewer than 10 studies.

In the aggregate analysis Egger's regression intercept was significant ($p = 0.006$, 1-tailed) however the application of the trim and fill method identified no missing studies within the random effects model. Visual inspection also displays asymmetry.

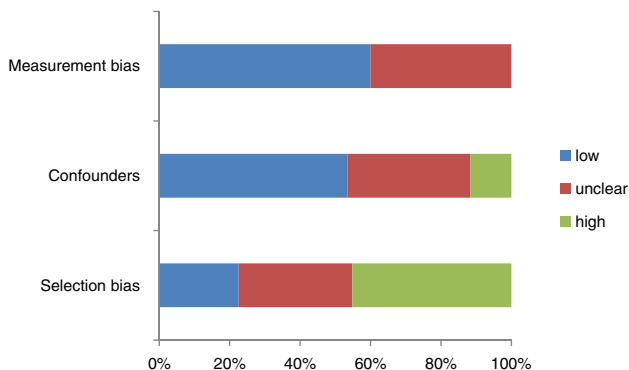


Fig. 3. Risk of bias graph: review authors' ratings of each risk of bias item presented as percentages across all included studies.

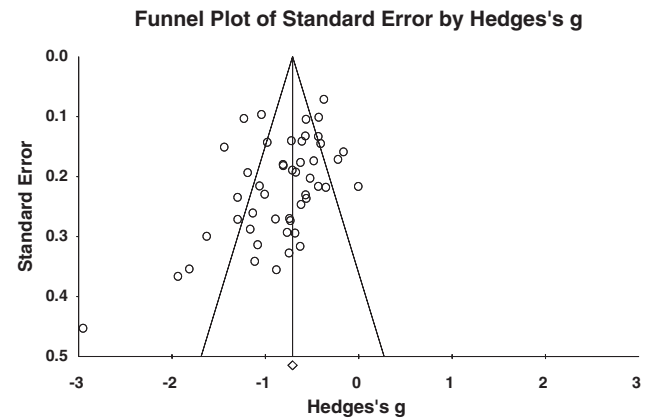


Fig. 4. Funnel plot of standard error by Hedge's g in meta-analysis.

Considering the factors above protecting against publication bias, the occurrence of asymmetry may be attributed to the studies being mostly of similar size or between study heterogeneity rather than publication bias. However bias cannot be discounted and 'small study effects' may be present. While the statistical findings suggest some publication bias they did not suggest that it has significant influence on estimated effect sizes. In line with heterogeneity findings this supports the use of confidence intervals over mean effects as the main method of analysis.

2.11. Psychometric properties of measures used in the meta-analysis

While a large range of measures were identified in the literature search (Appendix A) the following were used in the studies investigated. As many of the emotion regulation strategies are measured by self-report measures, the construct validity and reliability of each measure is reported.

Bermond-Vorst Alexithymia Scale (BVAQ; Vorst & Bermond, 2001) has five subscales (1) 'emotionizing', (2) 'fantasizing', (3) 'identifying' emotions, (4) 'verbalizing' emotions, and (5) 'analysing' emotions. Vorst and Bermond (2001) reported internal consistency (Cronbach's alpha) ranging from 0.67 to 0.87. Morera, Culhane, Watson, and Skewes, (2005) found significant inter-subscale correlations among the TAS-20 subscales and among the BVAQ-40. Müller et al. (2004) reported that the measure total scores were also correlated considerably ($r = 0.62$).

The *Cognitive Emotion Regulation Questionnaire* (CERQ; Garnefski & Kraaij, 2007) has nine conceptually separate emotion regulation strategy subscales; self-blame, other blame, rumination, catastrophizing, putting into perspective, positive refocusing, positive reappraisal, acceptance, and planning. However these don't all relate to the emotion regulation strategies as quantified in this study. Positive reappraisal and rumination subscales were chosen, catastrophizing which could measure worry was not included due to poor internal reliability. Internal reliability for positive reappraisal and rumination has been reported as 0.87 and 0.74, respectively (Jermann, Van der Linden, d'Acremont, & Zermatten, 2006).

Coping Inventory for Stressful Situations (CISS; Endler & Parker, 1990) has three subscales, task-oriented, emotion-oriented, and avoidance-oriented coping. Good psychometric properties were identified in several validation samples (Endler & Parker, 1997). Construct validity was documented by appropriate correlations with the Ways of Coping Questionnaire (Folkman & Lazarus, 1988) and various personality traits. A moderate correlation exists between emotion-oriented and avoidance-orientated coping. Avoidance-coping also comprised of distraction and social diversion (which could include seeking emotion support). As such only the task-orientated factor was used within cognitive reappraisal analysis.

Dissociative Experiences Scale (DES; Bernstein & Putnam, 1986). A meta-analysis (Van Ijzendoorn & Schuengel, 1996) reported the internal

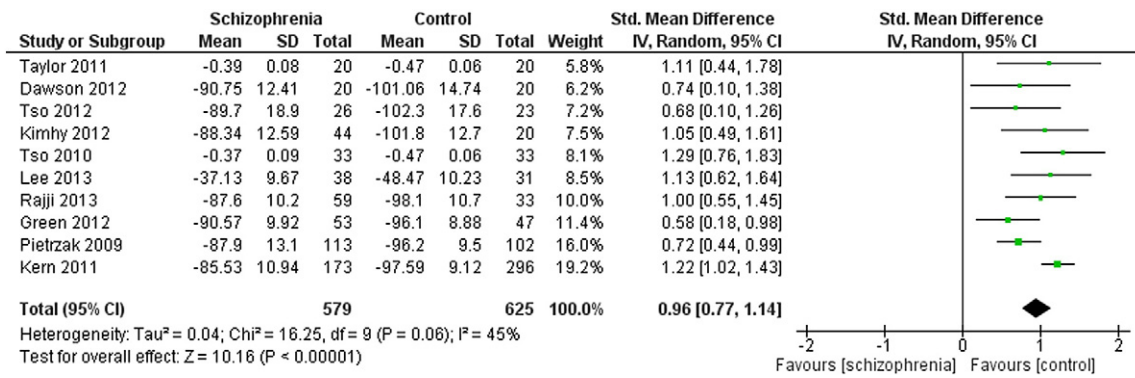


Fig. 5. Comparison data and forest plot for emotion management.

consistency as 0.93. The reported test–retest reliability ranged between 0.79–0.93 across studies. As they highlight the validity of the DES, of course, is limited by the validity of the dissociation theory on which it is based. The DES has 3 subscales (amnesia, absorption, derealisation/depersonalisation). The DES-Taxon (Putnam, Carlson, Ross, & Anderson, 1996) may not discriminate between pathological dissociation between clinical and non-clinical samples (Giesbrecht, Merckelbach, & Geraerts, 2007; Modestin & Erni, 2004) and was not investigated.

The *Emotion Regulation Questionnaire* (ERQ; Gross & John, 2003) is comprised of a reappraisal scale and a suppression scale which were both used within the meta-analysis. Alpha coefficients averaged 0.79 for reappraisal and 0.73 for suppression.

Mayer–Salovey–Caruso Emotion Intelligence Test (MSCEIT; Mayer, Salovey, & Caruso, 2002) is a measure of Emotion Intelligence. The tasks in MSCEIT involve vignettes of various situations, along with ways to cope with the emotions portrayed in the vignettes. The managing emotions component is reported in the meta-analysis. The internal consistency of the managing emotion branch has been reported as $r = 0.83$ and $.81$, for general and expert scoring, respectively (Mayer, Salovey, & Caruso, 2004).

The *Metacognitions Questionnaire* (MCQ; Cartwright-Hatton & Wells, 1997) has five subscales: (1) positive beliefs about worry; (2) negative beliefs about the uncontrollability of thoughts and corresponding danger; (3) cognitive confidence; (4) negative beliefs about thought in general; and (5) cognitive self-consciousness. The negative beliefs about the uncontrollability of thoughts and corresponding danger subscale was included in the meta-analysis as the association between MCQ uncontrollability/danger and pathological worry was large showing 53% shared variance (Wells & Cartwright-Hatton, 2004), and 57% shared variance with the 60-item MCQ (e.g. Wells & Carter, 2001). Internal consistency for the subscales was adequate (Cronbach's alpha range: 0.70–0.82).

Need for Closure Scale (NFC; Kruglanski, Webster, & Klem, 1993) was designed to measure the desire for a definite answer. Two subscales were used for the meta-analysis; discomfort with ambiguity, and

preference for predictability, as they are associated with the construct of intolerance of uncertainty. These two subscales have demonstrated good to very good internal consistency (discomfort with ambiguity subscale = .67 to .80, Preference for Predictability subscale = 0.72 to 0.79; Webster & Kruglanski, 1994). Correlations with the Intolerance of Uncertainty Scale (IUS; Freeston, Rhéaume, Letarte, Dugas, & Ladouceur, 1994) subscales were 0.32 to 0.47 for Preference for Predictability and 0.35 to 0.55 for discomfort with ambiguity (Berenbaum, Bredemeier, & Thompson, 2008).

The *Penn State Worry Questionnaire* (PSWQ; Meyer, Miller, Metzger, & Borkovec, 1990) has been reported to have high internal consistency in both non-clinical (Cronbach's alpha range: 0.90–0.95) and clinical samples (Cronbach's alpha range: 0.86 to 0.93).

Ruminative Response Scale (RRS; Nolen-hoeksema & Morrow, 1991; Treynor, Gonzalez, & Nolen-hoeksema, 2003), is part of the Response Styles Questionnaire (RSQ) containing rumination and distraction subscales with high internal consistency (0.89). RSQ has been reported in multiple studies to have high internal consistency, with Cronbach's alpha range: 0.88 to 0.92 (Luminet, 2003).

State Trait Anger Expression Inventory (STAXI; Spielberger, 1988). Subscales including State Anger, Trait Anger, Anger-in, Anger-out, and Anger Control. Subscale anger-in was used in the meta-analysis (suppression); it measures the frequency with which angry feelings are suppressed. Internal consistency of the subscale, Cronbach's alpha range: 0.64 to 0.78 (Jacobs, Latham, & Brown, 1988).

Thought Control Questionnaire (TCQ; Wells & Davies, 1994) subscales of distraction, worry and reappraisal were investigated. Wells & Davies reported subscale inter-correlations range from $r = -0.02$ to $r = 0.27$, with the highest correlation being between the punishment and worry sub-scales ($r = 0.27$). However, as the coefficients were generally low it suggests that each sub-scale is measuring a distinctly different dimension. Internal consistency was found to be acceptable to good ($\alpha = .67$ for reappraisal, $\alpha = .71$ for worry and $\alpha = 0.72$ for distraction). Subscale worry was shown to correlate with the PSWQ ($r = 0.49$).

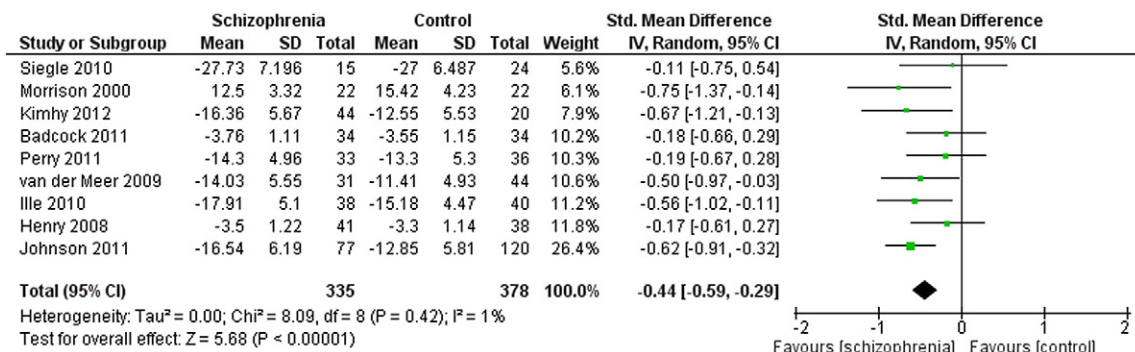


Fig. 6. Comparison data and forest plot for experiential avoidance.

Toronto Alexithymia Scale (TAS-20 and TAS-26; Bagby, Parker, & Taylor, 1994). TAS-26 has four subscales) (1) difficulties in identifying feelings and distinguishing between emotion and physical sensations (DIF), (2) difficulties in describing feelings (DDF), (3) diminished daydreaming, and (4) externally oriented thinking (EOT). TAS-20 removed the diminished day dreaming subscale. In a review of the literature (Kooiman, Spinhoven, & Trijsburg, 2002) reported test–retest reliability to be good ($r = .71-.86$), as was internal consistency except for subscale EOT.

3. Results

The summary effect is from a Z test of the null hypothesis that there is no effect on average (random-effects meta-analysis). Sixty-three studies fulfilled our inclusion criteria, of which 47 met quality criteria and provided data for meta-analyses.

Analysis was conducted on each construct and where applicable on subgroups of that construct. Since the outcomes were measured with similar, but not identical instruments, SMD was calculated (Hedges' (adjusted) g).

In order to facilitate interpretation we have followed the rule of thumb for estimated effect sizes: 0.2 represents a small effect, 0.5 a moderate effect and 0.8 a large effect (Cohen, 1992). The confidence interval describes the uncertainty inherent in this estimate, and describes a range of values within which we can be reasonably sure that the true effect actually lies. A 95% confidence interval (CI) was used for analyses and interpretation of the mean is considered in respect of the lower and upper limits. Where there is moderate or high heterogeneity in meta-analysis', confidence intervals are discussed rather than the average effect. Heterogeneity, within a random-effects model, increases confidence intervals, assuming a distribution of effects (Higgins, 2008). As such the average effect is not a particularly accurate measure of effect.

3.1. Moderator analysis

While there are many possible interacting factors (e.g. across phases of illness) we were only able to conduct a moderator analysis for age

given the data available. Age related differences have been observed in the use of CERS (Blanchard-Fields, Stein, & Watson, 2004).

Tests for moderator effects are less powerful than tests for average effects in meta-analysis (Hedges & Pigott, 2004) and given the small sample sizes in subgroups, a test for age as a moderator variable would have low power. A mixed effects model analysis was run on constructs where there were more than 10 studies (experiential avoidance, attentional deployment, cognitive reappraisal and emotion management). However age was not shown to be a significant moderator for any of these variables. This is not surprising as the age range across studies was not consistently broad across domains.

3.2. Emotion management

Thirteen studies were selected with the loss of two for whom data could not be obtained upon request. For the 10 studies (1204 participants) comparing schizophrenia group (579) with healthy controls (625), the primary outcome of emotion management was $g = 0.96$ (95% CI; 0.77 to 1.14). This indicated a large effect, negatively associated with schizophrenia (Fig. 5). There was moderate heterogeneity ($I^2 = 45\%$). Excluding Kern et al. (2011) reduced heterogeneity to $I^2 = 4\%$; $g = 0.86$ (95% CI; 0.71 to 1.02). However this study had the largest sample with no marked concerns regarding quality or risk of bias and the heterogeneity observed from inclusion of this study may be more related to specific sample characteristics.

3.3. Experiential avoidance

For the 9 studies (713 participants) measuring suppression and distraction, comparing schizophrenia group (335) with healthy controls (378), for the primary outcome of experiential avoidance was $g = -0.44$ (95% CI: $-0.59, -0.29$). This indicated a small to moderate effect, positively associated with schizophrenia (Fig. 6). There was low heterogeneity ($I^2 = 1\%$). While this was a significant effect, it should be noted that four of the nine studies showed zero-order low end confidence intervals.

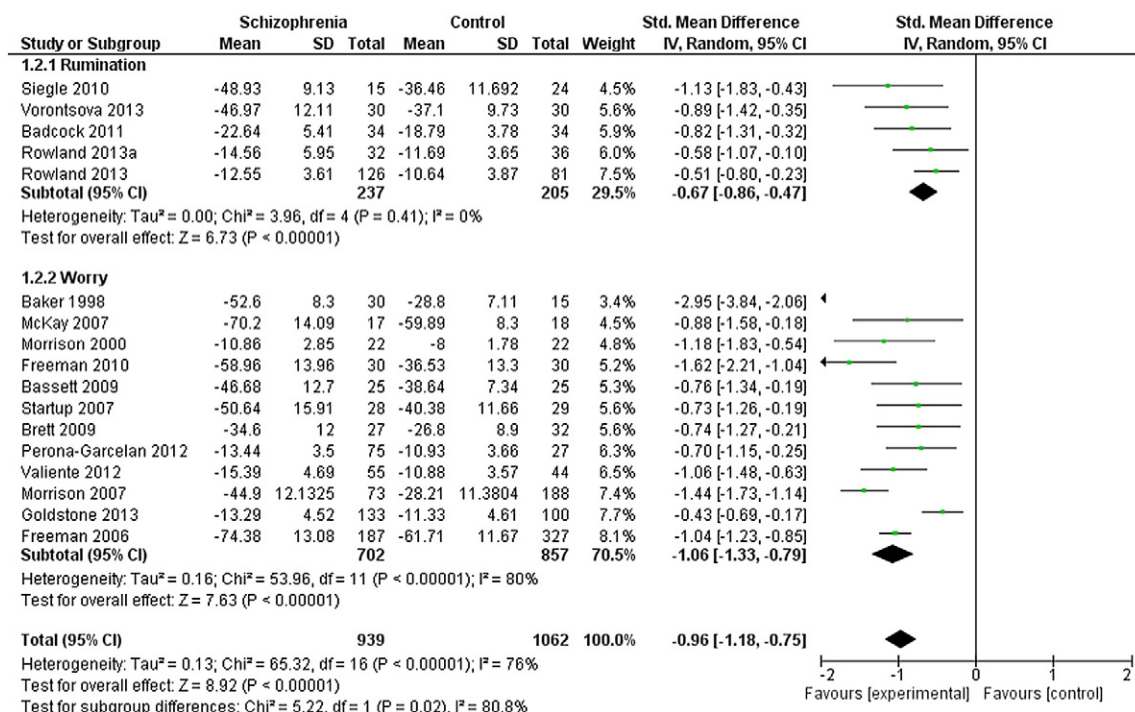


Fig. 7. Comparison data and forest plot for attentional deployment.

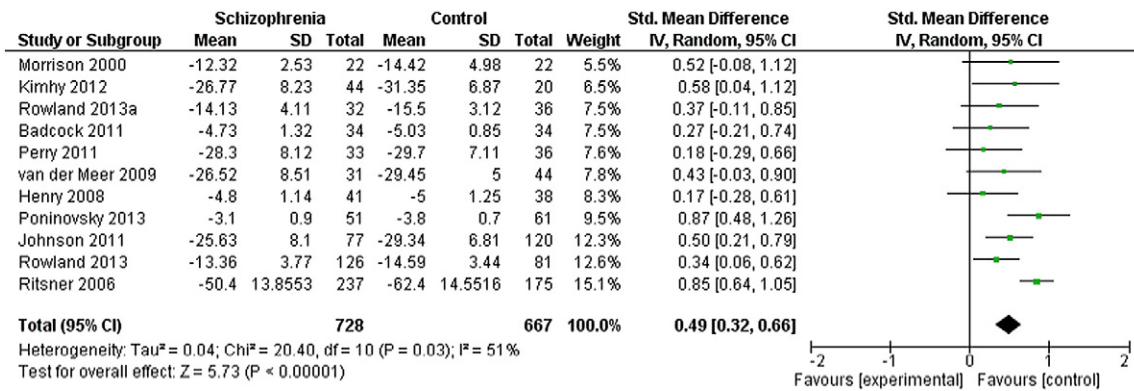


Fig. 8. Comparison data and forest plot for cognitive appraisal.

3.4. Attentional deployment

For the 17 studies (2001 participants) comparing schizophrenia group (939) with healthy controls (1062), the primary outcome of attentional deployment was $g = -0.96$ (95% CI; -1.18 to -0.75). This indicated a large effect, positively associated with schizophrenia (Fig. 7). There was high heterogeneity ($I^2 = 76%$).

3.5. Rumination

For the 5 studies (442 participants) comparing schizophrenia groups (237) with healthy controls (205), the secondary outcome of rumination was $g = -0.67$ (95% CI; -0.86 to -0.47). This indicated a moderate to large effect, positively associated with schizophrenia. There was no heterogeneity ($I^2 = 0%$).

3.6. Worry

Sixteen studies were selected with the loss of four for whom data could not be obtained upon request. For the 12 studies (1559 participants) comparing schizophrenia group (702) with healthy controls (857), the secondary outcome of worry was $g = -1.06$ (95% CI; -1.33 to -0.79). This indicated a large effect, positively associated with schizophrenia. There was high heterogeneity ($I^2 = 80%$) which did not appear to be strongly related to use of different measures (when studies using PSWQ were isolated they still produced high heterogeneity).

3.7. Cognitive reappraisal

For the 11 studies (1395 participants) comparing schizophrenia groups (728) with healthy controls (667), the primary outcome of cognitive reappraisal was $g = 0.49$ (95% CI; 0.32 to 0.66). This indicated a small to moderate effect, negatively associated with schizophrenia (Fig. 8). There was moderate heterogeneity ($I^2 = 51%$). Excluding Ritsner et al. (2006) reduced heterogeneity to $I^2 = 0%$; $g = 0.43$ (95%

CI; 0.30 to 0.56). Six studies reported zero-order low end confidence intervals.

3.8. Dissociation

For the 7 studies (767 participants) comparing schizophrenia groups (293) with healthy controls (474), the primary outcome of dissociation was $g = -0.86$ (95% CI; -1.13 to -0.60). This indicated a moderate to large effect, positively associated with schizophrenia (Fig. 9). There was moderate heterogeneity ($I^2 = 50%$), this was unlikely to be due to measurement as the DES was the sole measure. Excluding Modestin, Hermann, and Endrass (2007) reduced heterogeneity to $I^2 = 10%$; $g = -0.96$ (95% CI; -1.17 to -0.75).

3.9. Amnesia

Four studies (545) reported data for the amnesia subscale. Comparing schizophrenia groups (169) with healthy controls (376), $g = -0.73$ (95% CI; -1.03 to -0.44). This indicated a small to large effect, positively associated with schizophrenia. There was moderate heterogeneity ($I^2 = 36%$).

3.10. Absorption

Five studies (587) reported data for the absorption subscale. Comparing schizophrenia groups (191) with healthy controls (396), $g = -0.70$ (95% CI; -1.03 to -0.37). This indicated a small to large effect, positively associated with schizophrenia. There was moderate heterogeneity ($I^2 = 54%$).

3.11. Depersonalisation/derealisation

Four studies (545) reported data for the depersonalisation/derealisation subscale. Comparing schizophrenia groups (169) with healthy controls (376), $g = -0.95$ (95% CI; -1.19 to -0.72). This indicated a large effect positively associated with schizophrenia. There was no heterogeneity ($I^2 = 0%$). While there was no heterogeneity, these DES items may overlap with psychotic symptoms. Interestingly,

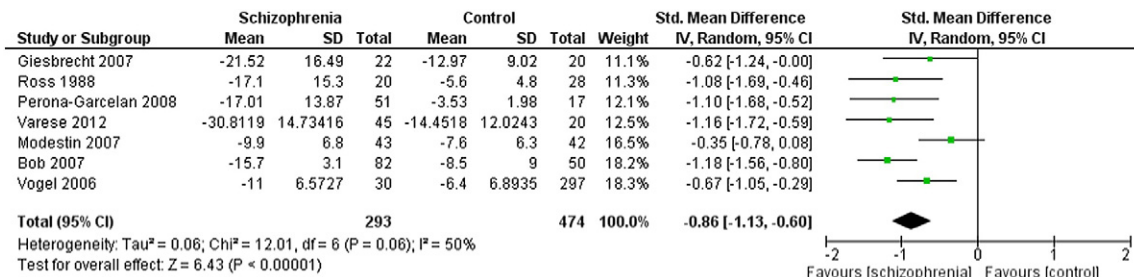


Fig. 9. Comparison data and forest plot for dissociation.

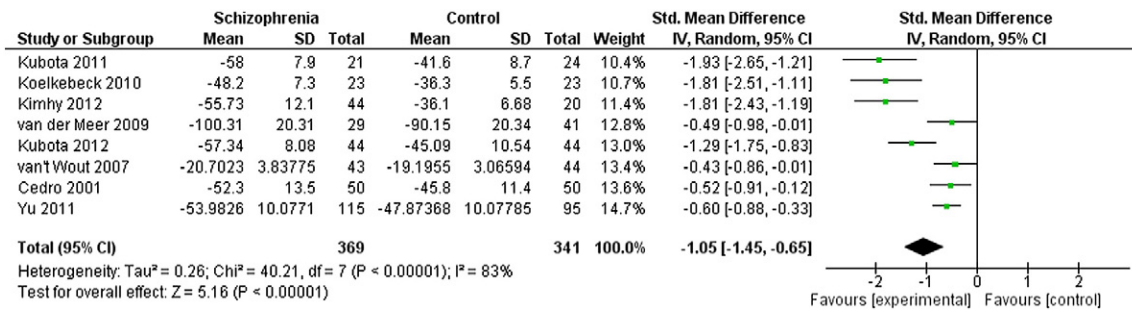


Fig. 10. Comparison data and forest plot for alexithymia.

Perona-Garcelan, Garcia-Montes, et al. (2012) replicated the results without overlapping items.

3.12. Alexithymia

Nine studies were selected with the loss of one for whom data could not be obtained upon request. For the 8 studies (710 participants) comparing schizophrenia group (369) with healthy controls (341), the primary outcome of alexithymia was $g = -1.05$ (95% CI; -1.45 to -0.65). This indicated a moderate to large effect, positively associated with schizophrenia (Fig. 10). There was high heterogeneity ($I^2 = 83%$).

4. Discussion

Overall the meta-analysis suggests that individuals with schizophrenia may engage in more maladaptive CERS with greater global emotion regulation difficulties. Alexithymia and dissociation were also indicated.

4.1. Attentional deployment

There were only five studies which investigated rumination in schizophrenia (relative to healthy controls). This is perhaps surprising given strong associations between depression and rumination (Aldao, Nolen-hoeksema, & Schweizer, 2010), and how cognitions relating to persecution (common in psychosis) may relate to anxious and depressive concerns (Garety & Freeman, 2013). Indeed, Vorontsova, Garety, and Freeman (2013) found a moderate to large effect size when controlling for clinical depression. While this meta-analysis strongly supports the role of both worry and rumination, co-morbid depression or anxiety disorders may play a moderating role that could not be fully examined here.

4.2. Experiential avoidance

Experiential avoidance has been postulated as negatively reinforcing worry and rumination processes (Pankey & Hayes, 2003). While experiential avoidance was not as strongly associated with schizophrenia as other strategies, the hypothesis that it increases rumination and worry could implicate a circular process where the focus of the individual is on distressing internal processes rather than strategies to avoid them. Experiential avoidance of unpleasant thoughts and feelings may impact upon the use of, or may be inversely related to, cognitive appraisal or acceptance.

4.3. Cognitive reappraisal

The results for cognitive reappraisal were in favour of controls but not as highly reliable due to heterogeneity and the number of studies with zero order low end confidence intervals. Cognitive reappraisal, as measured by the scales in this meta-analysis, was separate to the construct of problem-solving. As such it may be that context plays a large role (Troy, Shallcross, & Mauss, 2013). Cognitive reappraisal may be

linked to affective variables including factors such as 'psychological defeat' – feelings of defeat in response to failure, (Johnson, Gooding, Wood, Taylor, & Tarrier, 2011) which may facilitate rumination.

4.4. Dissociation

Dissociation is not specific to schizophrenia and may be more related to experiences of trauma within this population. Three of the studies explicitly investigated traumatic dissociation within their samples (Bob, Glaslova, Susta, Jasova, & Raboch, 2007; Varese, Barkus, & Bentall, 2012; Vogel et al., 2006). Vogel et al. isolated those with and without self-reported PTSD. This indicated a large effect ($g = 0.74$) in favour of those with co-morbid PTSD and may suggest trauma history as a potential mediator of dissociation within schizophrenia. While not investigated, trauma exposure may have been a factor in the other studies, and indeed, standard deviations were large suggesting marked variation within samples.

Both amnesia and absorption showed small to large effect sizes with moderate heterogeneity. The depersonalisation/derealisation subscale showed a large effect size. Two studies emphasize the role of depersonalisation as a predictor of hallucinatory experience (Kilcommons & Morrison, 2005; Perona-Garcelan et al., 2008). This strategy may be a response to trauma or possibly a source of anomalous experiences (Perona-Garcelan et al., 2011) interpreted in a delusional form due to cognitive biases and dysfunctional emotion regulation processes (Freeman, 2007). Attentional deployment has been indicated as a focus for altering the strength by which depersonalisation may facilitate more maladaptive and inhibit more adaptive response modulation (Stephan, 2012).

4.5. Alexithymia

The significant finding regarding alexithymia is noteworthy; though whether this is a core deficit in identifying or describing emotional experience is unclear. However, both measures (BVAQ and TAS) have subscales that are worthy of more detailed investigation.

The maladaptive use of CERS may imply greater attention to cognitive processes over emotional experience (Chambers et al., 2009) and subsequently individuals may not learn skills in identifying and describing emotions. This has important implications for accurate psychiatric assessment given the reliance on self-report. It is also a pertinent consideration for psychological interventions.

5. Conclusion

Our meta-analysis showed a greater use of maladaptive and less use of adaptive CERS in schizophrenia compared to healthy controls. Constructs of alexithymia and dissociation (at least as instantiated in these self-report measures) are also more evident in individuals with schizophrenia. However heterogeneity in results makes it difficult to identify distinct processes or the contribution of co-morbid pathology.

These findings suggest a significant role of emotion dysregulation in schizophrenia although the exact nature of which remains unclear.

While the component strategies may be independent, the way in which strategies are implemented is likely to be interactional. The sole focus on specific strategies in the literature undermines the ability to investigate these relationships and further develop cognitive–affective models in psychosis. The role of variables incorporated within dissociation and alexithymia while still unclear, appear to be significant. For schizophrenia, models of cognitive emotion regulation, beyond the ‘process model’, may benefit from consideration of dissociation and alexithymia.

5.1. Limitations

This meta-analysis was unable to consider the course of emotion regulation strategies at different phases of illness in schizophrenia which could reveal state specific CERS. The samples also included individuals with an array of chronicity and symptoms. We were also unable to look at relationship between different dimensions of schizophrenia (positive, negative symptoms) and CERS. At present, the available literature does not allow this kind of analysis. However it may be an interesting focus for future reviews.

Inferences of causality or linking effects is beyond this meta-analysis due to the cross sectional design. However the majority of studies do not look at CERS as a whole, but rather separate strategies. The measures which attempt to cover all CERS tend to have poorer validity. Based on a review of the psychometric properties we would suggest that a battery of CERS measures be used. Sixty-two CERS questionnaires were identified in our literature search. A thorough review of measures and a factorial analysis to identify the most reliable and valid factors involved would benefit emotion regulation research.

The main drawback within the literature, in respect of our aim, was the omission of a comparison group of healthy controls with over-reliance on norms that may not be appropriate control data. Considering this is the least problematic group to recruit it is important that researchers recognise the importance of the inclusion of this control when researching psychopathology.

5.2. Theoretical, methodological and clinical implications

Despite the heterogeneity of schizophrenia, it is important to identify patterns of CERS associated with paranoia, grandiosity and other psychotic processes or presentations. Equally comorbid depression or anxiety may well have a moderating impact on emotion regulation with knock on effects for distress and coping, and the maintenance cycles of psychotic symptoms.

Given the cognitive deficits implicated in schizophrenia and the current evidence for compromised emotional regulation, future emotional regulation research should incorporate neuropsychological variables and social cognition as relevant factors.

Future research could further explore a wider taxonomy of emotion regulation strategies (Webb, Miles, & Sheeran, 2012) to identify more specific cognitive processes associated with schizophrenia.

Difficulties identifying and verbalizing emotions is an important consideration within the process of therapy and may prove more challenging or stressful for individuals with schizophrenia. The process of developing adaptive responses requires developing awareness of emotional responses. Being unable to label the emotional experience could lead to greater distress and reliance on maladaptive strategies. As such, acquiring adaptive skills may need to be carefully facilitated in order to assure the individual had achieved mastery and becomes a more implicit process. Over reliance on a particular CERS or the presence of dissociative symptoms may also compromise efficacy of CBT skills training. These may be useful factors to consider given the modest effect size for CBT on the core symptoms of schizophrenia (Turner, van der Gaag, Karyotaki, & Cuijpers, 2014) and adverse events following CBTp

(Klingberg et al., 2012). It has been suggested that more focused CBT interventions are yielding larger effect sizes (Turner et al., 2014). Emotional processes are key within cognitive models of psychosis (Garety, Kuipers, Fowler, Freeman, & Bebbington, 2001; Morrison, 2001). Including more explicit emotion regulation skills training and psycho-education for emotions may facilitate the development of this capacity and aid cognitive appraisal (Cameron, Ogrodniczuk, & Hadjipavlou, 2014). Clinicians should screen for prominent maladaptive patterns but given the array of measures it is not currently clear which provide the best measure.

Given the marked dependence on maladaptive strategies, individuals with schizophrenia may experience increases in levels of distress before tolerance of negative emotions is acquired through experience.

Third wave cognitive behavioural therapies may be suitable adjunctive therapies to consider. Congruent with an emotion dysregulation focus, there is an emphasis on the function of symptoms and the individual's relationship to experiences using acceptance and mindfulness strategies. While the evidence for third wave therapies for psychosis is currently limited (Khoury, Lecomte, Gaudiano, & Paquin, 2013), it is a promising area of future research and treatment.

Equally, the evidence from this review may support the evidence for development of targeted, process-specific interventions for individuals with schizophrenia (Emmelkamp et al., 2014).

Appendix A. Supplementary data

Supplementary data to this article can be found online at <http://dx.doi.org/10.1016/j.cpr.2014.07.002>.

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