Thesis Portfolio

Social Functioning and Social Cognition in At-Risk and First Episode Psychosis

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Thesis Portfolio Abstract

Reduced social functioning is a key characteristic of the psychosis continuum. However, it is currently unclear how effective a range of psychological interventions are in improving social functioning in at risk mental states (ARMS) and first episode psychosis (FEP) populations. One treatment target that has received increased interest is social cognitive function. However, there has not yet been a comprehensive analysis of the literature investigating the relationship between social cognition, social functioning, and psychotic symptomatology. To this end we conducted a systematic review and meta-analysis to determine the effectiveness of psychological interventions on social functioning, and to determine the nature of relationship between social cognition, social functioning and psychotic symptoms in ARMS and FEP. Our systematic review demonstrated that CBT, multicomponent and service level interventions have efficacy in FEP, whilst there is currently no evidence that CBT, and limited evidence that other therapeutic modalities, are efficacious in improving social functioning in ARMS populations. Overall methodological quality was highly variable and there was a high risk of bias in many domains. Our meta-analysis revealed that in ARMS participants, better overall social cognitive performance and emotion recognition were related to better social functioning, and better emotion recognition performance was related to lower psychotic symptoms. In FEP, significant relationships were identified in all domains indicating that better social cognitive performance is related to enhanced social functioning and lower psychotic symptoms. Effect sizes for all meta-analyses were small (range r=0.1 to 0.3). Together, our findings indicate that there is a need for future trials targeting social functioning, particularly in ARMS populations. Moreover, considering the consistent significant relationship between

social cognitive performance, social functioning and psychotic symptoms, interventions designed to target social cognition specifically in ARMS and FEP may prove beneficial in improving deficits in this domain, and potentially functioning and psychotic symptomatology.

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Chapter 1

General Introduction

1.1. Overview of Introduction

The following section aims to introduce the key concepts, definitions, literature and theoretical models of relevance to this thesis. Psychosis and the psychosis continuum are defined and described, followed by a discussion of the Clinical Staging Model, the at-risk mental state concept and First Episode Psychosis. Next, the evidence indicating that social functioning is impaired along the psychosis continuum is reviewed. Social cognition is described and along with the commonly investigated subdomains, and the literature indicating that social cognitive deficits are apparent at different stages along the psychosis continuum, is outlined. Following this, key psychological models that are important for understanding how social functioning and social cognition are affected in psychosis are outlined, along with a conceptual framework linking social cognition, positive and negative symptoms and social functioning. Finally, the thesis aims and hypothesis are described in the final section of this General Introduction.

1.2. The Psychosis Continuum

In its broadest usage, the term psychosis refers to a set of symptoms which can occur in a number of psychiatric, neurodevelopmental, neurological and medical conditions (Arciniegas, 2015). The Diagnostic and Statistical Manual of Mental Disorders (5th ed.; DSM–5; American Psychiatric Association, 2013) defines psychotic symptoms as hallucinations in any sensory modality and/or delusions. When they occur in an organic condition they are referred to as secondary psychoses, whilst in the absence of any clear organic cause, are referred to as a primary affective or non-affective psychotic disorder (Arciniegas, 2015). Psychiatric nosology has produced discrete categorisations to identify and diagnose individuals presenting with particular combinations of positive symptoms (hallucinations and delusions) and negative symptoms which include reduced initiation of goal directed behaviour (avolition), range and intensity of emotional expression (affective flattening) fluency and production of speech and thought (alogia) and expectation and experience of pleasure (anhedonia; DSM-5, 2013).

Psychotic disorders, such as schizophrenia, are associated with significant personal and societal burden. Chronic course schizophrenia is associated with a reduced life expectancy of approximately 10 years and accounts for a disproportionate amount of disability when compared to all other health conditions (Rossler, Salize, van Os, & Riecher-Rossler, 2005). The impact of psychosis extends beyond the individual, impacting significantly on the family and carers of those who develop a psychotic disorder (Onwumere, Shiers, & Chew-Graham, 2016). In a comprehensive analysis of studies conducted between 1950 and 2009, the incidence of all new cases of psychoses in England during this time period was 31.7 per 100,000 person-years, with the peak age of onset in the early twenties

(Kirkbride et al., 2012). Prior to the age of 45 years, incidence rates were higher in men, after which point there was no gender difference, and rates were higher in ethnic minority groups (Kirkbride et al., 2012). In addition, the Adult Psychiatric Morbidity Survey estimated the prevalence of psychotic disorders in England as 0.7% of adults aged 16 and over (McManus, Meltzer, Brugha, & Bebbington, 2009). Findings in England are in line with the wider international literature (Häfner, 2000; McGrath et al., 2004).

Despite the clinical and research utility of discrete psychiatric diagnostic categories, there has been a move in recent decades towards understanding psychosis, and psychotic disorders, as representing a continuum of interrelated and overlapping mental health conditions (Guloksuz & van Os, 2018). This is an area of ongoing debate (Curtis & Derks, 2017), however, there are some key points which lend weight to adopting this perspective. The most commonly researched psychotic disorder is schizophrenia, yet it represents only 30% of the of the broader psychosis continuum of disorders (Perälä et al., 2007), in which patients have the worst outcomes. As such, an overly exclusive focus on the aetiology and treatment of schizophrenia will potentially miss a large number of individuals who experience psychotic symptoms, and will thus not be representative of the wider population. Recent studies have demonstrated that subthreshold psychotic experiences are common in the general population, with incidence rates around 2.5% (Linscott & Van Os, 2013). In addition, it appears that although psychotic like experiences have some predictive value in identifying who will later develop a psychotic disorder, the combination with affective disturbance and motivational impairments produces a much greater risk of psychotic disorder in the future (Dominguez, Saka, Lieb, Wittchen, & van Os, 2010; Hanssen, Bak, Bijl, Vollebergh, & Van Os, 2005). Thus psychotic symptoms alone are a poor indicator of the potential to progress to a psychotic disorder, and it has been proposed that psychosis is best viewed as a marker of severity of psychopathology

more broadly, and as a transdiagnostic symptom of the psychosis continuum (Guloksuz & van Os, 2018).

1.2.1. The Clinical Staging Model

The clinical staging model of psychosis (McGorry, Hickie, Yung, Pantelis, & Jackson, 2006), has largely been adopted in research and clinical settings to identify and provide treatment to individuals at the earliest possible time point. Within the clinical staging model, the current view is that there are three key stages in which to identify and treat individuals with varying severity of symptoms (see **Figure 1.1.**). The first stage is the 'at-risk' period prior to the onset of frank psychotic symptoms; the second stage is the early detection and intervention for individuals who have developed a FEP and frank psychotic symptoms; and the third stage is the critical period post diagnosis of FEP, which is most commonly viewed to be up to five years (McGorry et al., 2006; McGorry, Killackey, & Yung, 2008).

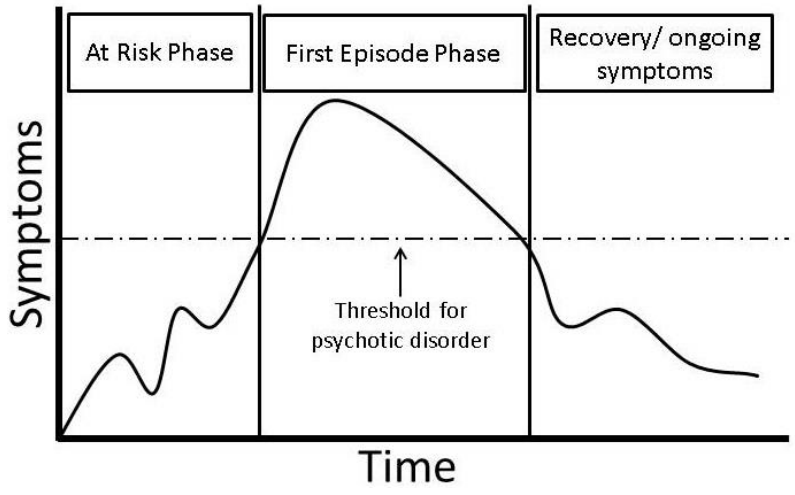

Figure 1.1. The Clinical Staging Model of Psychosis. Three key phases are identified across the psychosis continuum. 1. The at risk phase during which the individual may experiences elevated levels of general psychopathology (e.g. anxiety, low mood) and low level/ transient psychotic symptoms; 2. The first episode phase during which the individual has crossed a threshold to frank psychosis and presents to services for treatment; 3. The recovery or ongoing symptom phase during which the individual may recover fully and all psychotic symptomatology may remit, or some level of psychotic symptomatology may persist.

1.2.2. The At Risk Mental State Concept

A prodromal phase of psychosis has been recognised since the early 20th century (Fusar-Poli et al., 2013). However, the 'at risk' concept was first fully operationalized just over two decades ago, with a set of standardised criteria to identify individuals as being at Ultra-High-Risk (UHR) of developing a psychotic disorder (Yung & McGorry, 1996). In addition to UHR, there are a number of different terms in the literature referring to this period of illness including clinical high risk for psychosis (CHR) and at-risk mental state (ARMS). Herein, the term ARMS will be used to refer to UHR, prodromal and CHR.

Since the introduction of the UHR concept, there has been a rapid growth of studies utilising this criteria to investigate the risk factors and aetiological mechanisms involved in the development of psychosis (McHugh et al., 2018). In addition, there have now been a number of substantial clinical trials of psychological interventions to improve outcomes and prevent the progression to frank psychosis in ARMS individuals (see **Chapter 2** for review of trials).

The gold standard measure for identifying ARMS individuals is the clinician administered Comprehensive Assessment of At Risk Mental States (CAARMS; Yung et al., 2005). However, other measures for identifying individuals at risk of developing psychosis include the Structured Interview for Prodromal Syndromes (SIPS), the Scale of Prodromal Symptoms (SOPS; Miller et al., 2003), and Early Recognition Inventory (Häfner et al., 2004).

The CAARMS was developed for clinical and research use and defines individuals as UHR for developing psychosis if they fall into one or more of three categories; 1. Attenuated psychotic symptoms; 2. Brief limited intermittent psychotic symptoms; 3.Trait vulnerability group (see **Table 1.1. for details**). In addition, the individual must be

between 15 and 25 years-of-age, have been referred to a specialised service for support, and have experienced a decline in functioning lasting at least one month during the past year, or sustained low functioning (Yung et al., 2005).

Despite the utility of the CAARMS in identifying ARMS individuals, only a proportion of these individuals will subsequently transition to develop a full psychotic episode. For example, in an Australian sample of individuals identified as UHR, 34.9% developed psychosis during a 10-year follow-up period (Nelson et al., 2013), and when key predictor variables are combined using complex statistical modelling in empirical studies, the predictive value is, at best, around 80% (Thompson, Marwaha, & Broome, 2016). As such, there is ongoing debate regarding the utility and validity of the ARMS concept (Fusar-Poli, 2018; Fusar-Poli et al., 2013).

In those individuals who do transition to frank psychosis, the factors driving this are still not fully understood. Social functioning and social cognition are two factors which have become an area of significant interest, and will be discussed further below.

Table 1.1. The Ultra High Risk (UHR) Criteria

Group	Criteria
Vulnerability Group (state and trait risk factors)	1st degree relative with psychotic disorder OR schizotypal personality disorder in patient Significant decline in mental state or functioning (30% drop in SOFAS), maintained for at least 1 month, during the past 12 months Or sustained low functioning for 1 year or longer (SOFAS score of 50 or less functioning during the past month
Attenuated Positive Psychotic Symptoms	1 or more of the following symptoms: ideas of reference, odd beliefs or magical thinking, perceptual disturbance (visual, auditory, olfactory, gustatory, tactile or somatic), paranoia, disorganised speech. Symptoms must occur at least 3-6 times per week, lasting more than one hour. Or daily, lasting one hour or more Symptoms must be present for the past year. Symptoms must be present for 1 week or more but less than or equal to 5 years. Significant decline in mental state or functioning (30% drop in SOFAS), maintained for at least 1 month, during the past 12 months Or sustained low functioning for 1 year or longer (SOFAS score of 50 or less functioning during the past month
Brief limited intermittent psychotic symptoms	Transient psychotic symptoms: 1 or more of the following symptoms: ideas of reference, odd beliefs or magical thinking, perceptual disturbance (visual, auditory, olfactory, gustatory, tactile or somatic), paranoia, disorganised speech. Symptoms must be continuous/ occur several times per week Symptoms must have occurred during the past year. Symptom episode must have lasted for less than one week and spontaneously remitted Significant decline in mental state or functioning (30% drop in SOFAS), maintained for at least 1 month, during the past 12 months Or sustained low functioning for 1 year or longer (SOFAS score of 50 or less functioning during the past month

1.2.3. First Episode Psychosis

The concept of first episode psychosis (FEP) appears self-explanatory in that, an individual must cross a threshold to meet diagnostic criteria for one of the major non-affective or affective psychotic disorders, and this must be the first time they have presented to services for treatment and met these criteria (Fusar-Poli et al., 2016). However, there are some variations in definition and conceptualisations in the literature which are important to outline. In addition to FEP, other terms include; early schizophrenia, early psychosis, recent-onset schizophrenia, early phase schizophrenia, early stage schizophrenia and early course schizophrenia (Newton et al., 2018). Even more problematically, there is variation in the definition of these terms regarding number of episodes, duration of symptoms, and severity of symptoms. In many studies it is unclear if participants are in an acute phase or stable remission, and the 'cut-off' number of years in which someone is still considered to be in the FEP phase of illness varies from less than one year to less than five years (Newton et al., 2018). Clearly, there is a need for greater standardisation in definition and terminology of what constitutes a FEP. However, for the purpose of this thesis, FEP is considered to be within five years of developing frank psychotic symptoms and/or presenting to services for treatment within this period (McGorry et al., 2008).

1.2.4. Early Intervention in Psychosis

Until the 1980s, progress in early intervention in psychotic disorders was hampered by the legacy of the Kraepelinian view of psychotic disorders, particularly schizophrenia, as neurodegenerative diseases with an invariably poor long term outcome (Zubin, Oppenheimer, & Neugebauer, 1985). However,

following seminal research conducted in the early 1980s, (Crow, MacMillan, Johnson, & Johnstone, 1986; Kane, Rifkin, Quitkin, Nayak, & Ramos-Lorenzi, 1982; Lieberman et al., 1992) early intervention (EI) services were established, first in Melbourne, Australia, then in Europe and North America (Edwards & McGorry, 2002; McGorry, Edwards, Mihalopoulos, Harrigan, & Jackson, 1996). The key aim of EI services is to identify and provide treatment to individuals who have developed a FEP, so as to promote the best long term outcomes. In the UK, EI services were introduced by the National Service Framework in 1999 (Department of Health, 1999). Some of the key randomised controlled trials (RCTs) of early intervention services include the EPPIC trial in Australia (McGorry et al., 1996), the OPUS trial in Denmark (Petersen et al., 2005), and the Lambeth Early Onset (LEO) trial in the UK (Craig et al., 2004). The most comprehensive of these trials was the OPUS which had a large sample and followed patients for up to 10 years; at the 2 year time point the treatment group had significantly lower psychotic symptoms and higher general functioning (Bertelsen et al., 2008; Secher et al., 2014). The EPPIC trial has received criticism due to its methodology (Raven, 2013) and the LEO trial found only significant differences in hospital readmissions and not in relapse rates between the treatment and control group. Nonetheless, it is now widely accepted that psychological and functional outcomes for individuals presenting with psychosis are better when identified as early as possible, and treatment is provided within an EI model, rather than within a general community mental health team. As such, EI is now a standard of care in the UK for individuals suspected of having a FEP (National Institute for Health and Care Excellence, 2014).

1.3. Psychosis and Social Functioning

Social functioning broadly refers to an individual's capacity to engage in meaningful activities (e.g. work and leisure activities), and their ability to develop maintain interpersonal relationships (Couture, Lecomte, & Leclerc, 2007). A range of different measures are used in the literature and clinically to assess social functioning (see **Table 1.2.** below for commonly used measures). As noted above, part of the diagnostic criteria for ARMS is impaired social functioning, and such impairments have been recognised as a significant difficulty in those who develop a psychotic disorder (Hodgekins et al., 2015). Negative symptoms and neuropsychological impairments have previously been identified as key factors driving functional impairments in ARMS populations (Cotter et al., 2014). It has been reported that the level of social functioning impairment in ARMS participants is not significantly different to FEP participants or those who have had multiple psychotic episodes (Addington, Penn, Woods, Addington, & Perkins, 2008). However, this study measured social functioning using the Social Functioning Scale (Birchwood, Smith, Cochrane, Wetton, & Copestake, 1990) and different results have been reported when the analysis has used a different outcome measure. For example, in a comprehensive study using the Time Use Survey (Hodgekins et al., 2015), the average number of hours per week spent in structured activity was compared in ARMS and FEP participants. In this study, 45 hours of structured activity per week was identified as the cut-off for 'normal' levels of functioning. The following rates of social disability were identified: for ARMS participants 28.6% had no disability (≥45 hours), 21.1% were at risk of social disability (>30 hours < 40 hours), 21.6% had social disability (>15 hours ≤ 30hours) and 28.6% had severe social disability (≤15 hours). In FEP participants 18.9% had no

disability, 13.5% were at risk of social disability, 17.9% had social disability, and 49.7% had severe social disability (Hodgekins et al., 2015). The difference between ARMS and FEP participants was statistically significant, indicating that when a more sensitive measure of social functioning is employed, social functioning impairments are greater following the development of a FEP in comparison to being in an ARMS (Hodgekins et al., 2015).

The degree to which impaired social functioning precedes, or is a result of, psychotic symptomatology, is unclear. However, psychological models have been developed which provide some indication of this direction of effect and highlight the importance of social functioning as a treatment target (see **Section 1.6. below**). Importantly, in individuals diagnosed with a psychotic disorder, it has been reported that only around half return to normal social functioning and can engage in meaningful activities such as competitive employment (Harrison, Croudace, Mason, Glazebrook, & Medley, 1996; Tsai et al., 2001). The combination of a decline in social functioning along with co-morbid psychopathology (e.g. depression and anxiety) appears to be most predictive of long term social functioning impairments (Fowler et al., 2010). As such, there has been increased effort to better understand the psychological processes involved in functional outcomes, particularly social functioning, in psychotic disorders, and to develop better psychological interventions to alleviate these difficulties (see **Chapter 2** for review of interventions; (Devoe, Farris, Townes, & Addington, 2018; Fowler et al., 2010; Hodgekins et al., 2015). One psychological process that has received increased attention in functional outcomes in psychosis is social cognitive functioning.

Table 1.2. Commonly used measures of social functioning

Type of Measure	Social Functioning Measure	Measure Description	Outcomes	Available Psychometric Properties	References
Clinician Rated	SOFAS	10 anchor points assessing social, occupational, academic, and personal functioning	One item score (0-100) where higher score equals better functioning .	Interrater reliability: ICC=0.94, good convergent and discriminant validity	Burns & Patrick, (2007); Hilsenroth et al., (2000).
	GAF-F	10 anchor points assessing social, occupational, family and work/ academic domains	One item score (0-100) where higher score equals better functioning .	Correlations between self and expert ratings on the GAF have shown to be highly correlated (r= 0.62 $p<0.001$)	Bodlund, Kullgren, Ekselius, Lindström, & von Knorring, (1994); Burns & Patrick, (2007).
	GFS	10-item measure assessing the quality of peer relationships, level of peer conflict, age appropriate intimate relationships and involvement with family members	scoring range of 1-10 with 1 representing severe dysfunction and 10 representing superior functioning	excellent interrater reliability (α= 0.78-0.84), good convergent validity (total score r=0.59) when tested in a FEP sample of participants, and good discriminant and good predictive validity in an ARMS populations	Cornblatt et al., (2007); Piskulic, Addington, Auther, & A Cornblatt, (2011)

Type of Measure	Social Functioning Measure	Measure Description	Outcomes	Available Psychometric Properties	References
	SAS-II	53-item instrument assessing work role, immediate family relationships, extended family relationships, sexual functioning, romantic involvement, parental role, social leisure activities and personal well-being	Total score in each domain, and overall total score	Limited psychometric data available. Self and expert ratings on this scale have been shown to be highly correlated (r =0.72) and it differentiates participants diagnosed with schizophrenia and those without	Glazer, Prusoff, John, & Williams, (1981); Schooler et al., (1979); Weissman & Bothwell, (1976).
	RFS	Four rating scales assessing the following domains of social functioning; work productivity, independent living and self-care, immediate social network relationships and extended social network relationship	Total score in each domain, and overall total score	Good discriminant validity, construct validity, inter-rater reliability (r= 0.64-0.92) and test-retest reliability (r=0.85-0.92).	Goodman et al., (1993); Strauss & Carpenter, (1977).
	TUS	Semi-structured interview assessing time spent in employment, education, voluntary work, leisure activities, childcare, housework and chores	Weekly average hours spent in each activity	Good discriminant validity in differentiating social functioning between ARMS individuals and a non-clinical sample (all $p<0.007$, except for sporting activities	Gee et al., (2016); Hodgekins, French, et al., (2015).

Type of Measure	Social Functioning Measure	Measure Description	Outcomes	Available Psychometric Properties	References
Self-reported	SFS	79 items assessing social engagement/withdrawal, interpersonal behaviour/communication, participation in prosocial activities, participation in recreational activities, independence-competence (perceived ability to complete tasks of everyday social functioning), independence performance (rate of completion of tasks of everyday social functioning), employment/occupation	SFS total score which ranges from 0-236, with higher scores indicating better social functioning	Good internal consistency (Cronbach's α= 0.69- 0.87) in schizophrenia. Differentiates between ARMS and non-ARMS individuals	Addington et al., (2008); Addington et al., (2017); Birchwood et al., (1990); Burns & Patrick, (2007); Jang et al., (2011).
	SAS-SR	54-item instrument assessing work, social and leisure activities, family relationship, marital relationship, parental role, and role within the family unit	Total score in each domain, and overall total score	Significant inter-correlation between informant and patient (0.74) and interviewer and patient (0.70;	Weissman & Bothwell, (1976).

Type of Measure	Social Functioning Measure	Measure Description	Outcomes	Available Psychometric Properties	References
	SBS	Assesses a number of behaviours: communication, sociability, depression, anxiety, suicidality, odd ideas, restlessness, socially unacceptable habits or manners, violence, sexual behaviour, self-care, activity and speech, attention	Score for each individual behaviour and two global scores: the severe behaviour score (BSS) and mild and severe behaviour score (BSS)	inter-rater reliability (α= 0.94), and inter-informant reliability (α=0.91), are excellent; test-retest reliability (α=0.70) and Inter-setting reliability (α=0.70) are acceptable	Wykes & Sturt, (1986)

GAF-F, Global Assessment of Functioning- Functioning subscale; GFS; Global Functioning: Social Scale; RFS; Role Functioning Scale; SAS-II, Social Adjustment Scale 2nd Edition; SAS-SR, Social Adjustment Scale- Self Report; SBS, Social Behaviour Schedule; SFS; Social Functioning Scale ; SOFAS, Social and Occupational Functioning Assessment Scale; TUS, Time Use Survey.

1.4. Social Cognition

Social cognition is an umbrella term which refers to set of cognitive processes by which the individual perceives, interprets and processes social information (Green et al., 2008). It is considered to be a fundamental function of the human mind (with varying degrees apparent in other animals) which confers survival advantages; allows humans to learn through the consequences of other individuals experiences (social learning/ social referencing); underpins the ability to infer the intentions, desires, beliefs, wants and needs of people in the social environment; is the cognitive means by which humans can create a shared world and interact through symbols, myths, language, culture and religion; and provides the capacity to co-operate in small and large societies (Frith & Frith, 2007). Considering the role of social cognition in all of human social life, normal social cognitive functioning is believed to underpin general social functioning capacity (Schönherr, 2017)

Within the empirical literature, there is some variation in the specific subdomains of social cognition. However, most commonly the key subdomains include emotion recognition, theory of mind (ToM), social perception and attributional bias (Pinkham et al., 2014). It is important to note that social cognition is conceptualised as distinct, but not independent of, neuropsychological functions such as episodic memory or executive function. For example, verbal comprehension and perceptual reasoning are related to a number of social cognitive measures (Henry, Von Hippel, Molenberghs, Lee, & Sachdev, 2016), and if an individual has a primary memory or executive functioning impairment, then aspects of social cognition may also be affected (Pinkham & Penn, 2006).

There is now a significant literature across all the major psychiatric diagnoses, neurodevelopmental disorders and neurodegenerative diseases, indicating that social cognitive impairments are apparent, and quite pronounced, across these conditions (Cotter et al., 2018). As such, social cognitive dysfunction has been proposed as a transdiagnostic clinical marker of psychopathology and neurological disease (Cotter et al., 2018; Henry et al., 2016).

1.4.1. Emotion Recognition

Emotion recognition is defined as the ability to identify others' emotions through facial expressions, vocal prosody and body language (Pinkham et al., 2014). In addition, emotion processing refers to the ability to recognise and regulate one's own emotions, but is measured distinctly, and so will be considered here as a separate domain of psychological function from emotion recognition. However, it should be noted that the ability to identify others emotion and the ability to label and regulate one's own emotions are not mutually exclusive. A number of assessment methods have been developed to determine an individual's emotion recognition capacity (see **Table 1.3.** for description of common tests), which have their foundation in the work by Paul Ekman (Ekman & Friesen, 1976) who was inspired by Darwin's proposition of universal facial expressions of emotion (Darwin, 1872). Ekman and colleagues developed a set of standardised pictures of individuals expressing six basic emotions of happiness, sadness, anger, disgust, fear and surprise (Ekman & Friesen, 1976). Basic emotion is distinguished from complex emotion in that each basic emotion is a discrete category which can be observed and expressed alone, whereas a complex emotion may be a combination of basic emotions to create a new category (e.g. disgust and anger to form contempt). Since this early work, many variations on the presentation of facial emotional expressions have been developed (e.g. incremental

intensity of emotion, obscuring particular parts of the face, inverting faces etc), which have led to further understanding of the psychological and neurobiological processes underpinning facial emotion recognition. In addition to interpreting facial expressions, there has been some work in understanding emotion recognition of vocal prosody; variations in speech such as pitch, contour, duration and intensity, which convey particular emotional states (Besson, Magne, & Schön, 2002).

1.4.2. Theory of Mind

Theory of Mind (ToM) is the ability to infer more complex mental states in others such as beliefs, intentions, desires, needs and goals (Green, Horan, & Lee, 2015), and is sometimes referred to as cognitive empathy, mental state attribution or mentalizing (Fonagy, 2018; Pinkham et al., 2014). In the literature, ToM is sometimes separated into cognitive and affective ToM (Arioli, Crespi, & Canessa, 2018). However, the degree to which these represent distinct constructs is unclear. The pioneering work by Simon Baron-Cohen and colleagues with individuals with Autism Spectrum Disorders, spearheaded our understanding of ToM in the broader context, and introduced assessment methods to determine an individual's ToM capacity (Baron-Cohen, Leslie, & Frith, 1985). Since then, a number of assessments of ToM have been introduced (see **Table 1.3.** for details).

1.4.3. Social Perception

Social perception includes social context processing and social knowledge, and involves the capacity to understand social rules, roles and goals, and how these influence how the self and others behave (Pinkham et al., 2014). Social processing

and social knowledge are commonly assessed independently using a number of different measures (see **Table 1.3.** for details).

1.4.4. Attributional Bias

Attributional bias refers to the tendency to utilise particular cognitive processing patterns to make sense of social events and interactions (Pinkham et al., 2014). A number of attributional biases have been discussed in the literature in both clinical and non-clinical populations. Indeed, all humans are vulnerable to these cognitive biases to varying degrees. However, when particular biases become the default cognitive process or the common mode in which an individual makes sense of the social world, problematic psychological and behavioural consequences may ensue. The key biases that have received the most attention in psychosis are the 'jumping to conclusions bias,' 'hostile attribution bias,' 'externalizing bias' and 'personalising bias' (Bentall et al., 2009; Brookwell, Bentall, & Varese, 2013; Combs, Penn, Wicher, & Waldheter, 2007; Garety et al., 2011; So, Tang, & Leung, 2015; Thompson, Papas, Bartholomeusz, Nelson, & Yung, 2013). The jumping to conclusions bias refers to a tendency to draw conclusions in social situations based on limited information (Garety et al., 2011). The hostile attribution bias refers to the tendency to interpret ambiguous actions of others as indicative of hostile behaviour towards the self (Combs et al., 2007). The externalizing bias refers to the tendency to make external attributions for negative events (Brookwell et al., 2013), and the personalising bias refers to the tendency to blame other individuals for negative events (So et al., 2015). As noted above, social cognition and neuropsychological functions are not entirely independent of one another. Indeed, there is evidence that executive functioning impairments may underpin the Attributional Biases exhibited by individuals with psychosis (Berry, Bucci,

Kinderman, Emsley, & Corcoran, 2015). A number of measures have been developed to determine attributional biases an individual may exhibit (see **Table 1.3.** for details).

Table 1.3. Common social cognitive assessments used to determine performance on each subdomain

Social Cognitive Domain	Social Cognitive Test	Test description	Outcome Measures	Reference
Emotion Recognition	Bell Lysaker Emotion Recognition Task (BLERT)	Participants view 21, 10 sec video clips in which a male actor expressed emotions through facial expressions, upper body movements and vocal tone. Participant chooses one of seven emotions that they think the man is expressing; happiness, sadness, fear, disgust, surprise, anger, or no emotion	Total number correct	Bryson, Bell, & Lysaker, (1997)
	Penn Emotion Recognition Task (ER40)	Participants are presented with 40 colour photos of static faces expressing 4 emotions; happiness, sadness, anger, fear or neutral. Faces are balanced on gender, age and ethnicity. The stimuli-set includes four high and four low intensity expressions. Participants choose which emotion they think is correct.	Total number correct	Christian G Kohler et al., (2003)
	Ekman 60 faces	Participants are presented with 60 black and white photos of static faces expressing one of 6 emotions; anger, disgust fear, happiness, sadness, surprise or neutral.	Total number correct out of 60 Total correct for each emotion out of 10.	Ekman & Friesen, (1976)
Theory of Mind:	Reading the Mind in the Eyes Task	Participant is presented with 36 images of a person's eye s and a choice of four mental states. Participant choses one of four mental states	Total number correct	Baron-Cohen, Wheelwright, Hill, Raste, & Plumb, (2001)

Social Cognitive Domain	Social Cognitive Test	Test description	Outcome Measures	Reference
	The Awareness of Social Inferences Test (TASIT)	Participates are presented with video clips of every day social interactions and answer four standard questions for each video that seek to determine the individuals understanding of th e beliefs, intentions and meaning of the actors in the clip. Note: The TASIT also consists of an emotion recognition condition which tests the ability of an individual to identify six basic emotions; happiness, surprise, anger, sadness, fear and disgust, and their ability to discriminate these from neutral expressions.	Form B and C, average number correct.	McDonald, Flanagan, Rollins, & Kinch, (2003)
	Hinting Task	Participants are presented with 10 short passages in which 2 characters interact. One character drops a hint at the end of each passage indicating what their true intention is. Participants must provide an account of the characters true intent. A second hint is provided if participants first answer is incorrect.	Total number correct (0-20)	Corcoran, Mercer, & Frith, (1995)

Social Cognitive Domain	Social Cognitive Test	Test description	Outcome Measures	Reference
	Faux-Pas Recognition Test	Participants are read 20 short stories; 10 Faux Pas Stories and 10 control stories. After each, they are asked if anyone in the story said something they shouldn't have or said something socially awkward. Participants are also asked questions to assess their understanding of a characters intentions, beliefs and to assess the participants capacity for empathy.	A ratio score of % correct for Faux Pas and Control stories is calculated for each component; control questions score; Faux Pas Detection Score; Understanding Inappropriateness score; Intentions score; Belief score; Empathy score.	Stone, Baron-Cohen, & Knight, (1998)
Social Perception	Situational Feature Recognition Test (SFRT)	Participants are presented with 9 different situations, such as 'swinging a bat' and a list of 14 actions and 14 goals. Participants must choose the actions and goals that are most relevant to the situation. Participants also rate how familiar or unfamiliar each situation is on a 7-point scale (1=extremely familiar to 7=extremely unfamiliar)	Correct identification rate of; concrete/abstract features in familiar /unfamiliar situations; false positive rate of concrete/abstract features in familiar /unfamiliar situations	Corrigan & Green, (1993)
	Relationships Across Domains (RAD).	Participants are presented with 25 vignettes of a male-female dyad interacting. Following each vignette, 3 yes or no questions are completed in which the participant has to determine if a stated behaviour in the question is likely to be true based on their knowledge of the dyad from the vignette.	Total % Correct	Sergi et al., (2009)

Social Cognitive Domain	Social Cognitive Test	Test description	Outcome Measures	Reference
Attributional style:	Ambiguous Intentions and Hostility Questionnaire (AIHQ)	Participants are presented with 5 hypothetical, negative situations with ambiguous causes. Participants are asked to imagine this situation occurring for them and record a reason why it has occurred. Participants also rate on Likert scales how angry the situation made the, if the other person in the scenario did it on purpose and how much they blame the other person. Participants also indicate how they would respond to the situation.	A hostility bias and aggression bias is determined by independent raters coding open ended responses. A Blame Score is calculated from Likert scale questions	Combs et al., (2007)
	Attributional Style Questionnaire	Participants are presented with 12 hypothetical situations and are asked to imagine that this has occurred for them. Participants then record what they believe was the major cause o of the situation. Participants then answer three questions with a 7-point Likert scale response, about the cause of the situation, and answer one question with a 7-point Likert scale response about the situation.	Composite scores for Internality, Stability and Globality attributional styles are calculated	Peterson et al., (1982)
	Internal, Personal, Situational Attributions Questionnaire	Participants are presented with a 32-item questionnaire which describes 16 positive and 16 negative social situations in the second person. Participants are required to write down the one most likely cause of the situation. Participants then categorise the cause as being either internal (relating to the respondent), personal (relating to another person) or situational.	Externalizing Bias score Personalizing Bias score	Kinderman & Bentall, (1996)

1.5. Social Cognition and Psychosis

Social cognitive functioning in psychotic disorders has been investigated most extensively in individuals with a diagnosis of schizophrenia. Meta-analytic studies have demonstrated that individuals with longer duration schizophrenia exhibit significant impairments in social cognition (Bora, Yucel, & Pantelis, 2009; Kohler, Walker, Martin, Healey, & Moberg, 2010; Savla, Vella, Armstrong, Penn, & Twamley, 2012; Sprong, Schothorst, Vos, Hox, & Van Engeland, 2007). For example, it has been reported that individuals with a diagnosis of schizophrenia have reduced ability in identifying (Cohens d = −0.89) and differentiating (d = −1.09) facial emotional expressions in comparison to control participants (Kohler et al., 2010). Similar effect size differences have been reported for ToM (Hedges g=0.96) and social perception (g=1.04) in individuals with a diagnosis of schizophrenia (Savla et al., 2012). Indeed the central importance of social cognition in schizophrenia was recognised by the National Institute of Mental Health's, Measurement and Treatment Research to Improve Cognition in Schizophrenia (MATRICS; (Marder & Fenton, 2004) initiative, which included the Mayer-Salovey-Caruso Emotional Intelligence Test in the MATRICS Consensus Cognitive Battery (August, Kiwanuka, McMahon, & Gold, 2012). The focus of this initiative is to better characterise the nature of neuropsychological and social cognitive deficits in schizophrenia and to develop treatment approaches to alleviate these deficits. The hypothesis driving this work is that alleviating neuropsychological and social cognitive deficits will produce better social functioning outcomes with these patients (Marder & Fenton, 2004). Indeed, a meta-analysis of the literature reported that social cognitive performance predicts real world outcomes in longer term schizophrenia, such as community functioning (Fett, Viechtbauer, Penn, van Os, & Krabbendam, 2011)

1.5.1. Social Cognition and Social Functioning in ARMS and FEP

Following the recognition that social cognitive function is a key factor in the course of longer duration schizophrenia, there has been increasing interest in social cognitive impairment as an indicator of vulnerability to developing psychosis, and as potential early intervention treatment target in ARMS and FEP (Glenthøj, Hjorthøj, Kristensen, Davidson, & Nordentoft, 2017). There has been comparatively less investigation into social cognitive function in ARMS and FEP. However, this is a burgeoning literature with new developments rapidly emerging. Recent meta-analytic studies have demonstrated that ARMS individuals exhibit impairments on emotion recognition tasks (d= -0.46) and ToM tasks (d= -0.44) with medium effect size differences from controls (Cotter et al., 2015; Van Donkersgoed, Wunderink, Nieboer, Aleman, & Pijnenborg, 2015). In FEP, significant impairments on emotion recognition (d= -0.88; (Barkl, Lah, Harris, & Williams, 2014) and ToM (d= -1.0; (Bora & Pantelis, 2013) have been reported, with large effect sizes that are comparable to those found in longer duration schizophrenia. The degree of impairment in social perception and the difference between controls and ARMS / FEP on attributional biases has not been subject to meta-analytic study due to a lack of studies into these two social cognitive domains. Nonetheless, individual studies have demonstrated that ARMS and FEP participants exhibit impaired social perception ability and score higher on measures of attributional biases (see **Chapter 3** for review of studies).

Taken together, the empirical evidence suggests that social cognitive difficulties are apparent across the psychosis continuum. Of note is the fact that the effect sizes are much greater for FEP and longer duration schizophrenia than those

identified as ARMS. This likely reflects the impact of increased psychotic symptomatology, although the mechanisms involved unclear at present.

Similar to studies in longer duration schizophrenia, there is empirical evidence linking social cognitive performance and social functioning in ARMS and FEP (see **Chapter 3** for review of studies). However, this evidence has not yet been meta-analysed.

1.6. Psychological Models to Understand the Link Between Social Cognition, Psychotic Symptoms and Social Functioning

1.6.1. Cognitive Models of Positive Psychotic Symptoms

Two commonly utilised psychological models of psychosis were introduced by Garety and colleagues (Garety, Kuipers, Fowler, Freeman, & Bebbington, 2001) and Morrison and colleagues (Morrison, 2001). Each model draws on a stress-vulnerability framework to explain how hallucinations and delusions may develop and become pathological in some vulnerable individuals. For example, if an individual has a tendency to utilise the jumping to conclusions bias, they rapidly interpret ambiguous internal or external stimuli, coming to a decision on its meaning prior to considering disconfirmatory evidence (Garety et al., 2001). For example, in the classic "beads task" individuals with delusions tend to come to a decision on the basis of less information than those without delusions (Ross, McKay, Coltheart, & Langdon, 2015). As such, the individual may draw seemingly bizarre or unusual conclusions that do not represent what others view as reality. Thus, delusional beliefs about the world and others may be formed and interfere with the individuals functioning in various ways. In line with this, another attributional bias linked to the development of delusional beliefs is the externalizing bias (Bentall, Kinderman, & Kaney, 1994).

Similarly, with regards to hallucinations, normal intrusions into awareness by thoughts, or auditory, visual, olfactory, gustatory or somatic sensations, are misinterpreted, or appraised, in such a way that the individual concludes they are indicative of "going crazy" or "losing my mind." The misinterpretation or negative appraisal of stimuli leads to increased distress (anxiety, worry etc.), which increases the occurrence of similar intrusions (thoughts, bodily sensations), which are further misinterpreted (Morrison, 2001). This vicious cycle continues and further exacerbates the experience of 'hallucinations.' Of relevance here, a key element of the Garety and Morrison cognitive model of positive symptoms, is that individuals will tend to withdraw socially as a coping strategy for delusions and hallucinations (Garety et al., 2001; Morrison, 2001). This coping mechanism, although successful in reducing distress associated with social activities in the short term, perpetuates the problem as the individual has less opportunity to be exposed to disconfirmatory evidence of their delusions or hallucinations.

Taken together, it can be seen that an attributional biases and cognitive misinterpretations of anomalous stimuli may contribute to the development and maintenance of positive symptoms of psychosis leading to a reduction in social functioning as a coping response.

1.6.2. Cognitive Model of Negative Psychotic Symptoms

Beck and colleagues proposed a cognitive model of negative symptoms in psychosis (Beck, Rector, Stolar, & Grant, 2011; Rector, Beck, & Stolar, 2005). As with the models of positive symptoms described above, the cognitive model of negative symptoms draws on a stress vulnerability model to explain how negative symptoms of psychosis including affective flattening, alogia, volition and

anhedonia, may be influenced by particular negative beliefs and negative expectancies that may become activated in individuals vulnerable to psychosis (Rector et al., 2005). This model proposes that these negative beliefs and expectancies can influence negative symptoms independently of the secondary effects of positive symptoms. The problematic cognitive appraisals associated with negative symptoms in psychosis involve low expectancies for pleasure, success, and acceptance, and the perception of limited personal resources to manage social activities.

Low expectancy of pleasure in psychosis is characterised by thoughts such as "what's the point?" or "it's not worth it in the end" when provided with the opportunity to partake in pleasurable activities (Rector et al., 2005). As such, participants with psychosis predict less pleasure and positive emotion of engaging in pleasurable activities. However, when engaged in such activities they do report experiencing positive emotion, indicating that the motivational process to engage in activities is affected (Germans & Kring, 2000).

Low expectancy for success in psychosis is characterised by individuals expecting that they will fail to meet a given goal which leads to impaired motivation and action (Rector et al., 2005). For example, an individual with psychosis may avoid performance based tasks such as making an appointment to see their doctor as they have the thought "I will sound odd on the phone or will not be able to make it clear why I am calling." However, it should be noted that individuals with psychosis do exhibit cognitive difficulties that may impact their performance in various ways. However, it appears these cognitive difficulties do not account for all aspects of impaired goal directed action in psychosis and 'defeatist' beliefs may become reinforced in the individual when they do not meet there own or others expectations, and this may strengthen cognitive appraisals that they will not succeed (Beck et al., 2011).

Low expectancies for acceptance refers to the stigma attached to a diagnosis of a psychotic disorder, in addition to repeated failures to meet self-imposed or externally imposed standards and goals (Beck et al., 2011; Rector et al., 2005). Many individuals with psychosis may develop beliefs that they are worthless or incompetent and their perceived self-efficacy may be reduced, leading to a conclusion of "what's the point?" (Beck & Rector, 2002), and withdrawal from pursuing various activities.

Finally, perception of limited resources refers to a negative cognitive appraisal in which the individual with psychosis will have thoughts such as "it's too much" or "it will be too much for me to handle" when presented with the opportunity to engage in pleasurable or meaningful activities (Rector et al., 2005). In some cases, this may be related to neuropsychological difficulties such as impaired processing speed (Basso, Nasrallah, Olson, & Bornstein, 1998). However, within the cognitive model of negative symptoms, cognitive appraisals of having limited resources to manage a given situation are viewed as an excessive cognitive distortion in which the individual with psychosis, in reality, has greater resources to manage than they perceive (Rector et al., 2005).

Taken together, the influence of negative expectancy appraisals on the expression of negative symptoms in psychosis may lead to social functioning difficulties.

1.6.3. The Theory of Mind Model of Psychosis

The role of ToM difficulties in psychosis has been recognised for over two decades. Frith (1992) first proposed that schizophrenia may be viewed as a disorder of 'self-awareness.' In this view, three key factors combine to produce psychosis;

first is that there is a deficit in willed action; second, there is a dysfunction in the ability to self-monitor (thoughts, emotions, sensory stimuli); and third, there is a deficit in monitoring the intentions of others (Frith, 1992). A deficit in willed action is proposed to produce apathy and bizarre behaviour due to the individual having reduced awareness of their own intentions and difficulties recognizing their behaviour as a result of their willed action (Harrington, Siegert, & McClure, 2005). Reduced ability in self-monitoring thoughts, or sensory stimuli is proposed to result in the individual with psychosis misinterpreting these experiences as being external and being perceived as auditory/sensory hallucinations. Finally, the ability to accurately monitor the intentions of others may lead to erroneous interpretation of others thoughts, beliefs, intentions and desires, leading to delusional thinking in reference to others, and disorganised communication which heavily relies on the ability to interpret and predict the mind of others (Frith, 1992; Frith, 2014; Harrington et al., 2005).

1.6.4. Conceptual Framework Linking Social Cognition and Social Functioning

As noted above, psychological models of positive and negative symptoms of psychosis have helped to understand how such symptoms may develop and be maintained. Each model describes that social functioning problems may ensue due to attributional biases, negative appraisals of ambiguous internal or external stimuli, ToM deficits leading to impaired self and other monitoring, or negative expectancy appraisals of pleasure, success and acceptance. However, how social functioning difficulties occur in psychosis is conceptualised differently in each model. The cognitive models of positive symptoms suggest that social withdrawal is a coping mechanism as interacting with others is problematic when difficult experiences of hallucinations are present, or if a delusional

belief centres on others being the source of danger or threat (Garety et al., 2001; Morrison, 2001). On the other hand, the cognitive model of negative symptoms indicates that negative expectancy appraisals directly influence the occurrence of negative symptoms (Beck et al., 2011; Rector et al., 2005). An increase in negative symptoms may result in reduced social functioning through difficulties in interacting with others due to flattening of affect, low expectancies of pleasure derived from social interactions, low expectancy of ability to successfully complete social activities and avoidance of others due to reduced expectancy that others will accept that the individual has psychosis (Beck et al., 2011; Rector et al., 2005).

The role of attributional biases and negative appraisals has been clearly outlined in each model. ToM difficulties have also been described above as regards to self and other monitoring difficulties may result in aberrant perceptual processing and social communication difficulties due to reduced ability to infer others intentions, desires, beliefs and emotional state. The models discussed above do not explicitly discuss the role of emotion recognition and social perception in psychosis. However, a basic model has been described in which difficulties with recognising others emotions or inferring social norms, may lead to distress and difficulties in navigating the social world, or indeed, a fear or concern of others intentions and withdrawal from social activities (Couture, Penn, & Roberts, 2006).

This basic model conceptualising the interrelationship between social cognition and social functioning, in the context of positive symptoms is presented below (see **Figure 1.2.**). As is shown in **Figure 1.2.**, emotion recognition and social perception are considered to be more automatic and less deliberative responses to social stimuli than ToM and attributional biases, and so occur earlier in the process of exposure to experience, appraisal and subsequent behavioural

response (Couture et al., 2006). In this schematic, social cognitive difficulties may interact with the experience of hallucinations and/or delusions to impact on the individual's ability to accurately make sense of their social world, leading to social withdrawal as a coping response.

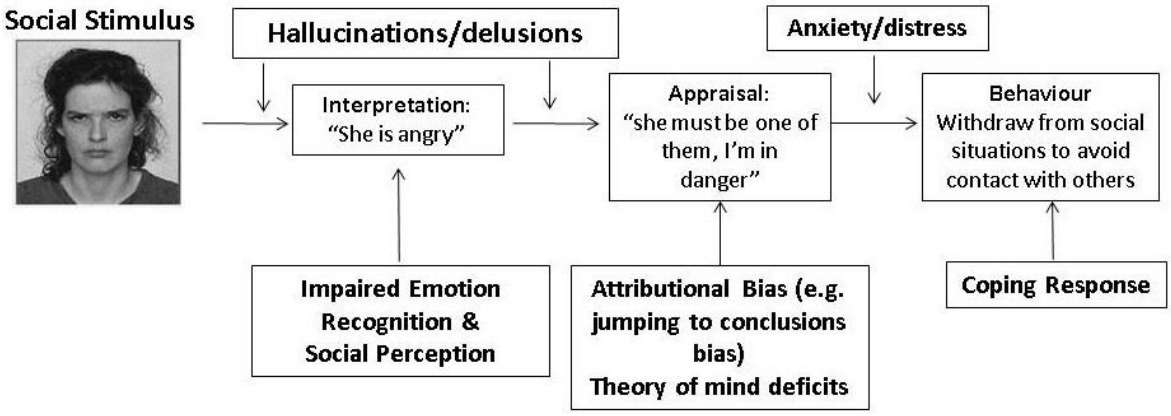

Figure 1.2. Schematic outlining how social cognitive impairment may interact with positive psychotic symptoms and lead to social withdrawal. Adapted from Couture et al., (2006).

In **Figure 1.3**. below a schematic indicating the interactions between social cognition, negative symptoms and social functioning is presented. Within this framework, negative appraisals of engaging in social activities may lead to reduced engagement with such activities and to the production of negative symptoms. In the conceptualisation below, negative cognitive appraisals, avoidance of social engagement and negative symptoms affect one another in a bidirectional fashion. Emotion recognition, ToM and social perception difficulties are not specifically described in the cognitive model of negative symptoms. However, below, we include these social cognitive functions as being involved in the individual's negative appraisals of oneself and others. These social cognitive factors may thus contribute to the expression of negative symptoms, but may also be affected by negative symptomatology.

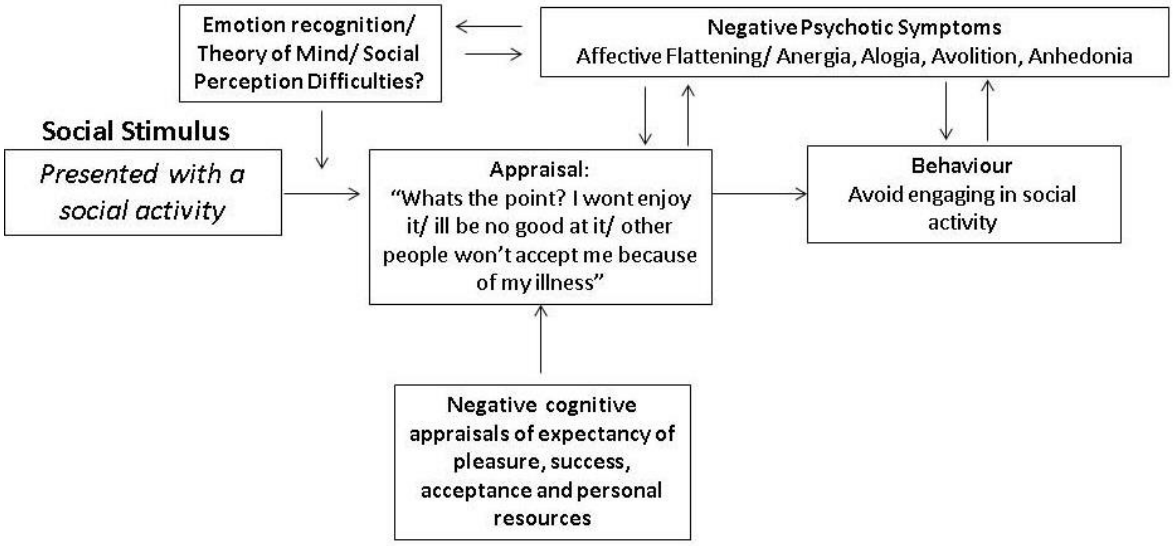

Figure 1.3. Schematic representation outlining the interactions between negative appraisals and other social cognitive functions, negative symptoms and reduced social engagement in psychosis.

1.7. Psychological Interventions for Improving Social Cognition and Social Functioning In Psychosis

1.7.1. Social Cognition

In light of the fact that social cognitive impairments are a feature of the psychosis continuum and may be related to the development and maintenance of positive and negative symptoms, there has been a focus on targeting social cognitive performance to improve outcomes (Grant, Lawrence, Preti, Wykes, & Cella, 2017). In a meta-analysis of studies targeting social cognitive outcomes in mostly longer duration schizophrenia, post-treatment moderate to large effect sizes were identified for emotion recognition ability (identification d= 0.71, discrimination d=1.01) and ToM (d= 0.46; (Kurtz & Richardson, 2011). Fewer studies have targeted social perception or attributional biases in schizophrenia, however, there is some evidence that interventions targeting these social cognitive domains can improve performance (see Grant et al., (2017) for review). Grant and colleagues, in their systematic review of the literature concluded that there was

little evidence that improving social cognition led to better functional outcomes in longer duration schizophrenia (Grant et al., 2017). However, in an independent meta-analytic study, a significant improvement in facial affect recognition was associated with large improvements in social functioning (g= 0.98; Bordon, O'Rourke, & Hutton, 2017).

Taken together, there is some evidence that interventions aimed at improving social cognitive deficits in longer duration schizophrenia are effective and may be associated with improved social functioning. The effects of such interventions in ARMS and FEP populations has received comparatively less investigation. However, some studies have focused on social cognitive function as the target of psychological intervention and these will be reviewed in **Chapter 2**. The degree to which targeting social cognition may lead to a positive outcome in psychotic symptoms and social functioning in ARMS and FEP is unclear at present. However, as an initial step in determining the efficacy of such interventions, there is a need for a systematic analysis of the empirical literature to determine the strength of the relationship between social cognitive performance, psychotic symptoms and social functioning in ARMS and FEP participants (see **Chapter 3**).

1.7.2. Social Functioning

An alternative to targeting social cognition to improve functional outcomes in psychotic disorders is to target social functioning directly. However, few psychological interventions have been developed which specifically target social functioning. Social functioning is a common outcome measure in psychological intervention studies in psychotic disorders, but it is unclear which psychological interventions confer the greatest benefits. A specified approach- Social Recovery CBT- has been introduced, and has demonstrated good outcomes in FEP (Fowler et al., 2018; Fowler et al., 2009). A recent meta-analytic study, published during the course of this thesis, concluded that no

psychological interventions were effective in improving social functioning in ARMS participants (Devoe et al., 2018). However, there are some methodological considerations when interpreting these findings (see **Chapter 2**). Moreover, the evidence that psychological interventions improve social functioning in FEP has not yet been subject to a systematic analysis.

Taken together, individual studies suggest that psychological interventions can improve social functioning in FEP. However, the evidence in ARMS populations is conflicted at present with individual studies indicating a beneficial outcome (see **Chapter 2** for review of studies) and one meta-analysis suggesting no beneficial effect. To date, no study has systematically reviewed the evidence base to determine if psychological interventions can improve social functioning in ARMS and FEP combined. As such, there a clear need for a synthesis of the current evidence, comparing and contrasting the evidence in ARMS and FEP.

1.8. Primary aims and hypotheses of thesis:

Drawing on the literature reviewed above, which indicates an important interplay between social cognitive performance, psychotic symptomatology and social functioning in ARMS individuals, and those who have experienced a FEP, this thesis has two main aims to answer the following research questions:

Aim 1: Do psychological interventions improve social functioning in ARMS and FEP participants? Is there a difference between intervention approaches, and do these have a differential effect at different stages of psychotic illness (i.e. ARMS versus FEP)?

We aimed to conduct a comprehensive systematic review of the literature to determine which psychological interventions are most effective in improving social functioning in ARMS and FEP participants. In addition, we aimed to compare and contrast our findings to determine if there are apparent differences in the effectiveness of specific psychological interventions (e.g. CBT or cognitive remediation). We also aimed to compare and contrast the effectiveness of psychological interventions in improving social functioning between ARMS and FEP participants.

Aim 2: Is overall social cognitive performance, and performance on specific subdomains, related to psychotic symptomatology and social functioning in ARMS and FEP participants? Is there a difference in the strength and/or direction of relationship between social cognitive performance, psychotic symptoms and social functioning at different stages of psychotic illness?

We aimed to conduct a comprehensive review and meta-analysis of the literature to determine the strength and direction of relationship between performance on social cognitive subdomains (emotion recognition, ToM, social perception, attributional biases), psychotic symptomatology (positive and negative symptoms) and social functioning, in ARMS and FEP participants. In addition, we aimed to conduct a quantitative between group analysis (ARMS versus FEP) of this data to identify differences in the strength of relationship between overall social cognitive performance, performance on specific subdomains, psychotic symptomatology and social functioning.

Chapter 2

Psychological interventions for improving social functioning in at-risk mental state and first episode psychosis: a systematic review

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2.1. Abstract

Reduced social functioning is a key component of the at-risk mental state (ARMS) and first episode psychosis (FEP). However, to date, the primary outcome measure in most randomised controlled trials (RCTs) of psychological interventions with these populations has been a change in psychotic symptomatology. Considering the central role of social functioning in the course and development of psychosis, it is of importance to understand which psychological interventions are effective in improving social functioning in ARMS and FEP populations. An extensive literature search of four databases was conducted. Twenty-two studies were included that provided a social functioning outcome measure and investigated the efficacy of structured psychological therapy interventions. Twenty-one were RCTs and one a non-randomised controlled trial. Overall, there is some evidence from individual trials that psychological interventions are efficacious in improving social functioning in ARMS and FEP participants. CBT has demonstrated efficacy in FEP, whilst to date, there is no evidence that CBT is efficacious in improving social functioning in ARMS populations. Multicomponent and service interventions have reported positive effects for social functioning in FEP participants. Overall methodological quality was variable and there was a high risk of bias in many domains for many of the included studies. As such, these conclusions should be interpreted with caution. A small number of methodologically rigorous trials have demonstrated that psychological therapy can improve social functioning in FEP. The current evidence base for ARMS populations is limited. Future trials are needed to determine the efficacy of CBT and CRT in ARMS and FEP populations.

2.2. Introduction

Social functioning is a broad outcome referring to an individual's ability to engage in meaningful activities such as work and social activities, and their ability to develop and maintain interpersonal relationships (Couture et al., 2007). Reduced social functioning is a key characteristic of the psychosis continuum (Hodgekins et al., 2015), and a decline in social functioning is a diagnostic requirement to identify individuals as at-risk mental state (ARMS) for developing psychosis (Addington et al., 2008; Jang et al., 2011). To date, the primary outcome measure in most randomised controlled trials (RCTs) of psychological interventions in ARMS or FEP populations has been a change in psychotic symptomatology, with social functioning largely included as a secondary outcome measure. However, there is increasing interest in targeting social function and improving social recovery in individuals who have experienced psychosis (Devoe et al., 2018; Fowler et al., 2010; Hodgekins et al., 2015). In a prospective longitudinal study conducted over a 20 year period, poor social functioning at baseline was shown to predict later negative functional outcomes in individuals with psychosis, including reduced educational achievement, unemployment and the ability to live independently (Velthorst et al., 2017). There is some variability in the social recovery profiles within cohorts of individuals who have experienced a FEP. For example, the majority of individuals who enter a specialised early intervention service (EI) with low social functioning, appear to remain at this level of functioning (66%), whilst a smaller proportion who enter with moderate functioning show improved recovery (27%) and those with high functioning show decreased social recovery rates (7%) (Hodgekins et al., 2015). These findings suggest that targeted interventions for those who enter EI services with low levels of social functioning are required to

improve social recovery.

In ARMS populations poor social functioning is consistently demonstrated as a common impairment, along with difficulties with neuropsychological functioning (Cornblatt et al., 2011; Fusar-Poli, Deste, et al., 2012; Seidman et al., 2010). Moreover, low social functioning is a key variable in predicting later transition to psychosis in ARMS (Addington et al., 2017; Cornblatt et al., 2011).

Considering the importance of social functioning in the course of illness in psychosis, it is pertinent to determine which interventions are most effective in improving social recovery in ARMS and FEP. As noted above, the majority of studies do not assign social functioning as a primary outcome measure. However, a recent well conducted RCT utilising social recovery focused CBT demonstrated a significant benefit of this targeted intervention for social functioning in individuals with FEP (Fowler et al., 2018). However, it is unclear the extent to which other psychological interventions produce positive social functioning outcomes in FEP participants.

A recent meta-analysis has addressed this question in youth at risk of developing psychosis (Devoe et al., 2018). The authors of this study concluded that CBT or cognitive remediation therapy (CRT) did not significantly improve social functioning in ARMS participants. However, considering the small number of studies included in this meta-analysis (Devoe et al., 2018), it seems premature to conclude that these interventions have no benefit in improving social functioning in ARMS. In addition, this meta-analysis did not include studies with individuals who have experienced a FEP. Considering the clinical staging model of psychosis (McGorry et al., 2006), it is of importance to compare the efficacy of treatments at different stages of illness, which may inform more targeted clinical intervention approaches.

Taken together, there is a clear need for a detailed analysis of the current evidence base for the efficacy of psychological therapies in improving social functioning in ARMS and FEP participants. As noted above, most studies do not assign social functioning as the primary outcome. As such, here we aim to assess the efficacy of psychological therapies in studies that do and do not assign social functioning as the primary outcome. Thus, this review has three main aims;

1. To determine the quantity and quality of evidence that psychological therapy improves social functioning in ARMS participants.
2. To determine the quantity and quality of evidence that psychological therapy can improve social functioning in FEP participants.
3. To compare and contrast the efficacy of specific psychological therapies in improving social functioning in ARMS and FEP participants.

2.3. Materials and Methods

2.3.1. Protocol

This systematic review was conducted in accordance with PRISMA guidelines and was pre-registered on the PROSPERO database of systematic reviews, number: CRD42018093769.

2.3.2. Search Strategy

A comprehensive search of the literature was conducted using the following databases: MEDLINE (Ovid), EMBASE (Ovid), CINAHL (EBSCO), and PsychINFO (EBSCO) from 1980 to June 2018. Search terms were: Ultra high risk for psychosis OR UHR OR clinical high risk of psychosis OR CHR OR at risk mental state* OR prodromal psychosis OR prodromal schizophrenia OR prodromal

phase OR prodrome OR prodromal stage OR prodromal symptoms AND first episode psychosis OR early psychosis OR FEP AND cognitive behaviour therapy OR CBT OR cognitive remediation OR cognitive remediation therapy OR behaviour therapy OR behavioral therapy OR psychological treatment OR psychological intervention OR psychological therapy OR cognitive enhancement OR cognitive enhancement therapy OR social skills OR social skills training OR social skills training intervention OR mindfulness OR mindfulness-based cognitive therapy OR mindfulness based stress reduction OR acceptance and commitment therapy AND social functioning OR social impairment OR social dysfunction OR social adjustment. Google Scholar was also searched to identify further articles. None were identified. Google Scholar alerts for the above search terms were set up to receive updates of new articles that may fit the inclusion criteria for this review. The search terms were chosen so as to capture a broad range of studies. As can be seen in **Figure 2.1.**, a large number of studies were excluded at the screening stage. The main exclusion reasons were studies that were non-interventional, drug trials, or studies investigating cross-sectional relationships between factors involved in the development/ progression of psychosis. Titles and abstracts were initially screened by the first author using Covidence systematic review software. Full text articles were screened by two reviewers (PK, JH) for eligibility for inclusion. Full text screening for eligibility was carried out by two independent reviewers (PK, JH) and discrepancies discussed to come to a final decision.

2.4. Selection Criteria

Studies were included in this systematic review based on the following inclusion/exclusion criteria:

Inclusion Criteria:

1. Primary research including randomised and non-randomised controlled trials (double or single blind); open label trials, pragmatic trials, pilot trials.
2. Participant age range 16-65 years old;
3. Male or female;
4. Participants identified as being at-risk for developing psychosis as defined by the Comprehensive Assessment of At Risk Mental States (CAARMS; (Yung et al., 2005), Criteria of Prodromal States (COPS) using the Structured Interview for Prodromal Symptoms (SIPS), Scale of Prodromal Symptoms (SOPS; (Miller et al., 2003) or Early Recognition Inventory (Häfner et al., 2004);
5. Participants identified as having experienced a FEP diagnosed according to DSM-IV, DSM-IV-TR, DSM-V, ICD-10 criteria. The duration of illness must have been ≤5 years and the first and only time an individual had a psychotic episode (McGorry et al., 2006).
6. Psychological intervention defined as structured, evidence-based, theory driven intervention to include CBT, CBT for psychosis (CBTp), CBT for ultra-high risk (CBTuhr), Acceptance and Commitment Therapy and other Mindfulness based therapies, and Cognitive Remediation Therapy. Other therapeutic approaches including psychodynamic therapy, group therapy, family therapy, social skills training were also considered. The focus of intervention did not have to be social functioning.
7. Control group to include, but not limited to; waiting list control, case management or ongoing pharmacotherapy.
8. Studies reporting a social functioning outcome measure (primary or secondary) to include, but not limited to, clinician rate, self-report and performance based measures; Social and Occupational Functioning Assessment Scale (SOFAS; Burns

& Patrick, 2007); Multnomah Community Ability Scale (MCAS; Barker, Barron, McFarland, & Bigelow, 1994); Global Assessment of Functioning- Functioning subscale (GAF-F; Burns & Patrick, 2007); Global Functioning: Social Scale (GFS; Barbara A. Cornblatt et al., 2007); Social Adjustment Scale-II (SAS-II; Schooler, Hogarty, & Weissman., 1979); Role Functioning Scale (RFS; Goodman, Sewell, Cooley, & Leavitt, 1993); Social Functioning Scale (SFS; Birchwood et al., 1990); Social Adjustment Scale-Self Report (SAS-SR; Weissman & Bothwell, 1976); and Social Skills Performance Assessment (Patterson, Moscona, McKibbin, Davidson, & Jeste, 2001). The above measures were identified in a pre-screen of the literature to identify commonly used social functioning measures.

Exclusion Criteria:

1. Drug only trials
2. Other interventions including occupational therapy, exercise and dietary studies
3. Studies comparing a psychological intervention to pharmacotherapy
4. Studies that include only a wider measure of functioning such as general functioning and quality of life. The rationale for this is that, although social functioning may be a component of these measures, they will capture a broader range of factors such as symptoms, which is not the focus of this systematic review.

2.4.1. Quality Assessment:

Studies were assessed for quality using the Cochrane risk of bias assessment tool (Higgins et al., 2011) in the Covidence systematic review program. A random sample of 25% of included papers were quality assessed by an independent reviewer to determine inter-rater reliability, which showed moderate agreement ($\kappa = 0.45$, $p<0.001$). Where

disagreements arose, the raters discussed the ratings in reference to the Cochrane risk of bias manual and a final decision was made on the appropriate rating. The remainder of quality assessments were carried out by the first author. The Cochrane risk of bias assessment tool covers the following seven domains to determine methodological quality of RCTs: random sequence generation (selection bias), allocation of concealment (selection bias), blinding of participants and personnel (performance bias), blinding of outcome assessment (detection bias), incomplete outcome data (attrition bias), selective reporting (reporting bias) and other sources of bias as determined by the investigator. For this review we considered other sources of bias to include; reporting of sample size calculations; if a study was adequately powered to detect changes in social functioning; general quality of reporting of methodology; control group not matched in terms of important variables such as 'time spent with clinician.'

2.4.2. Data Extraction

Data were extracted from each study based on (1) study characteristics (year of publication, country where study was conducted, sample size); (2) characteristics of ARMS, FEP and control participants (mean age, %female in sample); (3) clinical assessment/ diagnostic instruments used to identify ARMS participants and FEP participants; (4) The name of the psychological intervention; (5) Primary outcome measure; (6) % conversion to psychosis in ARMS studies; (7) social functioning measure; (8) details of the effect of the intervention on social functioning; (9) post intervention, between group effect sizes on social functioning. Effect sizes are expressed as Hedges g and were calculated using Comprehensive Meta-Analysis software (CMA; Borenstein, Hedges, Higgins, & Rothstein, 2013).

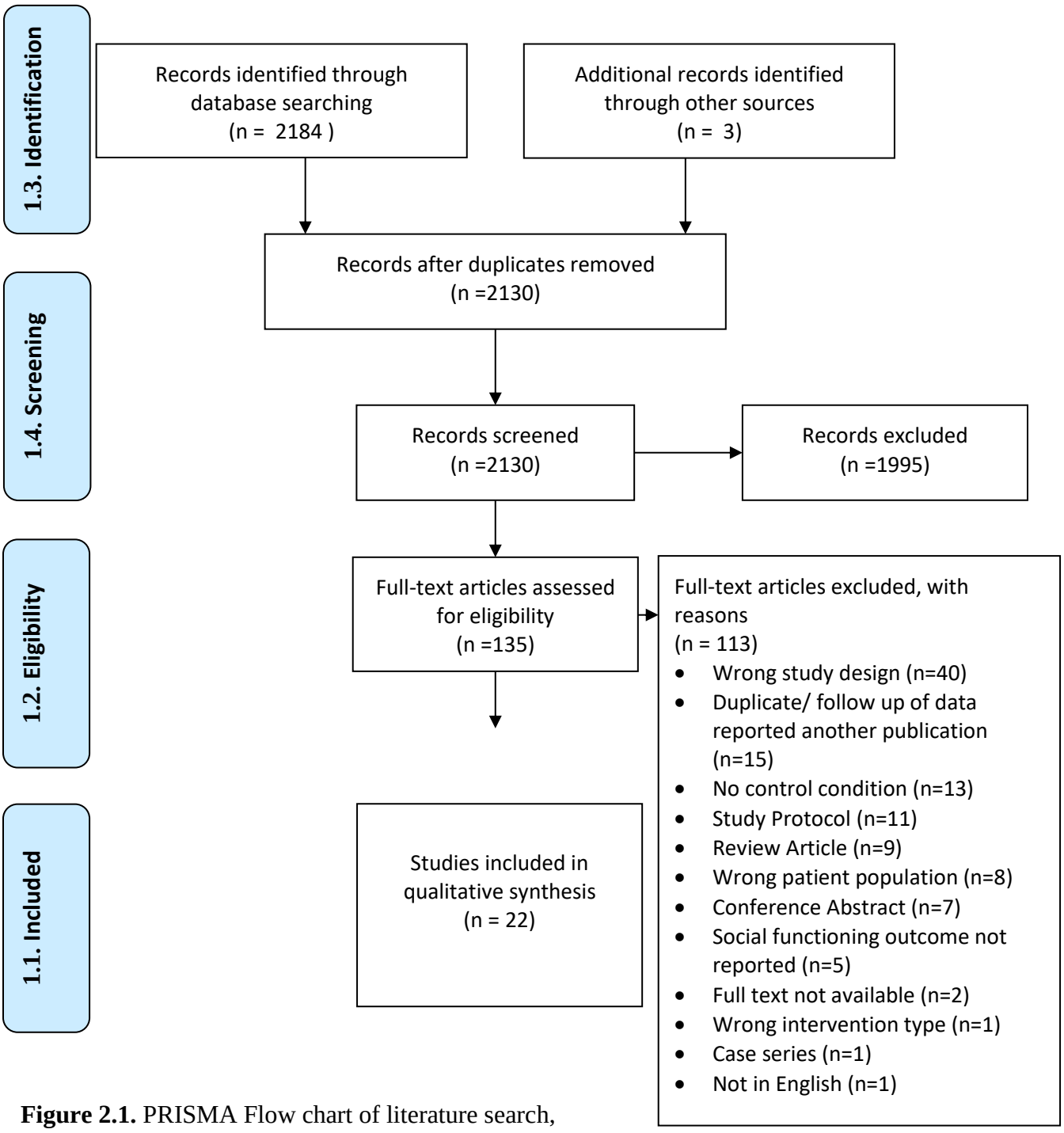

Figure 2.1. PRISMA Flow chart of literature search, study review and study inclusion.

2.5. Results

A total of 22 studies, published between 1980 and 2018, with 21 independent samples, were identified for inclusion within this review. Of these, seven studies with a population of individuals categorised as being ARMS for developing psychosis were included, and 15 studies included a sample of participants who had experienced a FEP. Sample sizes of studies ranged from 32 to 201 for ARMS studies and 40 to 557 for FEP studies. The overall sample size for included studies was 1947. Twenty-one of included studies used RCT methodology with one study a non-randomised clinical trial. Intervention length, and number of sessions varied widely between included studies (see **Table 2.1.** for details). Of the included studies with an ARMS population, four investigated the effects of CBT and three investigated the effects of cognitive remediation. Within included FEP studies, six investigated the effects of CBT, four the effects of cognitive remediation, two the effect of a service level intervention, one the effect of a psychodynamic therapy intervention, and two the effect of multicomponent therapeutic interventions (See **Table 2.2.** and **2.3.** for details).

Table 2.1. Details of each intervention used in included studies.

Study	Population	Primary Intervention	Length of Intervention	Maximum No. of Sessions/ Hours	Mean No. of Sessions/ Hours
Addington e al., (2011)	ARMS	CBT	6 months	20	12 sessions
Bechdolf et al., (2007)	ARMS	CBT	12 months	25 1:1/ 15 group/ 12 CRT	23.4 1:1 & group sessions
Ising et al., (2016)	ARMS	CBT	6 months	26 sessions	10 sessions
Van der Gaag et al., (2012)	ARMS	CBT	6 months	26 sessions	10 sessions
Choi et al., (2017)	ARMS	CRT	2 months	30 hours	30.32 hours
Holzer et al., (2014)	ARMS	CRT	2 months	12 hours	10 hours
Piskulic et al., (2015)	ARMS	CRT	3 months	40 hours	20 hours
Drake et al., (2014)	FEP	CBT	NS	six to thirty weeks	median 7 sessions
Fowler et al., (2009)	FEP	CBT	9 months	mean 12 sessions	mean 12 sessions
Fowler et al., (2018)	FEP	CBT	9 months	median 15 sessions	mean 16.49
Gleeson et al., (2013)	FEP	CBT	7 months	30 sessions	8.51 sessions
Jackson et al., (2008)	FEP	CBT	3.5 months	20 sessions	mean 9 sessions
Fernandez-Gonzalez et al., (2015)	FEP	CRT	NS	minimum 15 hours	30.7 hours
Fisher et al., (2015)	FEP	CRT	2 months	40 hours	34.65
Lee et al., (2013)	FEP	CRT	2.5 months	20 hours	NS
Wykes et al., (2007)	FEP	CRT	3 months	40 hours	NS
Harder et al., (2014)	FEP	Psychodynamic	NS	3 years	NS
Penn et al., (2011)	FEP	Multicomponent	NS	36 sessions	19 sessions
Peterson et al., (2005)	FEP	Multicomponent	24 months	NS	NS
Craig et al., (2014)	FEP	Service Level	12 months	3 day training on MI and IPS	NS
Garety et al., (2006)	FEP	Service Level	18 months	NS	NS

ARMS, at-risk mental state; CBT, Cognitive Behavioural Therapy; FEP, first episode psychosis; CRT, Cognitive Remediation Therapy; NS, not stated.

2.5.1. Outcome Measures

2.5.1.1. ***Summary of Outcome Measures***

Clinician rated social functioning measures were used by the following studies: Six studies used the SOFAS (Addington et al., 2011; Drake et al., 2014; Gleeson et al., 2013; Holzer et al., 2014; Ising et al., 2016; Jackson et al., 2008; van der Gaag et al., 2012), two studies the GAF-F (Harder, Koester, Valbak, & Rosenbaum, 2014; Petersen et al., 2005), two studies the GFS (Fisher et al., 2015; Piskulic, Barbato, Liu, & Addington, 2015), two studies used the Time Use Survey (TUS; Fowler et al., 2018; Fowler et al., 2009), one study the SAS-II (Bechdolf et al., 2007), and one study used the RFS (Penn et al., 2011).

Self-reported social functioning measures were used by the following studies: Three studies used the SFS (Addington et al., 2011; Fernandez-Gonzalo et al., 2015; Lee et al., 2013), one study the SAS-SR (Choi et al., 2017), and one study the Social Behaviour Schedule (SBS; Wykes et al., 2007). In addition, two studies measured post treatment increases in employment/vocational and educational outcomes (Craig et al., 2014; Garety et al., 2006).

The measures utilised by included studies vary on a number of dimensions and a decision as to which is most appropriate depends on the primary question and outcome in each study. As this review includes studies in which social functioning is and is not the primary outcome measure, a number of different outcome measures have been selected. For those studies in which social functioning is the primary outcome, a measure such as total time in employment/ vocational activity or education, and total hours of structured activity per week/ month as in the TUS, is likely to provide the most sensitivity to change and relate to real world meaningful changes for the individual.

2.5.2. Psychological Interventions:

French and Morrison (2004) Cognitive Therapy Manual: One study used the French and Morrison (2004) treatment protocol for ARMS participants (Addington & Piskulic, 2011). This protocol is formulation driven and based on a specific cognitive model of psychosis (Morrison, 2001). The intervention is limited to a maximum of 26 sessions over six months and incorporates modules on psychoeducation and normalisation, generating and testing alternative beliefs, identification and modification of safety behaviours, work on metacognitive beliefs, core beliefs and social isolation, and relapse prevention (French & Morrison, 2004). The primary outcome of studies using this manual included here was the number of ARMS participants that transitioned to psychosis.

CBT Ultra High Risk (CBTuhr): Of the included at risk studies, two publications of the same trial used a specific CBTuhr manual (Ising et al., 2016; van der Gaag et al., 2012). CBTuhr is based on the protocol outlined above (French & Morrison, 2004) with additional psychoeducational components on dopamine super sensitivity and how this relates to perception and thinking. Additional exercises are included to experience cognitive biases including jumping to conclusions, selective attention to threat, confirmatory bias, negative expectation bias and covariance bias (van der Gaag et al., 2012). CBTuhr consists of a maximum of 26 weekly sessions and includes behavioural goals focused on school and work attendance, fostering interactions with friends and relatives, and a reduction of cannabis use, where relevant. The primary outcome of studies using this manual included here was the number of ARMS participants that transitioned to psychosis.

Other CBT based interventions: One included study used a treatment manual developed by the investigators (Bechdolf et al., 2007). This protocol combined 25 individual therapy sessions consisting of psychoeducation, stress management, symptom management and crisis management; 15 group therapy sessions consisting of positive mood and enjoying, training social perception and skills, and mastering difficult situations; 12 sessions of cognitive remediation consisting of training of concentration, attention, vigilance and memory; 3 sessions of family psychoeducation (Bechdolf et al., 2007). The primary outcome measure in this study was a change on the SAS-II.

CBT for Psychosis (CBTp): One included study used a CBTp manual (Drake et al., 2014) although the authors do not reference a specific manual. Typically, CBTp consists of up to 26 sessions over six to nine months (Morrison, 2017) drawing on a cognitive model of psychosis (Garety et al., 2001; Morrison, 2001). Phases of the protocol include, engagement and formulation, normalisation, advantages and disadvantages of events, appraisals and responses, coping strategies, generating alternative explanations, role play/skills practice, safety behaviours and behavioural experiments, metacognitive beliefs and strategies, attentional strategies, imagery modification, core beliefs, schema change, and relapse prevention (Morrison, 2017). The included study in this review had a reduction in psychotic symptoms as the primary outcome measure following this intervention (Drake et al., 2014).

Social Recovery Therapy: Two included trials used Social Recovery Therapy (Fowler et al., 2018; Fowler et al., 2009) which is specifically designed to target social functioning impairments in psychosis. This intervention consists of three main phases. The first phase involves engagement, formulation, goal setting, value identification, motivational

assessment, and identification of how symptoms affect activity levels and setting day to day activity targets. Stage two involves preparatory work in beginning new activities by identifying pathways to achieve new activities. Cognitive strategies are included to promote agency and reduce hopelessness, and behavioural experiments are introduced. Phase three involves engagement in new activities and behavioural experiments to address specific problems related to engagement in activities (Fowler et al., 2018). Social Recovery therapists take an assertive outreach approach and visit participants at home or community settings (Fowler et al., 2018). The primary outcome measure in the studies by Fowler et al., (2009; 2018) was a change in structured activity on the TUS.

Active Cognitive Behaviour Therapy for Early Psychosis (ACE): One included study used ACE as an intervention (Jackson et al., 2008) which consists of a maximum of 20 sessions over a 14 week period (Bendall, Killackey, Marois, & Jackson, 2005). This intervention consists of standard CBT stages and focuses on priority symptoms (e.g. positive symptoms), then co-morbidity, negative symptoms, identify issues and relapse prevention (Jackson et al., 2008). The primary outcome measure in the Jackson et al., (2008) trial was psychotic symptoms.

Supportive Psychodynamic Therapy (SPP): One study used SPP as an intervention approach (Harder et al., 2014) which is non-specific regarding number and frequency of sessions. Therapy is provided to participants for up to two years and is developed from prior psychotherapy manual (Holmes & Bateman, 2002). SPP consists of a range of psychodynamic therapy techniques including transference interpretations, explorative interventions, meaning making, and understanding of interpersonal and intra-psychological process (Harder et al., 2014).

Graduated Recovery Intervention Program (GRIP): One study used GRIP as an intervention approach (Penn et al., 2011) which consists of up to 26 weekly sessions comprised of four main phases: engagement and wellness management, substance use, persistent symptoms and functional recovery (Waldheter et al., 2008). It utilises a CBT approach with a focus on functional recovery by targeting social skills and role and community functioning. The primary outcome measure in the trial by Penn et al., (2011) was community functioning and social skills.

Assertive Community Treatment: One study used Assertive Community Treatment which was integrated with CBT, family therapy, social skills training and medication (Petersen et al., 2005). Assertive Community Treatment is an assertive outreach approach in which patients receive a high frequency of contact with clinicians who actively encourage and motivate the individual to engage in the recovery process. The primary outcome measure in the trial by Petersen et al., (2005) was not specified.

Individual Placement and Support (IPS) with Motivational Interviewing (MI): One study used an integrated IPS and MI intervention (Craig et al., 2014). IPS is a specific approach which provides support in job searching, pre-vocational preparation and ongoing support. MI is a therapeutic technique which aims to reduce an individual's ambivalence to change and encourages behavioural change using a person centred approach (Miller & Rollnick, 2012). The primary outcome measure in the trial by Criag et al., (2014) was the proportion of participants in paid employment by 12 month follow up.

Early Intervention Service: One included trial was conducted using an Early Intervention approach (Garety et al., 2006). This is an integrated approach utilising CBTp, vocational support, family therapy and medication management. The primary outcome measure in the trial by Garety et al., (2006) was vocational and educational activity.

CRT Trials

Processing Speed Training (PST): One study used PST as an intervention approach (Choi et al., 2017) which is delivered over approximately 30 hours over a two month period. PST consists of repetitive drill and practice tasks centred on pupillometric cognitive load, working memory and motivational theory (Choi et al., 2017). The primary outcome measure in the trial by Choi et al., (2017) was processing speed.

Captain's Log® neuropsychological training software: This intervention was used by one study (Holzer et al., 2014) and consists of a maximum of 12 hours of training delivered over two months. The training modules aim to train attention skills, concentration, memory, eye-hand coordination, problem solving/ reasoning skills, self-esteem and self-control (Sandford & Browne, 1988). The primary outcome measure in the trial by Holzer et al., (2014) was neuropsychological performance.

Posit Science Brain Fitness Training: One study used this CRT program as an intervention approach (Piskulic et al., 2015) which consists of a maximum of 40 hours of training over a three month period. It is focused on training auditory processing speed, and interpretation of semantic and emotional aspects of speech (Piskulic et al., 2015). The primary outcome measure in the trial by Piskulic et al., (2015) was not specified by the authors.

NeuroPersonalTrainer-Mental Health (NPT-MH): One study used the NPT-MH program as an intervention approach (Fernandez-Gonzalo et al., 2015) which consists of a minimum of 15 hours of training focused on attention, memory, executive function, emotional processing, theory of mind and cognitive biases (Caballero-Hernández et al., 2014). The primary outcome measure in the trial by Fernandez-Gonzalo et al., (2015) was not specified by the investigators.

Neuropsychological and Educational Approach to Remediation (NEAR): One study used the NEAR as an intervention approach (Lee et al., 2013) which consists of a maximum of 20 hours of training over a period of 10 weeks. NEAR is comprised of psychoeducation on cognitive deficits and drill and practice sessions which are tailored to the individuals particular neuropsychological profile (Lee et al., 2013). The primary outcome measure in the trial by Lee et al., (2013) was neuropsychological performance.

Non Specific CRT: One study used a non-specific treatment manual of CRT (Wykes et al., 2007) which consists of 40 hourly sessions focused on complex planning, memory and problem solving (Delahunty, Reeder, Wykes, Newton, & Morice, 1999). The primary outcome measure in the trial by Wykes et al., (2007) was neuropsychological performance.

2.5.3. Methodological Quality

Quality of ARMS studies: Risk of bias assessments for ARMS studies included in this review are summarised in **Figure 2.2.** and **2.3**. All CBT trials had a high risk of bias regarding blinding of participants and personnel. This is usual with psychotherapy trials as it is not possible for a therapist to be blind to the treatment they are providing, and the

psychoeducational component of therapy means socialising participants to the model. With this caveat in mind, the trial by van der Gaag et al., (2012)/ Ising et al., (2016) was the most methodologically rigorous trial included in this review. In contrast, the two other included CBT trials had relatively small sample sizes, did not provide adequate detail on allocation concealment and were not preregistered trials meaning it was not possible to ascertain if all data were reported and analysed as *a-priori* planned (Addington et al., 2011; Bechdolf et al., 2007). CRT studies with ARMS populations in this review were conducted with small sample sizes and two did not provide adequate reporting of statistical power analyses (Choi et al., 2017; Holzer et al., 2014; Piskulic, Addington, Auther, & Cornblatt, 2011). Overall, CRT studies had a high or unclear risk of bias. With one exception (Bechdolf et al., 2007) CBT and CRT trials reported here did not have social functioning as the primary outcome measure. As such, drawing conclusions as to the effectiveness of CBT or CRT on social functioning in ARMS is limited by poor methodological quality and by most studies not being powered with social functioning as the primary outcome measure.

Quality of FEP Studies: The risk of bias assessments for FEP studies included this review are summarised in **Figure 2.4.** and **2.5**. CBT trials were of varying quality with all studies suffering from a high risk of bias for blinding of participants and personnel. One CBT trial was methodologically rigorous, had an overall low risk of bias, and showed a positive outcome on social functioning (Fowler et al., 2018). Drake et al., (2014) was limited by attrition bias, but scored as low risk of bias in five of seven domains. The remaining CBT studies suffered from a number of sources of bias which may be the result of insufficient reporting of methodology in the published article (Fowler et al., 2009; Gleeson et al., 2013). Of the CRT studies, one was rated as low in risk of bias in five of seven domains

(Wykes et al., 2007), with the remaining rated as high or unclear risk of bias in most domains; again potentially due to insufficient reporting of methodology (Fernandez-Gonzalo et al., 2015; Fisher et al., 2015; Lee et al., 2013). The one psychodynamic intervention trial included in this review was rated as high risk of bias across almost all domains (Harder et al., 2014). Similarly multi-component studies were rated as high or unclear risk of bias across most domains (Penn et al., 2011; Petersen et al., 2005). Finally, the two service level interventions included here were divergent in methodological quality. One study was rated as high or unclear risk across five of seven domains (Craig et al., 2014) whilst the other was rated as having low risk of bias in all domains except blinding of participants and personnel (Garety et al., 2006).

2.5.4. Description of studies:

The effect of CBT on Social Functioning in* ARMS *Participants: Four studies (RCTs) reported a social functioning outcome measure following a CBT intervention with ARMS participants (see **Table 2.2** for details). Of these, two studies were conducted within the same sample following the initial trial period (van der Gaag et al., 2012) and a four year follow up (Ising et al., 2016) using the CBT for ultra-high risk (CBTuhr) specific manual (Van der Gaag, Nieman, & Van den Berg, 2013). There was no significant change on the SOFAS at the 6, 12, and 18 month time point (Van der Gaag et al., 2013) nor the 4 year follow-up (Ising et al., 2016). Similarly an earlier small open label RCT reported no significant improvement on the SFS following treatment with CBT in ARMS individuals (Addington et al., 2011). Finally, Bechdolf et al., (2007) reported a significant improvement in social functioning in both the treatment and control group as measured by the SAS-II, with no differential effect between groups. In comparing effect sizes and methodological quality, the post intervention effect size for the study by van der Gagg et

al., (2012) which was rated as having overall low risk of bias, was g= 0.23, and for Addington et al., (2011) which had high risk or unknown risk of bias was also g=0.23. In contrast, the study by Bechdolf et al., (2007) which had a significant post intervention effect size on social functioning of g=0.41, was the lowest quality study with the highest risk of bias across domains.

The effect of Cognitive Remediation on Social Functioning in ARMS Participants:

Three studies were included that reported a social functioning outcome measure following treatment with cognitive remediation in ARMS participants. Choi et al., (2017) reported that compared to an active control, Processing Speed Training resulted in a significant improvement in social functioning as measured by Social Adjustment Scale-Self Report with a large post intervention effect size of g=1.0. Piskulic et al., (2015) reported a significant improvement in social functioning, as measured by the GFS, in the CRT group between baseline and 9 month follow-up, whilst there was no change in the control group. However, it is important to note that this finding appears to represent a within group change and the authors do not report a treatment by time interaction with post-hoc comparisons and suitable corrections for multiple comparisons (Piskulic et al., 2015). The between group post intervention effect size for this study was negligible (g= 0.05; Piskulic et al., (2015). Finally, Holzer et al., (2014) reported a significant within group change in social functioning as measure by the SOFAS in both the treatment and control group. However, the post intervention effect size difference was g= -0.05. The study by Choi et al., (2017) was rated a low risk of bias in only three of seven domains, while the study by Holzer et al., (2014) was rated as low risk of bias in five of seven domains. The trial by Piskulic et al., (2015) was very poor methodologically and was rated as high or unknown risk across all domains. Taken together, the efficacy of CRT in

improving social functioning in ARMS participants is unclear when considering the methodological quality of studies and differences in post intervention effect sizes.

The effect of CBT on Social Functioning in FEP: Five trials were included that report a social functioning outcome measure with a CBT focused treatment (see **Table 2.3.** for details). The largest and well conducted trial (Fowler et al., 2018), found that social recovery-CBT (SR-CBT), when compared to TAU in a specialised early intervention service, resulted in a significant increase in structured activity of 8.1h as measured by the TUS with a post intervention effect size of g=0.39. An earlier study with a smaller sample size utilising SR-CBT reported no overall effect on the TUS in a combined affective and non-affective psychosis group (Fowler et al., 2009). However, when these groups were separated, there was a significant improvement in social functioning in the non-affective psychosis group following treatment with an effect size of g=0.27 (Fowler et al., 2009). (Jackson et al., 2008) reported the effect size difference at each time point in a trial utilising Active Cognitive Therapy for psychosis (ACE) versus befriending. The authors report a moderate effect size favouring ACE at treatment endpoint (d= 0.39) which had reversed by the end-of-treatment to follow-up (d=- 0.31). Gleeson et al., (2013) reported the outcome on the SOFAS following treatment with Relapse Prevention Therapy (combined CBT/family therapy) versus specialised FEP care. The authors report a significant group by time interaction on the SOFAS which was no longer significant when medication adherence was controlled for, producing a post intervention effect size of g=0.15 (Gleeson et al., 2013). Finally, Drake et al., (2014) reported outcomes on the SOFAS following a trial investigating CBTp plus social contact vs. CBTp plus cognitive remediation in FEP. The authors found no significant differential effect of treatment group on social functioning and the effect size was not able to be calculated (Drake et al., 2014).

Taken together, the evidence indicates that one trial (Fowler et al., 2018) was methodologically rigours and found a meaningful post intervention effect size for improving social functioning. The study by Drake et al., (2014) was rated as low risk in five of seven domains and so can be considered as moderately rigorous trial. The other studies (Fowler et al., 2009; Gleeson et al., 2013) were of low or unknown risk of bias across domains and as such should be interpreted with caution. However, it should be noted that the same intervention was used by the same research team in the most recent well conducted trial (Fowler et al., 2018) and earlier less rigorous trial (Fowler et al., 2009). In addition, it should be noted that the trial by Fowler et al., (2018) specifically recruited participants who had very low levels of social functioning at baseline, whilst this was not specified in other trials.

The effect of Cognitive Remediation on Social Functioning in FEP: Four included trials reported a social functioning outcome measure following treatment with cognitive remediation therapy (see **Table 2.3.** for details). One study reported a significant improvement in social functioning following CRT (Lee et al., 2013) whilst three found no differential effect of treatment (Fernandez-Gonzalo et al., 2015; Fisher et al., 2015; Wykes et al., 2007). Lee et al., (2013) reported that Neuropsychological and Educational Approach to Remediation improved social functioning, as measured by the SFS, when compared to TAU. The authors reported that the treatment effect on social functioning was large, accounting for 14.6% of the variability in improvement (Lee et al., 2013). However, the post intervention effect size was small (g=0.21) Fernandez-Gonzalo et al., (2015) reported a significant improvement in social functioning, as measured using the SFS, in both the CRT (NeuroPersonalTrainer-Mental Health) and control group, but with no differential effect of treatment. This study produced a small post intervention effect size

(g=0.31). Finally, Fisher et al., (2015) found no significant improvement on the GAF-S following CRT (g=0.16); and Wkyes et al., (2007) found no significant effect of CRT on the SFS with FEP participants (g= -0.36; lower score= improved functioning). Although non-significant, the trial by Wykes et al., (2007) produced the largest post intervention effect size and was the most methodologically rigorous. The one trial by Lee et al., (2013) that reported a significant intervention effect for social functioning, had an overall small effect size (g=0.21) and was of very poor methodological quality. Taken together, effect sizes for the best conducted trials are in the small to moderate range, however, the evidence base for CRT improving social functioning in FEP is limited.

The effect of psychodynamic and multi-component therapy on Social Functioning in FEP: One included trial reported a social functioning outcome measure following a psychodynamic therapy intervention (Harder et al., 2014) and two following a multi-component therapy intervention (Penn et al., 2011; Petersen et al., 2005). Harder et al., (2014) conducted a non-randomized trial with a relatively large sample size (*n*= 269) of individuals experiencing a FEP. Trial participants received manualised psychodynamic therapy or standard treatment. The authors found no significant improvement in social functioning, as measured by the GAF-S, in the treatment versus control group, with a very small post-intervention effect size (Harder et al., 2014). Penn et al., (2011) randomized a small sample (n=46) of individuals with FEP to GRIP (psychoeducation, CBT, MI and social skills training) versus TAU and reported a significant increase in work functioning as measured by the RFS, with no effect on other social functioning measures (g=0.29). Finally, Peterson et al., (2005) randomized a large sample (n=547) of individuals with FEP to Integrated Treatment (Assertive Community Treatment, psychoeducational family intervention, social skills training and CBT) versus TAU, and reported a significant

improvement in work and education following treatment (g= -0.65; reduction equals better functioning). Although the trial by Peterson et al., (2005) reported a moderate post intervention effect size for work and educational engagement, this trial was very poor methodologically, being rated as high risk of bias in six of seven domains. Similarly, the trial discussed above by Harder et al., (2014) was of poor quality as was Penn et al., (2011). Taken together, there is no evidence that psychodynamic focused interventions improve social functioning in FEP. For multicomponent studies, one study suggests a multifaceted approach may be beneficial, but considering the methodological quality, further studies are needed to confirm this finding.

The effect of service level interventions on social functioning in FEP: Two included studies reported a social functioning outcome measure following a service level intervention in FEP (Craig et al., 2014; Garety et al., 2006). Both studies reported a significant beneficial effect of the intervention on social functioning in FEP. Craig et al., (2014) randomized FEP participants (n=159) to receive individual placement and support (IPS) from clinicians additionally trained in motivational interviewing (MI), versus with IPS clinicians not trained in MI. The authors reported that IPS plus MI was superior to IPS alone in increasing the number of participants in paid employment by the trial endpoint (g=0.69; (Craig et al., 2014). In one of the first studies to trial a specialised early intervention for psychosis service (EIS) in the UK (The Lambeth Early Onset trial), Garety et al., (2006) randomized FEP participants (n=144) to EIS (medication management, CBT, vocational input and family intervention) versus standard care, and reported that the EIS group was engaged in significantly more months of structured activity compared to the control group at treatment end (g=0.45). The post intervention effect size was moderate for the trial by Craig et al., (2014) but this trial had a high risk of bias in five of seven

domains. In contrast, Garety et al., (2006) reported a smaller, but moderate, effect size and had a high risk of bias only for blinding of participants. Taken together, there is evidence that EI service level approach is beneficial for improving social functioning in FEP participants.

Table 2.2. Psychological Interventions for Social Functioning with ARMS Participants

Study	Country	Study Design	N Study Sites	Treatments	N at Baseline	Age (M, SD)	Female (N, %)	ARMS Measure	Intervention Details	Primary Outcome Measure	% Conversion to Psychosis	Social Functioning Measure	Effect of intervention on social functioning	Post Intervention Between Group Effect size
CBT														
Addington et al., (2011)	Canada	RCT (Single Blind)	1	CBT Supportive Therapy	27 24	20.8 (4.51) 21.1 (3.74)	17.7 11.8	COPS/ SIPS	CBT: 20 sessions over 6 months	Transition to psychosis	0 12.5	SFS	No significant change	6 months: g= 0.23
Bechdolf et al., (2007)	Germany	RCT	4	CBT Supportive Counselling	54 59	25.2 (5.3) 26.4 (5.7)	35.2 32.2	Early Recognition Inventory	Individual CBT x 25 sessions Group therapy x 15 sessions Cognitive Remediation x 12 sessions Information & counselling of relatives x 3 sessions.	Social Adjustment	N/A	SAS II	Significant within group increase in both groups, but no differential effect between groups	Post treatment: g=0.41

Study	Country	Study Design	N Study Sites	Treatments	N at Baseline	Age (M, SD)	Female (N, %)	ARMS Measure	Intervention Details	Primary Outcome Measure	% Conversion to Psychosis	Social Functioning Measure	Effect of intervention on social functioning	Post Intervention Between Group Effect size
Ising et al., (2016)	Netherlands	RCT	6	CBT TAU	95 101	22.7 (5.6) 22.6 (5.4)	47 (49.5) 52 (51.5)	CAARMS	CBT for UHR specific treatment manual	Transition to psychosis	15.7% (CBT) vs 25.5 (TAU)	SOFAS	No significant change due to treatment. d= -1.43; converters vs. non converters.	For non-converters: d = -0.1 CBTuhr vs. control across all timepoints
van der Gaag et al., (2012)	Netherlands	RCT	4	CBT TAU	98 103	22.9 (5.6) 22.6 (5.5)	49 (50) 50 (54)	CAARMS	CBT for UHR specific treatment manual	Transition to psychosis	9.8% (CBTuhr) vs. 22.66% (TAU)	SOFAS	No significant difference between groups due to treatment	6 months: g= 0.23
Cognitive Remediation														

Study	Country	Study Design	N Study Sites	Treatments	N at Baseline	Age (M, SD)	Female (N, %)	ARMS Measure	Intervention Details	Primary Outcome Measure	% Conversion to Psychosis	Social Functioning Measure	Effect of intervention on social functioning	Post Intervention Between Group Effect size
Choi et al., (2017)	USA	RCT		CRT Active Control	30 32	18.17(3.81) 18.53(3.72)	48 50	(SIPS/SOPS)	Processing Speed Training	Processing Speed	N/A	Social Adjustment Scale-Self Report (SAS-SR),	Significant improvement in social adjustment in CRT group compared to control	4 months: g= 1.0
Holzer et al., (2014)	Switzerland	RCT	1	CRT Active Control	18 14	15.4 (1.3) 15.7 (1.4)	9 (50) 5 (36)	(SIPS/SOPS)	Captain's Log® software	Neuropsychological Function	N/A	SOFAS	Significant effect of time showing increase in social functioning but no differential group effect	g= -0.05
Piskulic et al., (2015)	Canada	RCT	1	CRT Computer Games	18 14	19.72(5.71) 17.5(3.48)	7 (38.8) 4 (28.6)	(SIPS/SOPS)	Posit Science Brain Fitness Training	Not specified	n/a	GF S	Significant within group change in treatment group	9 months: g= 0.05

CAARMS, Comprehensive Assessment for At Risk Mental State; COPS, Criteria of Prodromal States; CBT, Cognitive Behavioural Therapy; CRT, Cognitive Remediation Therapy; GFS, Global Functioning Social; RCT, Randomised Controlled Trial; SAS-II, Social Adjustment Scale 2nd Version; SFS, Social Functioning Scale; SOFAS, Social and Occupational Functioning Scale; SIPS/SOPS; Structured Interview for Prodromal Syndromes/Scale of Prodromal Symptoms; TAU, Treatment as Usual.

Figure 2.2. Risk of bias summary across each domain for each ARMS study included in this review

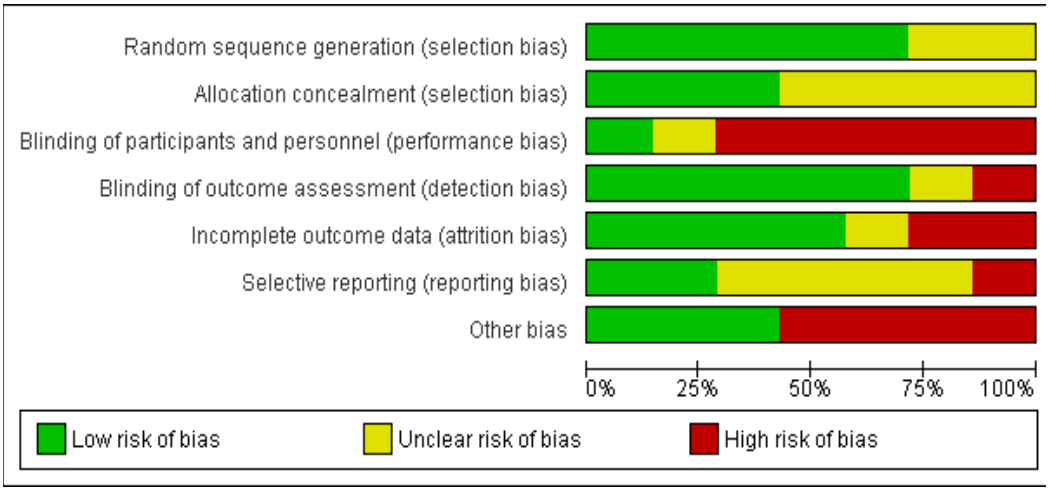

Figure 2.3. A summary of risk of bias in each domain (expressed as a percentage) of all included ARMS studies.

Table 2.3. Psychological Interventions for Social Functioning with FEP Participants

Study	Country	Study Design	N Study Sites	Treatments	N at Baseline	Age (M, SD)	Female (N, %)	FEP Categorisation	Intervention Details	Primary Outcome Measure	Social Functioning Measure	Effect of intervention on social functioning	Post Intervention Between Group Effect size
CBT													
Drake et al., (2014)	UK	RCT	1	CBPp + Social Contact CBPp+ Cognitive Remediation	31 31	24.7 (5.2) 23.4 (4.4)	10 (32) 14 (47)	DSM-IV	CBTp manual not specified Cognitive remediation: Computerised Interactive Remediation of Cognition – Interactive Training for Schizophrenia' (CIRCUITS) software	PSYRATS	SOFAS	No significant group differences between groups at follow up.	Data not reported for ES
Fowler et al., (2018)	UK	RCT (Single Blind)	4	Social Recovery Therapy TAU	75 79	Median (IQR): 24.84 (20.73-29.04) 24.15 (22.17-27.79)	19 (25%) 19 (24%)	NS	Social recovery therapy based CBT vs. TAU in a specialised early intervention team	TUS	TUS	Social recovery therapy group had increase in structured activity of 8.1 h	9 months: g= 0.39
Fowler et al., (2009)	UK	RCT	2	Social Recovery Therapy TAU	35 42	27.8(6.1) 30.0(7.2)	10 (28.6) 12 (28.6)	N.S.	Social recovery therapy based CBT vs. TAU in a specialised early intervention team	TUS	TUS	No significant effect in combined affective and non-affective psychosis groups. Significant improvement in non-affective psychosis group	9 months: g= 0.27 (non-affective group)

Study	Country	Study Design	N Study Sites	Treatments	N at Baseline	Age (M, SD)	Female (N, %)	FEP Categorisation	Intervention Details	Primary Outcome Measure	Social Functioning Measure	Effect of intervention on social functioning	Post Intervention Between Group Effect size
Gleeson et al., (2013)	Australia	RCT Single Blind	2	Relapse Prevention Therapy	41	20.1 (2.9)	14 (34.1)	DSM-IV	Combined CBT/Family therapy	Number of relapses/time to relapse	SOFAS	RPT group had significantly lower functioning at 30 months compared with the TAU group. No significant group x time interaction effect when medication adherence controlled for.	Across all timepoints: g= 0.15
				Specialised FEP care	40	20.1 (3.2)	16 (40)						
Jackson et al., (2008)	Australia	RCT	1	CBT	31	22.13 (3.3)	12 (38)	DSM-IV	Active Cognitive Therapy for Early Psychosis: ACE	BPRS/SANS	SOFAS	Moderately large effect baseline 6 weeks (g=0.50) which lowered at end of tx 12 weeks (0.39) and tx follow up at 1 year (-0.31).	12 weeks: g= 0.39
				Befriending	31	22.45 (3.82)	5 (16)						
Cognitive Remediation													

Study	Country	Study Design	N Study Sites	Treatments	N at Baseline	Age (M, SD)	Female (N, %)	FEP Categorisation	Intervention Details	Primary Outcome Measure	Social Functioning Measure	Effect of intervention on social functioning	Post Intervention Between Group Effect size
Fernandez-Gonzalo et al., (2015)	Spain	RCT	1	CRT	28	30.9(5.9)	11 (39.3)	DSM-IV	NeuroPersonalTrainer-Mental Health (NPT-MH)	Not specified	SFS	Significant main effect of time within both groups but no significant group or interaction effects	Post treatment: g=0.31
				Control	25	30.02(7.4)	8 (32)						
Fisher et al., (2015)	USA	RCT	1	CRT	43	21.7 (3.26)	12 (27.9)	DSM-IV	Posit Science Brain Fitness Training	MATRICS	GFS	No significant interaction of condition x time	Post treatment: g=-0.16
				Computer Game	43	20.74(3.37)	10 (23.2)						
Lee et al., (2013)	Australia	RCT	1	CRT	28	22.88 (4)	14 (53.8)	DSM-IV	Neuropsychological and Educational Approach to Remediation	Neuropsychological Assessment	SFS	Controlling for diagnosis, CRT significantly greater effect on social functioning	g=0.21
				TAU	27	22.74 (4.7)	11 (40.7)						
Wykes et al., (2007)	UK	RCT	1	CRT	21	18.8(2.6)	8 (38)	DSM-IV	CRT Delahunty et al., (1999)	Neuropsychological Assessment	SBS	No significant effect	Across all time points g= -0.36
				TAU	19	17.5 (2.2)	6 (32)						

Study	Country	Study Design	N Study Sites	Treatments	N at Baseline	Age (M, SD)	Female (N, %)	FEP Categorisation	Intervention Details	Primary Outcome Measure	Social Functioning Measure	Effect of intervention on social functioning	Post Intervention Between Group Effect size
Psychodynamic Interventions													
Harder et al., (2014)	Denmark	Not RCT	14	Supportive psychodynamic psychotherapy	119	Median (min-max) 24.6 (17.6-35.9)	41 (35)	ICD-10	Supportive Psychodynamic Therapy	GAF-Social Functioning	GAF-Functioning	No significant interaction.	Across all time points: g= 0.17
				Standard Treatment	150	23.2 (16.2-35.6)	46 (31)						
Multi-compnent therapy approaches													
Penn et al., (2011)	USA	RCT	1	GRIP	23	23.48 (3.89) 20.96 (2.14)	9 (39.1)	SCID-P	GRIP includes elements of psychoeducation, CBT, MI, social skills training.	Quality of life, community functioning, and social skill.	RFS	Only significant effect is increased work functioning on RFS in GRIP vs TAU. No other significant effects	g= 0.29
				TAU	23		9 (39.1)						

Study	Country	Study Design	N Study Sites	Treatments	N at Baseline	Age (M, SD)	Female (N, %)	FEP Categorisation	Intervention Details	Primary Outcome Measure	Social Functioning Measure	Effect of intervention on social functioning	Post Intervention Between Group Effect size
Petersen et al., (2005)	Denmark	RCT	3	Integrated Treatment	275	26.6(6.4)	115 (42)	ICD-10	Assertive Community Treatment (ACT; psychoeducation, family intervention, social skills training, CBT)	No single measure	GAF (Functioning)	Significant improvement in IT group on work and education	d= - 0.65
				TAU	272	26.6(6.3)	108 (40)						
Service Level Interventions													
Craig et al., (2014)	UK	RCT	4	IPS	78	24 (4.2)	24 (30.8)	Not specified	IPS: support to search for work and pre-vocational preparation. MI for one group of clinicians.	Proportion of participants in paid employment at 12 month follow up	Active employment	IPS+MI was superior to IPS alone in increasing the number of participants in paid employment	12 months: d= 0.69
				IPS+MI (for clinicians)	81	24 (4.2)	18 (22.2)						

Study	Country	Study Design	N Study Sites	Treatments	N at Baseline	Age (M, SD)	Female (N, %)	FEP Categorisation	Intervention Details	Primary Outcome Measure	Social Functioning Measure	Effect of intervention on social functioning	Post Intervention Between Group Effect size
Garety et al., (2006)	UK	RCT	2	Early Intervention Service Standard Care	71 73	Average age of whole sample: 26 years	35% of whole sample female	ICD-10	EI Service: medication management, cognitive–behavioural therapy, vocational input and family interventions was provided according to individual need	Relapse rates	Vocational and Educational Activity	Intervention group was engaged in an activity for significantly more months (6.9 months) than the control group (4.2 months)	18 months: g= 0.45

BPRS, Brief Psychiatric Rating Scale; CBT, Cognitive Behavioural Therapy; CRT, Cognitive Remediation Therapy; EI, Early Intervention; GAF, Global Assessment of Functioning; IPS, Individual Placement and Support; MI, Motivational interviewing; MCAS; Multnomah Community Ability Scale; PSYRATS, Psychotic Symptom Rating Scales; RCT, Randomised Controlled Trial; RFS, Role Functioning Scale; SANS, Scale for the Assessment of Negative Symptoms ; SIPS/SOPS; Structured Interview for Prodromal Syndromes/Scale of Prodromal Symptoms ; SFS, Social Functioning Scale; SOFAS, Social and Occupational Functioning Scale; TAU, Treatment as Usual; TUS, Time Use Survey; UK, United Kingdom.

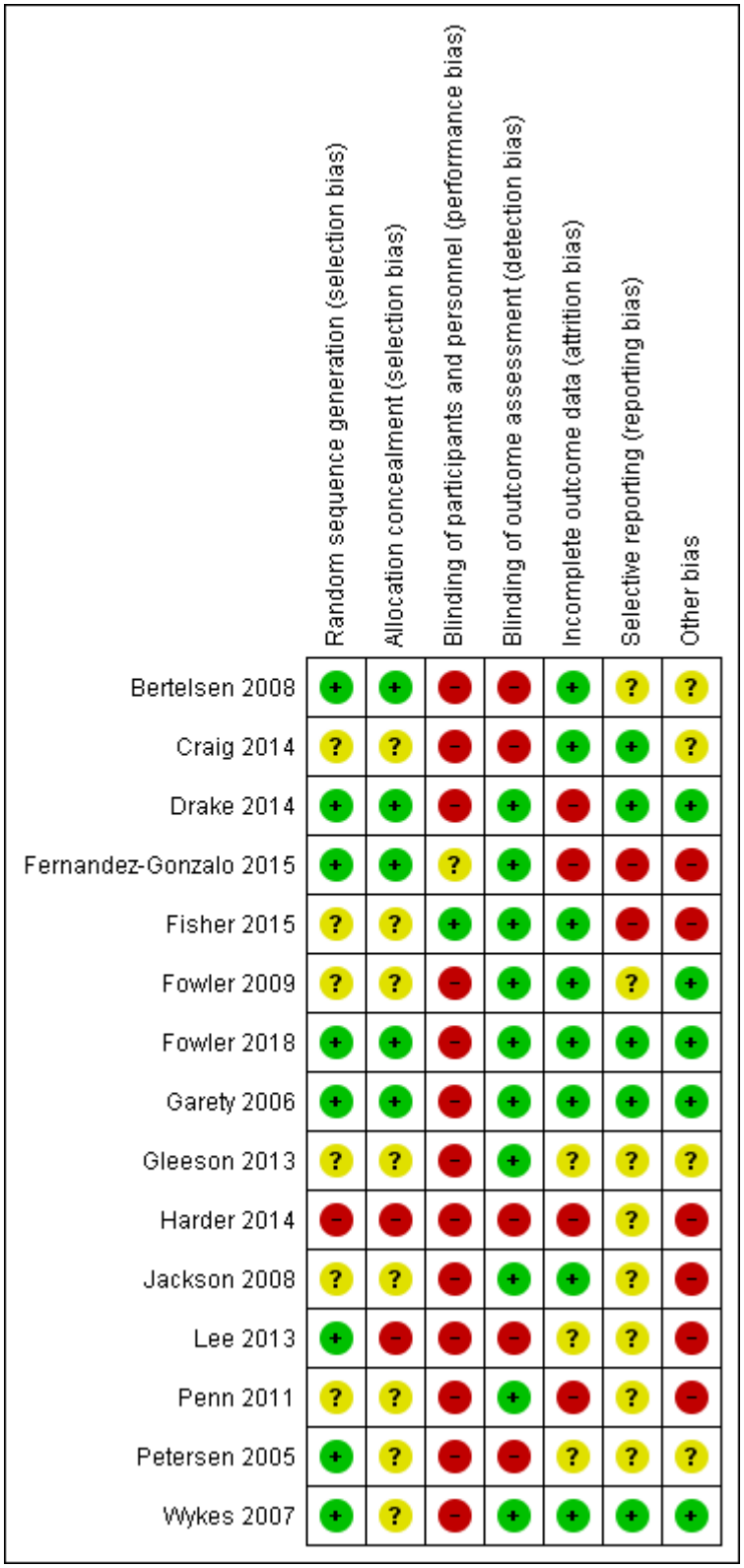

Figure 2.4. Risk of bias summary across each domain for each first episode psychosis study included in this review

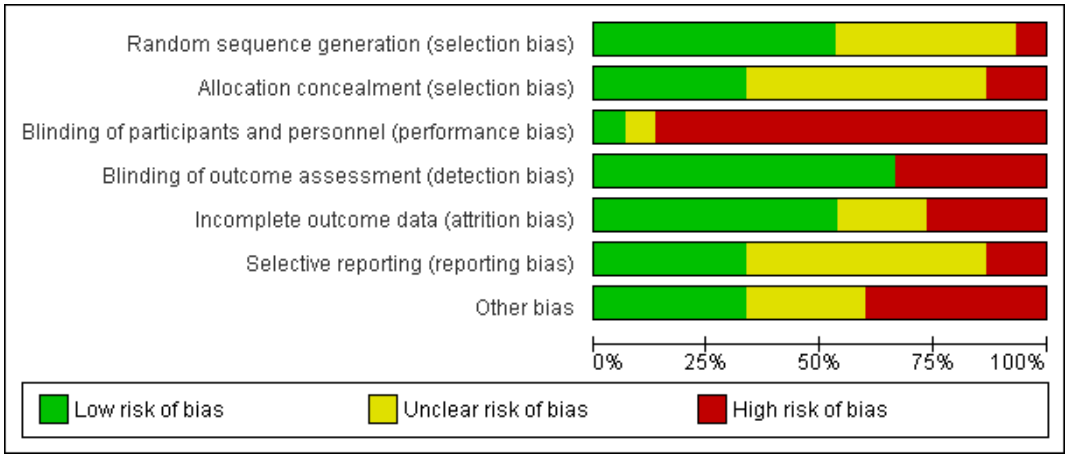

Figure 2.5. A summary of risk of bias in each domain (expressed as a percentage) of all included first episode psychosis studies.

2.6. Discussion

This systematic review aimed to determine the effect of psychological interventions on social functioning in ARMS and FEP participants. No ARMS studies, but three of five FEP studies (Fowler et al., 2018; Fowler et al., 2009; Jackson et al., 2008) reported a positive effect on social functioning following a CBT focused intervention. Our findings in ARMS participants are in line with findings from a recent meta-analysis (Devoe et al., 2018). Two of three ARMS studies (Choi et al., 2017; Piskulic et al., 2015) and one of three FEP study (Lee et al., 2013) reported a positive effect on social functioning following CRT treatment. We found no evidence from one trial that psychodynamic therapy produced a positive outcome on social functioning in FEP (Harder et al., 2014). In contrast, both multi-component trials (Penn et al., 2011; Petersen et al., 2005) and both service level intervention trials (Craig et al., 2014; Garety et al., 2006) included in this review, reported a significant improvement in social functioning in FEP. There

are a number of considerations to take into account when interpreting these findings.

Of the CBT studies that showed a positive outcome in social functioning in FEP participants, most (Fowler et al., 2018; Fowler et al., 2009) but not all (Jackson et al., 2008) had social functioning as the primary outcome measure. This suggests that CBT studies not showing a positive outcome on social functioning in ARMS or FEP were not adequately powered to do so as sample size calculations were powered on other primary outcomes (e.g. symptoms). Another important consideration is the therapeutic target of each CBT intervention. For example, the largest and most methodologically rigorous trial of CBT in ARMS participants (Ising et al., 2016; van der Gaag et al., 2012) did not find a significant improvement in social functioning. This trial utilised CBTuhr (Van der Gaag et al., 2013) which is focused primarily on psychotic symptom reduction. Similarly, studies which utilised specialised CBT for psychosis manuals which focus on symptom reduction found no significant effect on social functioning in ARMS participants (Addington et al., 2011) or FEP participants (Drake et al., 2014; Gleeson et al., 2013). In contrast, the most methodologically rigorous CBT trial in FEP participants which did find a significant improvement in social functioning, utilised a CBT intervention which specifically targets social functioning (Fowler et al., 2018). An earlier study using the same CBT intervention also reported a positive outcome on social functioning in non-affective FEP participants (Fowler et al., 2009). Of note, the trial by Jackson et al., (2008) did report a moderate positive effect size on social functioning at the treatment end point. However, this effect had reversed by treatment follow-up. Moreover, the authors did not report if this effect was statistically significant (Jackson et al., 2008). Taken together, these findings indicate that CBT has efficacy in improving social functioning in FEP participants but not ARMS participants. However, this is dependent on studies being adequately powered to detect

changes in social functioning and, moreover, social functioning being a primary treatment target of the intervention.

The methodological quality of most of the CRT trials was poor and these findings should be interpreted with caution. While there is more evidence that CRT is more effective in improving social functioning in ARMS than FEP participants, clearly a difference of one study is insufficient to draw meaningful conclusions. A previous meta-analysis concluded that there was no global benefit of CRT in improving social functioning in ARMS participants (Devoe et al., 2018). However, it is noteworthy that the authors only analysed effect sizes of CRT studies in ARMS participants at a 2-3 month time point (Devoe et al., 2018). This approach may have served to mask treatment effects which were apparent at later time points (e.g. 9 months in (Piskulic et al., 2015). As such, our findings that two studies included in the current review showed positive effects of CRT on social functioning in ARMS participants (Choi et al., 2017; Piskulic et al., 2015) are not in contention with previous findings (Devoe et al., 2018). The apparent discrepancy represents that we interpreted a positive treatment effect being eligible at any time point, whereas Devoe et al. (2018) only included treatment effects at 2-3 months in the meta-analysis.

The two multi-component therapy studies included in this review were of low or unclear methodological quality. The trial by Peterson et al., (2005) had a very large sample size, whilst Penn et al., (2011) conducted a small pilot study. Nevertheless, both studies reported a significant positive effect on social functioning in FEP participants. Drawing conclusions as to which aspect of the intervention was beneficial for social functioning is not possible. Both trials incorporated CBT as part of the intervention but there was variation as to how

many sessions each participant received. Both trials also incorporated social skills training which may have had a more direct effect on social functioning. In particular, work functioning was the main social functioning domain in which participants in both trials showed significant improvements. Taken together, multicomponent therapeutic interventions appear to show good efficacy in improving social functioning in FEP. However, it is unclear if specific elements or the treatment as a whole confers these benefits. Moreover, the trials here are of questionable methodological quality and as such, these findings may not be reliable.

Finally, both service level interventions we included in this review reported positive outcomes in social functioning in FEP. One trial specifically targeted work placement support training and found that participants who received an intervention from therapists trained in MI had achieved more full-time employment than participants who received an intervention with an IPS only trained therapist. An earlier trial by Garety et al., (2006) which was the first service level RCT of a specialised EI service provided a multi-component intervention consisting of CBT, vocational input and family interventions according to each individuals need. Similar to the multicomponent therapeutic interventions discussed above, it is unclear if individual elements of the intervention described by Garety et al., (2006) were most beneficial for social functioning, or if the combined elements are needed to produce a positive effect. Taken together, these studies indicate that service level interventions can provide beneficial outcomes in social functioning for individuals experiencing a FEP. However, as these studies focused on work and educational outcomes alone, it is not clear if these interventions had any beneficial effect on other domains of social functioning such as engagement in hobbies or social activities with family and friends.

Strengths & Limitations

This systematic review included 22 studies with 21 independent samples investigating the effect of structured psychological therapies on social functioning in ARMS and FEP participants. An extensive literature search was carried out across a number of databases and to the best of our knowledge, this is the first systematic review to specifically compare the effects of a range of psychological interventions on social functioning in ARMS and FEP participants. Nevertheless, a number of limitations should be noted when interpreting our findings and conclusions.

Across trials, different treatment manuals were utilised. As such, in trials in which the treatment modality was broadly similar (e.g. CBT, CRT), there are differences in the target of intervention and so generalising across studies is problematic.

With some exceptions (Fowler et al., 2018; van der Gaag et al., 2012) the methodological quality of many of the studies included in this review was poor and there was a high risk of bias across a number of domains. Many studies did not report a sample size calculation and as such it is not possible to tell if they were sufficiently powered to detect the desired change in their primary outcome. Within the context of this review, few studies had social functioning as their primary outcome measure. As such, most studies in this review, even when a sufficient sample size calculation was conducted, may have been underpowered to detect changes in social functioning.

In line with methodological issues, there was little consistency in the specific social functioning measured used between studies. As such, the different psychometric properties of instruments used to measure social functioning may

have affected results across studies. Some standardisation to outcome measures used in ARMS and FEP populations would allow for greater confidence in making generalisations as to the specific intervention effects.

Conclusions & Future Directions

As noted above, the combined methodological quality of trials included in this review was mixed with some studies showing good methodological rigour and others poor. Individual studies suggest that CBT, CRT, multicomponent and service level interventions have efficacy in improving social functioning in ARMS and FEP populations. However, there is clearly a need for further investigation to determine which interventions work for whom and at what stage of psychosis. To date, there have been no trials to determine if social functioning focused CBT has efficacy in improving social functioning in ARMS populations. This is perhaps surprising considering that a change in social functioning forms part of the criteria to identify an individual in an at-risk state (Yung et al., 2005).

Considering the methodological limitations of CRT studies included in this review, there is a need for larger, well powered studies to establish the efficacy of this therapeutic approach in improving social functioning in ARMS and FEP participants. As with CBT, these interventions may need to be tailored to both the clinical presentation (ARMS / FEP) and the desired outcome (e.g. improved social functioning). A potential focus of future CRT trials may be to focus on social cognition training (Kurtz, Gagen, Rocha, Machado, & Penn, 2016) for which there is some evidence of beneficial effects on social functioning with individuals diagnosed with schizophrenia (Grant et al., 2017).

Specialised EIP services are established in a number of regions of the UK (Neale & Kinnair, 2017) other European countries, North America and Australia (Csillag et al., 2018), and have been subject to RCTs to determine efficacy in treating FEP (e.g. (Garety et

al., 2006). However, the efficacy of specialised ARMS services in improving outcomes is unclear at present (Fusar-Poli, McGorry, & Kane, 2017). Determining the efficacy of such services in preventing the transition to psychosis and improving key outcomes, including social functioning, is necessary in future RCTs. Finally, future trials are needed to determine if multi-component interventions have greater benefit in improving social functioning than individual treatment modalities alone.

Chapter 3

The relationship between social cognition, social functioning and psychotic symptoms in at-risk mental state and first episode psychosis: a meta-analysis

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3.1. Abstract

Social cognition, including the domains of emotion recognition (ER) and theory of mind (ToM), underpin an individual's ability to navigate their social environment. Meta-analytic studies have demonstrated that individuals in an at-risk mental state (ARMS) for developing psychosis, or having experienced a first episode psychosis (FEP), exhibit impaired social cognitive functioning across most domains. Recent interest has been on the impact of impaired social cognition on functional outcomes and psychotic symptomatology. However, to date, no meta-analysis of the literature has been conducted to determine the strength and direction of relationship between social cognitive performance, social functioning and psychotic symptoms in ARMS and FEP. A comprehensive literature search of four databases was conducted. Thirty-two studies were included that reported on the relationship between at least one social cognitive domain, social functioning and/or psychotic symptoms. Overall social cognitive performance was positively correlated with social functioning in ARMS (0.12, p=0.015) and FEP (0.205, p<0.001), and negatively correlated with positive (-0.178, p<0.001) and negative symptoms in FEP (-0.221, p<0.001). Emotion Recognition (ER) was positively correlated with social functioning in ARMS (0.131, P=0.01) and FEP (ER: 0.222, P<0.001), negatively correlated with positive symptoms in FEP, (-0.166, p<0.001), and negative symptoms in ARMS (-0.11, p=0.021) and FEP (-0.211). ToM was positively correlated with social functioning in ARMS (0.178, p=0.01) and FEP (0.208, P<0.001), and negatively correlated with positive (-0.189, p<0.001) and negative (-0.3) symptoms in FEP. Pooled correlation coefficient estimates did not differ significantly between ARMS and FEP participants for each social cognitive domain and outcome analysed (all p>0.05). These findings indicate that better

social cognitive performance is associated with enhanced social functioning and lower psychotic symptomatology. However, effect sizes were generally small and the clinical impact of targeting social cognitive performance to enhance outcomes in ARMS and FEP is unclear at present.

3.2. Introduction

Social cognition is an umbrella term for a number of related psychological constructs which underpin an individual's ability to navigate their social environment and to develop, maintain and understand inter and intra personal relationships (Harvey & Penn, 2010). There is some variation in the literature regarding which specific subdomains comprise the concept of social cognition and there is some overlap between domains. Nevertheless, the most commonly defined social cognitive subdomains are emotion recognition , theory of mind (ToM), social perception and attributional biases (Green, Olivier, Crawley, Penn, & Silverstein, 2005; Green et al., 2008). Social cognitive function has received increased attention over recent years as a clinical marker of the major psychiatric and neurodevelopmental disorders (Cotter et al., 2018). A large focus has been on psychosis spectrum conditions, in particular, schizophrenia (Cotter et al., 2018). Meta-analytic studies have consistently demonstrated that individuals with chronic course schizophrenia exhibit a significant impairment in social cognition when compared to healthy controls, with large effects sizes ranging from 0.88 to 1.04 depending on the sub domain (Bora et al., 2009; Kohler et al., 2010; Savla et al., 2012; Sprong et al., 2007). Similarly, meta-analyses have demonstrated that individuals who have experienced a first episode of psychosis (FEP; Barkl et al., 2014; Bora et al., 2009; Cotter et al., 2018), and individuals defined as being in an at-risk mental state (ARMS) of developing psychosis (Cotter et al., 2018; Lee, Hong, Shin, & Kwon, 2015; Van Donkersgoed et al., 2015), exhibit impaired social cognitive performance across the major subdomains. Taken together, the current evidence suggests that social cognitive impairment is apparent across the psychosis

continuum. As such, there has been increasing investigation into the effect of modulating social cognitive functioning to improve outcomes in psychosis.

Of particular interest has been the relationship between social cognition and functional outcomes. Cognitive models of positive psychotic symptoms incorporate attributional biases as key in the development of hallucinations and delusions, with social withdrawal as an important coping response (Garety et al., 2001; Morrison, 2001). A ToM model of psychosis was described over two decades ago, and proposes that difficulties with processing sensory information and deficits in self and other monitoring play a role in positive symptoms of psychosis, with resulting reduction in social functioning (Frith, 1992). In addition, a cognitive model of negative psychotic symptoms highlights negative expectation biases in relation to pleasure, success, acceptance and perceived resources, may influence the development of negative symptoms and lead to social functioning impairments (Beck et al., 2011; Rector et al., 2005). Emotion recognition has received less empirical investigation in relation to psychosis and functional outcomes, however a basic model has been proposed where by deficits in emotion recognition and social perception may lead to anxiety and difficulty navigating the social world, which may lead to withdrawal and reduced social functioning (Couture et al., 2006).

A meta-analysis in chronic course schizophrenia demonstrated that social cognition is a stronger predictor of functional outcome than neuropsychological performance (Fett et al., 2011). Of note, in this study, the strongest association was found between ToM and community functioning (Fett et al., 2011). A number of individual studies have reported the relationship between social cognition and functional outcomes in FEP and ARMS populations (e.g. Cotter et al., 2018; Palmier-Claus et al., 2016). However, these data have not yet been combined using meta-analytic methods to allow for a quantitative analysis of all studies in the literature.

Considering the important role of social cognition in psychosis and the evidence that, in chronic course schizophrenia, social cognition is strongly related to functional outcomes, it is of importance to determine the strength of relationship between social cognition and functional outcomes in FEP and ARMS participants. In addition to social functioning, it is of interest to determine the strength of relationship between social cognition and psychotic symptomatology in ARMS and FEP. As with functional outcomes, individual studies have reported correlations between social cognition and psychotic symptoms in ARMS and FEP participants (e.g. Green et al., 2012; Ntouros et al., 2014). However, again, these findings have not yet been combined using meta-analytic methods.

A better understanding of the relationship between social cognition, functional outcomes, and psychotic symptoms in FEP and ARMS participants, may provide important information for more targeted therapeutic interventions. For example, in chronic course schizophrenia, social cognitive training has shown promise as a treatment for improving social cognitive impairments, with some effects in treating negative symptoms (Kurtz et al., 2016). Moreover, there is evidence that improving facial affect recognition in schizophrenia is associated with large improvements in social functioning (Bordon et al., 2017). At present, it is unclear which social cognitive domains are most strongly related to functioning and psychotic symptomatology in ARMS and FEP, and thus, which domains should be the target of therapeutic intervention. It is also unclear if the relationship between social cognition, functioning and psychotic symptoms differs due to stage of illness i.e. when in the ARMS stage or following the development of frank psychotic symptoms.

As such, the current study aims to address the gap in the evidence by conducting a meta-analysis to determine the following:

1. The strength of relationship between social cognition, social functioning and positive and negative psychotic symptoms in ARMS and FEP participants.
2. The strength of relationship between each social cognition subdomain (emotion recognition, ToM, social perception and attributional biases), social functioning and positive and negative psychotic symptoms in ARMS and FEP participants.
3. The effect of demographic moderator variables on the strength of relationship between social cognition, social functioning and positive and negative psychotic symptoms in ARMS and FEP participants.

3.3. Method

3.3.1. Search Strategy

A comprehensive search of the literature was conducted using the following databases: MEDLINE (Ovid), EMBASE (Ovid), CINAHL (EBSCO), and PsychINFO (EBSCO) from 1980 to June 2018. Search terms were: Ultra high risk for psychosis OR ultra high risk OR ultra-high risk OR UHR OR clinical high risk of psychosis OR clinical high risk OR CHR OR at risk mental state OR at-risk mental state OR ARMS OR prodromal psychosis OR prodromal schizophrenia OR schizophrenia prodrome OR prodromal phase OR prodrome OR prodromal stage OR prodromal symptoms OR attenuated psychotic symptom OR attenuated psychosis syndrome AND first episode psychosis OR early psychosis OR FEP OR early schizophrenia AND social functioning OR social impairment OR social dysfunction OR social adjustment OR social recovery OR functioning OR impaired functioning OR general functioning OR functional impairment AND psychotic symptoms OR delusions OR hallucinations OR paranoia AND social

cognition OR social cognitive OR theory of mind OR emotion recognition OR affect recognition OR facial affect recognition OR emotional prosody OR emotional body language OR social perception OR mentalizing OR mentalising OR empathy OR faux pas OR social faux pas OR attributional style OR attributional bias

3.3.2. Selection Criteria

Studies were included in this meta-analysis based on the following inclusion/exclusion criteria:

Inclusion Criteria:

1 Primary research including observational and intervention studies reporting a relationship between a social cognition measure, functioning measure, and/or psychotic symptom measure.

2 Participant age range <65 years old;

3 Male and female;

4 Participants identified as being at-risk for developing psychosis as defined by the Comprehensive Assessment of At Risk Mental States (CAARMS; Yung et al., 2005), Criteria of Prodromal States (COPS) using the Structured Interview for Prodromal Symptoms (SIPS), Scale of Prodromal Symptoms (SOPS; Miller et al., 2003) or Early Recognition Inventory (Häfner et al., 2004).

5 Participants identified as having experienced a FEP diagnosed according to DSM-IV, DSM-IV-TR, DSM-5, ICD-10 criteria.

6 Studies reporting a social cognition measure including but not limited to emotion processing (facial emotion recognition, emotion prosody), Social Perception, Theory of Mind and Attributional Style.

7 Studies reporting a reliable and valid social functioning outcome measure to include, but not limited to, clinician rate, self-report and performance based measures; Social and Occupational Functioning Assessment Scale (SOFAS; Burns & Patrick, 2007); Multnomah Community Ability Scale (MCAS; Barker et al., 1994); Global Assessment of Functioning- Functioning subscale (Burns & Patrick, 2007); Global Functioning: Social Scale (Cornblatt et al., 2007); Social Adjustment Scale-II (Schooler et al., 1979); Role Functioning Scale (Goodman et al., 1993); Social Functioning Scale (SFS; Birchwood et al., 1990); Social Adjustment Scale-Self Report (Weissman & Bothwell, 1976); and Social Skills Performance Assessment (Patterson et al., 2001).

8 Studies reporting a reliable and valid psychotic symptom outcome measure including but not limited to Brief Psychiatric Rating Scale (BPRS), Positive and Negative Syndrome Scale (PANSS), Scale for the Assessment of Positive Symptoms (SAPS); Scale for the Assessment of Negative Symptoms (SANS).

Exclusion Criteria:

1. Studies not reporting a cross-sectional relationship between a social cognition measure and social functioning or psychotic symptoms.
2. Studies not including at-risk or FEP participants.

3.3.3. Quality Assessment:

Studies were assessed for quality using the QualSyst tool (Kmet, Cook, & Lee, 2004). The QualSyst tool provides 14 quality assessment items which are scored depending on if the study meets criteria fully (yes=2) partially (partial=1) not at all (no= 0) or if the criteria is non-applicable (N/A). For the current study, three of 14 criteria pertaining to interventional trials were rated N/A for each study and these three criteria were excluded when determining the overall score, as described in the original article (Kmet et al., 2004).

A random sample of 20% of included papers were blind quality assessed by an independent reviewer to determine inter-rater reliability, which showed fair agreement (84% agreement; $\kappa = 0.35$, $p=0.001$). Where disagreements arose, the assessors referred to the QualSyst scoring manual to discuss and agree on a final score. The remainder of quality assessments were carried out by the first author.

Each of 14 quality assessment items are added together to give an overall quality score for each study with a maximum score of 28. The total score is then divided by the maximum total score. As three items on the QualSyst tool pertain to interventional trials, the total number of items for each study in the current review was 11, providing a maximum total score of 22 for each paper and a maximum global rating (total score/ total number of quality items rated) of one for each study. A cut-off score of <0.5 was used to determine study inclusion (Kmet et al., 2004).

3.3.4. Data Extraction

Data were extracted from each study based on (1) study characteristics (year of publication, country where study was conducted, sample size); (2) characteristics of ARMS and FEP participants (mean age, ratio of male to female in sample,

duration of illness, IQ, chlorpromazine equivalent of medication use in milligrams per day (CPZ equiv/ mg per day); (3) clinical assessment/ diagnostic instruments used to identify ARMS and FEP participants (including the specific diagnosis that FEP participants where available); (4) measures used to assess social functioning and psychotic symptomatology; (5) social cognitive tests employed in each study and social cognitive domain assessed by this test (ER, ToM, SP, AB); (6) statistical correlation data between each available social cognitive measure and functioning/psychotic symptom outcomes. Data was not imputed if missing, unclear and/or not made available by the study authors.

3.3.5. Summary Measures and Synthesis of Results for Meta-analysis

Meta-analyses were conducted by computing a pooled correlation coefficient of extracted data using Comprehensive Meta-Analysis (CMA; Borenstein et al., 2013). When meta-analysing correlational data, CMA conducts all statistical analysis on transformed standardised effect sizes (Fishers Z). However, for clarity, all data are presented as correlation coefficients (Pearson's r).

For each study, effect size (r values), 95% confidence interval (CI), Z and p values were computed based on the correlation coefficient data on the relationship between a social cognitive function test and social function/ psychotic symptom outcome. As between study heterogeneity was expected, the pooled correlation coefficient estimate and 95% CI were calculated using a random effects model. A random effects model accounts for within study variance and sample size to provide a weighted estimate of effect size and 95% CI.

A series of meta-analyses were conducted to investigate the relationships of interest following the same protocol for each. First, an analysis of the relationship between overall social cognitive performance (calculated by averaging all relevant correlational data provided in each study) and the outcome (social functioning, positive psychotic symptoms,

negative psychotic symptoms) was conducted. Next, we determined the relationship between each social cognitive domain individually (where data were available) and each outcome (social functioning, positive psychotic symptoms, negative psychotic symptoms). We determined that a minimum of three studies were required to incorporate in a meta-analysis (Borenstein et al., 2013). If less than three studies were unavailable for quantitative analysis, a narrative synthesis of available studies is provided.

For each analysis determining the strength of relationship between a social cognitive measure) and outcome, a pooled correlation coefficient estimate was computed for ARMS and FEP groups individually. Following this, analysis of variance (ANOVA) were conducted to determine if the pooled correlation coefficient estimates significantly differed between ARMS and FEP participants. Z and p-values are reported for ANOVA and significance was set at $p<0.05$. Finally, the overall pooled correlation coefficient for the combined ARMS and FEP groups is reported along with Z, p-values and 95% CI.

Heterogeneity in effect size estimates between studies was determined using Chi-square based on Cochrans Q-statistic (Cochran, 1950). The proportion of variability in the pooled effect size due to between study heterogeneity is provided by the I^2 value. An $I^{2=}$ 25% corresponds to low heterogeneity, 50% to moderate and 75% to high (Higgins & Thompson, 2002). As I^2 has low sensitivity in detecting heterogeneity, alpha level of significance was set at $p<0.1$ (Song, Sheldon, Sutton, Abrams, & Jones, 2001).

Where heterogeneity was significant in either ARMS or FEP groups, random effects meta-regression was conducted on the groups combined to determine which variables might account for heterogeneity. Variables entered into

the meta-regression model were publication year, continent in which study was conducted, study quality, sample size, mean age and gender (% of males in sample). Q and p values are reported for meta-regression analysis in addition to % of variance accounted for by the model, where relevant.

Risk of bias was determined using funnel plots of Fishers Z standard error (SE) and the trim and fill method (Duval & Tweedie, 2000). The trim and fill method calculates how many studies might be missing from each meta-analysis to correct for funnel plot asymmetry and provides adjusted effect size estimates based on the inclusion of missing studies.

3.4. Results

A total of 45 studies, published between 1980 and January 2019 were identified for inclusion in this meta-analysis. Of these studies, 40 were independent samples. However, the authors of 8 other studies were unable to provide study data or were uncontactable, leaving a total of 32 studies included for quantitative analysis (see **Figure 3.1.** for details). In cases where data sets were overlapping, the authors were contacted to provide the original data set. Where this was not possible, data was extracted from the earliest publication and used for analysis. Of included studies, six studies had only a population of at risk participants (Amminger et al., 2013; Barbato et al., 2013; Cotter et al., 2015; Eack et al., 2010; Glenthoj et al., 2018; Piskulic et al., 2016), 20 studies with only a population of FEP participants (Achim, Ouellet, Roy, & Jackson, 2012; Addington, Saeedi, & Addington, 2006; Bozikas et al., 2018; Bozikas et al., 2015; Caletti et al., 2018; Catalan et al., 2018; Catalan et al., 2016; Eack et al., 2010; Gardner et al., 2017; Hooper et al., 2010; Humphreys & Barrowclough, 2006; Koelkebeck et al., 2010; Langdon, Connors, Still, Ward, & Catts, 2014; Ludwig, Pinkham, Harvey, Kelsven, & Penn, 2017; Mazza et al.,

2012; Ntouros et al., 2014; Romero-Ferreiro et al., 2016; Stouten, Veling, Laan, van der Helm, & van der Gaag, 2014, 2017; Tsui et al., 2013), and six studies which included a sample of both at-risk and FEP participants (Clayson et al., 2018; Green et al., 2012; Lee et al., 2015; Ntouros et al., 2018; Ohmuro et al., 2016; Palmier-Claus et al., 2016). The total number of participants in the combined at risk (n=1403) and FEP sample (n=1596) was n=2999. However, it should be noted that in the at-risk group one study had a much larger sample size (n=746) than all other studies (Piskulic et al., 2016). The sample size ranged from 12 to 746. The age range of participants was 14.25 to 37.8 years with a mean of 23.03 years. The majority of included studies had a predominantly male sample (range: 27.5% to 100% male, mean= 63.74%).

A total of 21 studies included a social functioning measure and 23 a psychotic symptom measure. A total of 23 studies included a measure of emotion recognition, 20 a ToM measure (see **Table 3.1.** and **3.2.** for details of tests), nine a Social Perception measure and four an Attributional Bias measure. As there were too few studies to combine Social Perception and Attributional Bias in a meta-analysis for ARMS and FEP participants, these social cognitive domains were not analysed and only overall social cognition, emotion recognition and ToM were included.

3.4.1. Study quality

No studies which were quality rated fell below the <0.5 cut-off score and so no studies were excluded on this basis. As such, all studies met quality criteria. The range was 0.59 to 1.0 with a mean of 0.9 (S.D. ± 0.089). Quality ratings for each study are presented in **Table 3.3.** below.

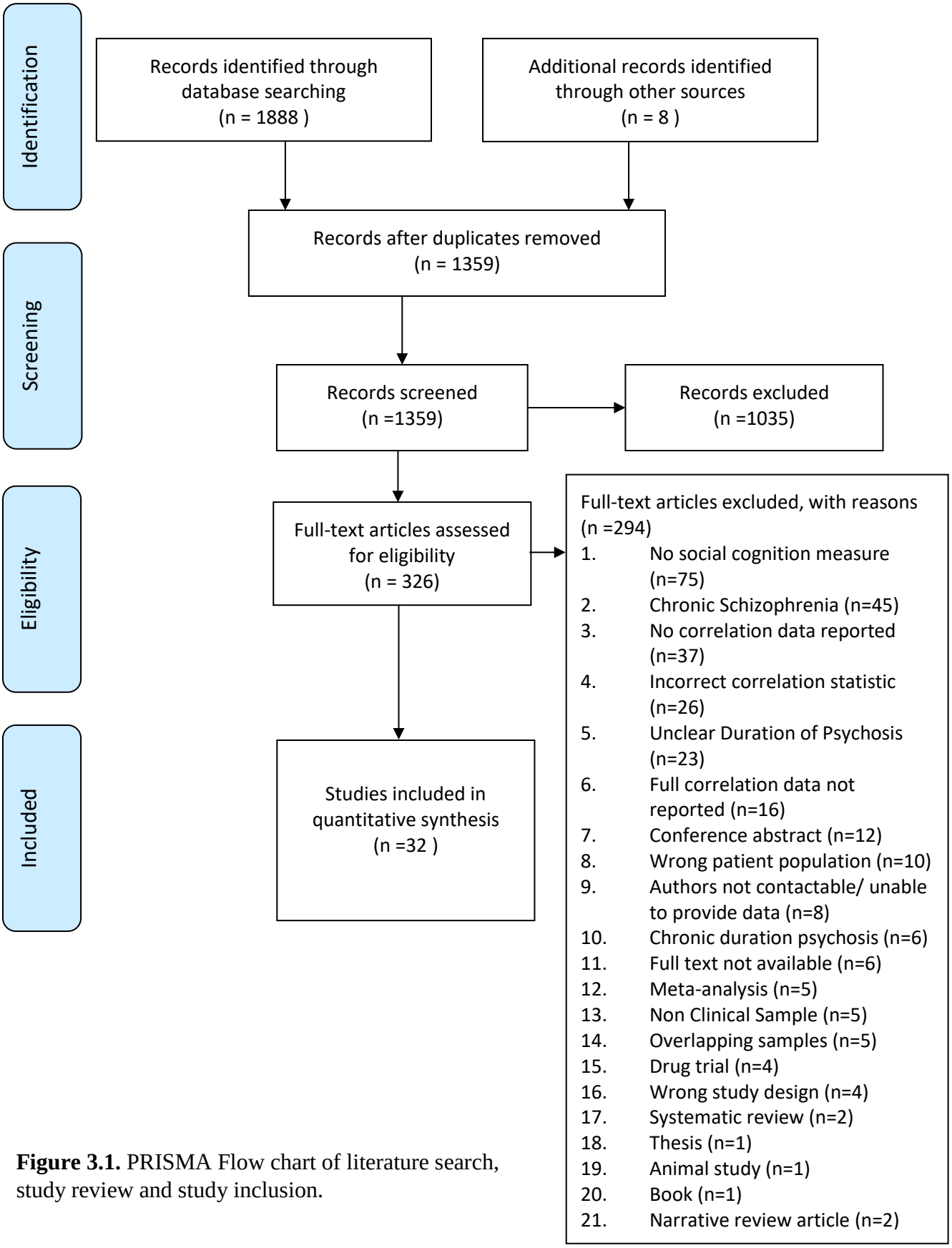

Figure 3.1. PRISMA Flow chart of literature search, study review and study inclusion.

Table 3.1. Studies included in review with AMRS participants

Study	Country	N	Age (M, SD)	Gender (n; M:F,)	Duration of illness	IQ M, SD	ARMS Measure	Social Functioning Measure	Psychotic Symptom Measure	Social Cognition Measure	Social Cognitive Domains
Amminger et al., (2013)	Australia	79	16.5 (2.1)	26:53	NR	NR	NR	NR	NR	Facial Recognition/Vocal Prosody	ER
Barbato et al., (2013)	USA, Canada	137	19.96 (4.67)	81:56	NR	NR	SIPS	SFS	NR	FEIT, FEDT, RMET	ER
Clayson et al., (2018)	USA	43	18.8 (3.9)	31:12	NR	NR	SIPS	GFS:Social	NR	FEIT	ER
Cotter et al., (2015)	Australia	30	19.1 (2.8)	14:16	NR	103.3 (16)	CAARMS	SOFAS	NR	DANVA-2, Hinting Task, MSCEIT, SCST-R, ANSIE	ER, ToM, SP, AB
Eack et al., (2010)	Spain	70	16.3 (3.4)19	38:32	NR	104.11	SIPS/SOPS	NR	SIPS/SOPS	ER-40	ER
Glenthoj et al., (2018)	Denmark	146	24.3 (4.2)	66:80	NR	105 (12.9)	CAARMS	SOFAS/PSP	NR	CANTAB ERT	ER
Green et al., (2012)	USA	50	18.25 (3.12)	36:14	NR	NR	SIPS	NR	SAPS/SANS	MSCEIT, TASIT, RADS	ER, SP
Lee et al., (2015)	South Korea	40	19.9 (3.6)	25:15	NR	104.1 (11.8)	SIPS	Social Anhedonia Scale	Chapman Perceptual aberration scale	Ekmans Faces	ER
Ntouros et al., (2018)	Greece	12	24.5 (3.1)	12:0	NR	NR	CAARMS	NR	PANSS	PESIT	ToM
Ohmuro et al., (2016)	Japan	36	20.9 (4.7)	14:22	NR	101.1 (11.7)	CAARMS-J	SFS	NR	Picture Stories Task	ToM
Palmier-Claus et al., (2016)	UK	14	22.6 (5.2)	6:8	NR	NR	CAARMS	PSP	NR	RMET, Hinting Task	ToM
Piskulic et al., (2016)	USA, Canada	746	18.5 (4.23)	436:328	NR	NR	COPS		SIPS/SOPS	Penn Emotion Differentiation task, TASIT, RADS	ER, ToM, SP

ANSIE, Adult Nowicki Strickland Internal External locus of control scale; CAARMS, Comprehensive Assessment of At-Risk Mental States; COPS, Criteria of Psychosis-risk Syndromes; DANVA-2, Diagnostic Analysis of Nonverbal Accuracy 2; ER, Emotion Recognition; ER-40, Penn Emotion Recognition Task; FEIT, Face Emotion Identification Task; FEDT, Face Emotion Discrimination Task; GFS, General Functioning Scale; MSCEIT, Mayer–Salovey–Caruso Emotional Intelligence Test; NR, Not reported; PANSS, Positive and Negative Symptom Scale; PESIT, Perception of Social Inference Test; PSP, Personal and Social Performance Scale; RADS, Relationship Across the Domains test; RMET, Reading the Mind in The Eyes Test; SIPS/SOPS, Structured Interview for Psychosis-risk Syndromes/ Scale Of Psychosis-risk Symptoms; SP, Social Perception; SOFAS, Social and Occupational Functioning Assessment Scale; SCST-R, Schema Component Sequencing Task–Revised; TASIT, The Awareness of Social Inference Test; ToM, Theory of Mind.

Table 3.2. Studies included in review with participants with first episode psychosis

Study	Country	N (patients)	Age (M, SD)	Gender (M:F)	Duration of illness (months, mean)	IQ (mean, SD)	Meds (CPZ equiv/mg per day(SD)	Diagnosis	Social Functioning Measure	Psychotic Symptom Measure	Social Cognition Measure(s)	Social Cognitive Domains
Achim et al., (2012)	Canada	31	24.9 (4.5)	26:5	20.9	100.4 (15.1)	NR	Schizophrenia (n=23), schizoaffective disorder (n=2), delusional disorder (n=4), and psychosis not otherwise specified (n=2)	SOFAS	NR	Ekman Faces, Hinting Task, False Belief Task, Faux Pas, Strange Stories Test, Social Knowledge Test, SCRT	ER, ToM, SP
Addington et al., (2006)	Canada	50	25.1 (8.0)	30:20	NR	NR	343.5	Schizophrenia (n=32) , schizophreniform (n=12), delusional disorder (n=1), brief psychotic disorder (n=1), psychotic disorder not otherwise specified (n=3) and schizoaffective (n=1)	Quality of Life Scale, Assessment of Interpersonal Problem Solving	PANSS	Emotion Recognition, Discrimination, SFRT	ER, SP
Bozikas et al., (2015)	Greece	27	26.33 (4.51)	24:3			538.09 (67.32)	DSM-IV-TR, psychotic disorder		PANSS	PESIT	SP
Bozikas et al., (2018)	Greece	35	32.77 (7.56)	19:16	NR		358.37 (200.41)	Schizophrenia (n=21), Schizoaffective disorder, (n=1), Delusional disorder (n=2), Unspecified psychotic disorder (n=2), Brief psychotic disorder (n=5), Bipolar disorder (n=4)		PANSS	Facial affect recognition	ER
Caletti et al., (2018)	Italy	208	30.2 (10.3)	118:90	NR	109.8 (6.9)	NR	ICD-10 for psychosis		PANSS	MEC	ER
Catalan et al., (2018)	Spain	32	37.8 (13)	13:19	NR	91.1 (17.3)	NR	DSM-IV psychotic disorder		PANSS	MASC	ToM

Study	Country	N (patients)	Age (M, SD)	Gender (M:F)	Duration of illness (months, mean)	IQ (mean, SD)	Meds (CPZ equiv/mg per day(SD)	Diagnosis	Social Functioning Measure	Psychotic Symptom Measure	Social Cognition Measure(s)	Social Cognitive Domains
Catalan et al., (2016)	Spain	64	35.5 (12.9)	41:23	NR	95.3 (14.4)	NR	Schizophrenia or schizophreniform disorder (n = 32), Affective psychosis (n = 18), Brief psychotic episode (n = 7), Delusional disorder (n = 7)		PANSS	MASC	TOM
Clayson et al., (2018)	USA	63	22.7 (3.5)	46:17	NR	NR	NR	DSM-IV diagnostic criteria for schizophrenia, schizoaffective disorder, or schizophreniform disorder	GFS:Social		FEIT	ER
Eack et al., (2010)	USA	64	25.78 (6.15)	44:20	38.4 (27.72)	NR	NR	schizophrenia (n = 37), schizoaffective (n = 23), or schizophreniform disorder (n = 4)	Performance Potential Inventory		MSCEIT	ER
Gardner et al., (2017)	Australia	146	20.49 (2.41)	101:45	8.9 (16.11)	92.4 (13.93)	NR	Schizophrenia (n=56), Depression with psychotic features (n=21), Schizoaffective disorder (n=19), Psychosis not otherwise specified (n=17), Bipolar disorder with psychotic features (n=16), Schizophreniform disorder (n=8), Delusional disorder (n=8), Brief psychotic disorder (n=1)	SOFAS		DANVA, False Belief and Deception Stories	ER, ToM

Study	Country	N (patients)	Age (M, SD)	Gender (M:F)	Duration of illness (months, mean)	IQ (mean, SD)	Meds (CPZ equiv/mg per day(SD)	Diagnosis	Social Functioning Measure	Psychotic Symptom Measure	Social Cognition Measure(s)	Social Cognitive Domains
Green et al., (2012)	USA	81	22.02 (4.18)	30:20	NR	NR	NR	Schizophrenia (n = 46), Schizoaffective disorder (n =10), Schizophreniform disorder (n = 25)		SAPS/SANS	MSCEIT, TASIT, RADS	ER, SP
Hooper et al., (2010)	USA	119	14.25 (2.41)						VABS		RMET	ToM
Humphreys & Barrowclough, (2006)	UK	35	27.91 (7.81)	28:7	NR	NR	NR	Schizophrenia, Schizophreniform, Schizoaffective disorder.		PANSS	ASQ, IPSAQ	AB
Koelkebeck et al., (2010)	Germany	23	24.5 (5.6)	11:12	36.4 (34.5)	NR	539.7 (296.9)	SCID-I		PANSS	Moving Shapes paradigm	ToM
Langdon et al., (2014)	Australia	23	20.91 (1.83)	22:1	11.8 (6.88)	96.65 (8.41)	NR	ICD-10 criteria Paranoid Schizophrenia (n=17); Undifferentiated Schizophrenia (n=4); Schizoaffective Disorder – Bipolar Subtype (n=1); Other Non-Organic Psychotic Disorder (n=1)	SOFAS	SAPS/SANS	False belief, Joke Appreciation, Story comprehension	ToM
Lee et al., (2015)	South Korea	24	20.5 (3.3)	8:16	9.5 (10.8)	96 (15.7)	454.7 (307.6)	NR	Social Anhedonia Scale	Chapman Perceptual aberration scale	Ekmans Faces	ER
Ludwig et al., (2017)	USA	38	23.5 (3.01)	33:5	NR	NR	NR	Schizophrenia(n=25) Schizoaffective (n=6) Psychosis NOS (n= 7)	SSPA		ER-40, BLERT, TASIT, Hinting Task, RADS, AIHQ	ER, ToM, SP, AB
Mazza et al., (2012)	Italy	49	26.4 (7.56)	33:16	NR	79.7 (12.9)		DSM-IV-TR diagnoses of schizophrenia or schizoaffective disorder	VADO Personal and Social Functioning Scale		Strange Stories Test	ToM

Study	Country	N (patients)	Age (M, SD)	Gender (M:F)	Duration of illness (months, mean)	IQ (mean, SD)	Meds (CPZ equiv/mg per day(SD)	Diagnosis	Social Functioning Measure	Psychotic Symptom Measure	Social Cognition Measure(s)	Social Cognitive Domains
Ntouros et al., (2014)	Greece	27	26.33 (4.51)	24:3	NR	NR	538.09	NR		PANSS	PESIT	ER, ToM
Ntouros et al., (2018)	Greece	25	25.48 (5.41)	25:0	NR	NR	555.32 (388.67)	NR		PANSS	PESIT	ToM
Ohmuro et al., (2016)	Japan	40	22.9 (6.3)	11:29	NR	99.1 (8.3)	371.9(343.1)	Schizophrenia (n=24,); Schizophreniform disorder (n=4); Brief psychotic disorder (n=1); Delusional disorder (n=1), Bipolar disorder with psychotic features (n=2), Psychotic disorder not otherwise specified (n=8)	SFS		Picture Stories Task	ToM
Palmier-Claus et al., (2016)	UK	20	24.6 (5.2)	16:4	NR	NR	NR	Cut-off scores on the Positive and Negative Syndrome Scale	PSP	Green Paranoid Thought Scales	RMET, Hinting Task	ToM
Romero-Ferreiro et al., (2016)	Spain	21	15.6 (1.63)	13:7	NR	NR	206.45 (128.63)	ICD-10		PANSS	NimStim set facial affect recognition	ER
Stouten et al., (2014)	Netherlands	153	27.8	111:42	NR	NR	NR	Schizophrenia (n=81), brief psychotic disorder (n=9), delusional disorder (n=5), shared psychotic disorder (n=2), psychotic disorder NOS (n=56)	PSP	PANSS	Hinting Task	TOM

Study	Country	N (patients)	Age (M, SD)	Gender (M:F)	Duration of illness (months, mean)	IQ (mean, SD)	Meds (CPZ equiv/mg per day(SD)	Diagnosis	Social Functioning Measure	Psychotic Symptom Measure	Social Cognition Measure(s)	Social Cognitive Domains
Stouten et al., (2017)	Netherlands	162	27.61 (6.3)	116:46	NR	NR	NR	Schizophrenia (n=81) Schizoaffective disorder (n= 9); Brief psychotic disorder (n= 9); Delusional disorder (n=5) Shared psychotic disorder (n=2); Psychotic disorder NOS (n=56)	PSP	PANSS	Amsterdam Neuropsychological Tasks (emotion processing speed), Hinting Task, WAIS III Picture Arrangement, Davos Assessment of Cognitive Biases Scale	ER, TOM, SP, AB
Tsui et al., (2013)	China	36	22 (4.6)	18:18	29.6 (20.1)	105.3 (15.6)	358.1 (23.1)	Schizophrenia		SAPS/SANS	Facial emotion categorization	ER

AB, Attributional Bias; AIHQ, Ambiguous Intentions Hostility Questionnaire; ANSIE, Adult Nowicki Strickland Internal External locus of control scale; ASQ, Attributional Style Questionnaire; BLERT, Bell Lysaker Emotion Recognition Task; CANTAB ERT, Cambridge Neuropsychological Test Automated Battery-Emotion Recognition Test; DANVA-2, Diagnostic Analysis of Nonverbal Accuracy 2; DSM-IV, Diagnostic and Statistical Manual of Mental Disorders; ER, Emotion Recognition; ER-40, Penn Emotion Recognition Task; FEIT, Face Emotion Identification Task; FEDT, Face Emotion Discrimination Task;GFS, General Functioning Scale; IPSAQ, International, Personal, and Situational Attributions Questionnaire; ICD, International Classification of Diseases; MASC, Movie for the Assessment of Social Cognition; MEC, Montreal Evaluation Protocol of Communication; MSCEIT, Mayer–Salovey–Caruso Emotional Intelligence Test; NR, Not reported; PANSS, Positive and Negative Symptom Scale; PESIT, Perception of Social Inference Test; PERT, Penn Emotion Recognition Test; PSP, Personal and Social Performance Scale; RAD, Relationship Across the Domains test; RMET, Reading the Mind in The Eyes Test; SIPS/SOPS, Structured Interview for Psychosis-risk Syndromes/ Scale Of Psychosis-risk Symptoms; SP, Social Perception; SOFAS, Social and Occupational Functioning Assessment Scale; SAPS/SANS, Scale for the Assessment of Positive Symptoms/ Scale for the Assessment of Negative Symptoms; SCST-R, Schema Component Sequencing Task–Revised; SCID-I, Structured Clinical Interview; SFRT, Situational Features Recognition Test; SP, Social Perception; SSPA, Social Skills Performance Assessment; TASIT, The Awareness of Social Inference Test; ToM, Theory of Mind; VABS, Vineland Adaptive Behavior Scale; VSIT, Video Social Inference Task; WAIS, Wechsler Adult Intelligence Scale.

Table 3.3. Quality ratings for each included study

Study	Objective	Study Design	Recruitment Method	Sample Characteristics	Measures	Sample Size	Analysis	Estimate of Variance	Confounding Variables	Results	Valid Conclusions	Global Score
Achim (2012)	2	2	2	2	2	1	2	0	2	1	2	0.82
Addington (2006)	2	2	2	2	2	1	2	0	2	1	2	0.82
Amminger (2013)	2	1	1	1	1	0	1	2	0	2	2	0.59
Barbato (2013)	2	2	2	2	2	2	2	2	2	2	2	1.00
Bozikas (2015)	2	2	2	2	2	0	2	2	2	2	2	0.91
Bozikas (2018)	2	2	2	2	2	1	2	2	2	2	2	0.95
Caletti (2018)	1	2	1	2	2	1	2	2	2	2	2	0.86
Catalan (2016)	2	2	2	2	2	1	1	2	2	1	2	0.86
Catalan 2018	2	2	2	2	2	1	2	2	2	2	2	0.95
Clayson (2018)	2	2	2	2	2	1	2	2	2	2	2	0.95
Cotter (2015)	2	1	2	2	2	0	1	2	1	2	2	0.77
Eack, Greeno (2010)	2	2	2	2	2	1	1	2	1	2	2	0.86
Eack, Mermon (2010)	2	2	2	2	2	1	0	2	2	2	2	0.86
Gardner (2017)	2	2	2	2	2	1	2	2	1	2	2	0.91
Glenthoj (2018)	2	2	2	2	2	2	2	2	2	2	2	1.00
Green (2012)	2	2	2	2	2	1	2	2	2	2	2	0.95
Hooper (2010)	1	2	2	2	1	1	2	2	1	2	2	0.73
Humphreys (2006)	2	2	2	2	2	1	0	2	2	2	2	0.86

Koelkebeck (2010)	2	2	2	2	2	1	2	2	2	2	2	0.95
Langdon (2014)	2	1	2	2	2	2	2	2	2	2	2	0.95
Lee (2015)	2	1	2	2	2	1	2	2	2	2	2	0.91
Ludwig (2017)	2	2	2	2	2	1	2	2	2	2	2	0.95
Mazzaetal.(2012)	2	2	2	2	2	1	2	2	2	2	2	0.95
Ntouros (2014)	2	2	2	2	2	1	2	2	2	2	2	0.95
Ntouros (2018)	2	2	2	2	0	0	2	2	2	2	2	0.82
Ohumuro (2016)	2	2	2	2	2	2	2	2	2	2	2	1.00
Palmier-Claus (2016)	2	2	2	2	2	1	2	2	2	2	2	0.95
Piskulic (2016)	2	2	2	2	2	1	2	2	2	2	2	1.00
Romero-Ferreiro (2016)	2	2	2	2	2	1	2	2	2	2	2	0.95
Stouten (2014)	2	2	2	1	2	1	2	2	0	2	2	0.82
Stouten (2017)	2	2	2	2	2	1	2	2	0	2	2	0.86
Tsui (2013)	2	2	2	2	1	1	2	2	2	2	2	0.91

3.4.2. Results from Meta-analyses

The results from each meta-analysis are summarised in **Table 3.3.** For ARMS participants, a significant positive relationship was identified between overall social cognition (r= 0.118 (95% CI: 0.023 to 0.210), emotion recognition (r= 0.131 (95% CI: 0.031 to 0.228), ToM 0.178 (95% CI: 0.043 to 0.306) and social functioning. In addition, a significant negative relationship was identified between emotion recognition performance and negative symptoms in ARMS participants (r= -0.11 (95% CI: -0.201 to -0.017). Only two included studies reported the correlation coefficient between ToM performance and negative psychotic symptoms in ARMS participants. As such these were not included in a quantitative analysis. These studies reported differing results and had notable differences in sample size. Piskulic et al., (2016) reported a weak negative correlation between these variables (r= -0.07, n=764) whilst Ntouros et al., (2018) reported a weak positive correlation (r=0.042, n=12). Significant pooled effect sizes in each analysis were small. For non-significant findings in ARMS participants, similarly small effect sizes were identified for each social cognitive domain, social functioning and psychotic symptoms (see **Table 3.4.** for details). Between study heterogeneity varied depending on the analysis and ranged from I^2 = 0% to 58.82%.

In FEP participants, significant pooled effect sizes were identified for each meta-analysis (see **Table 3.4.** for details). Overall social cognition, emotion recognition and ToM were significantly positively related to social functioning and significantly negatively related to positive and negative psychotic symptoms (see **Table 3.4.**). Effect sizes in each analysis were small ranging from r= -0.3 to r= 0.222. The largest effect size was identified for the negative relationship between

ToM performance and negative symptoms. Across analyses between study heterogeneity was low, ranging from I^2 = 0% to 19.18% (see **Table 3.4.**). Forest plots with results from individual studies in each meta-analysis can be inspected in **Appendix C**.

2.4. Summary table of all meta-analyses carried out to determine the relationship between overall social cognition, social functioning and psychotic symptoms in ARMS and FEP participants

Social Cognitive Domain	Outcome Measure	ARMS *N*	ARMS K studies	ARMS Pooled Estimate (95% CI)	Z Pooled Estimate P value	Q	Df	I^2 (%)	Tau^2	H P value	FEP *N*	FEP K Studies	FEP Pooled Estimate (95% CI)	Z Pooled P value	Q	Df	I2	Tau	H P value
Overall Social Cognition	Social Functioning	446	7	**0.118 (0.023 to 0.210)**	2.443 0.015	2.458	6	0	0.0	0.873	965	14	**0.205 (0.143 to 0.266)**	6.327 <0.001	7.448	13	0	0.0	0.878
	Positive Symptoms	940	6	-0.144 (-0.315 to 0.035)	-1.575 0.115	12.14 1	5	58.82	0.025	0.033	833	15	**-0.178 (-0.245 to 0.109)**	-2.036 <0.001	13.40 5	15	0	0.0	0.571
	Negative Symptoms	885	4	-0.131 (-0.277 to 0.021)	-1.691 0.091	5.01	3	40.11	0.01	0.171	973	14	**-0.211 (95% CI: -0.282 to -0.137)**	-5.514 <0.001	16.08 6	13	19. 18	0.004	0.245
Emotion Recognition	Social Functioning	396	5	**0.131 (0.031 to 0.228)**	2.571 0.01	1.651	4	0	0.00	0.8	577	8	**0.222 (0.141 to 0.299)**	5.3 <0.001	10.97	7	0	0.00	0.993
	Positive Symptoms	913	5	-0.144 (-0.315 to 0.035)	-1.575 0.115	12.14 1	5	58.82	0.025	0.033	459	8	**-0.166 (-0.234 to 0.069)**	-4.633 <0.001	8.914	14	0	0.00	0.836
	Negative Symptoms	945	4	**-0.11 (-0.201 to -0.017)**	-2.317 0.021	3.64	3	17.59	0.002	0.303	677	9	**-0.211 (-0.283 to -0.137)**	-5.465 <0.001	6.086	8	0	0.00	0.638
ToM	Social Functioning	217	4	**0.178 (0.043 to 0.306)**	2.571 0.01	2.134	3	0	0.00	0.545	767	10	**0.208 (0.138 to 0.276)**	5.72 <0.001	8.262	9	0	0.00	0.508
	Positive Symptoms	790	3	0.033 (-0.301 to 0.36)	0.187 0.851	3.991	2	49.88	0.051	0.136	465	8	**-0.189 (-0.288 to -0.085)**	-3.547 <0.001	7843	7	10. 74	0.003	0.347
	Negative Symptoms	-	-	-	- -	-	-	-	-	-	399	5	**-0.3 (-0.396 to -0.198)**	-5.56 <0.001	4.389	4	8.8 7	0.002	0.356

ARMS, at-risk mental state; FEP, first episode psychoisis; H; Heterogeneity p value; K, number of studies; DF, degrees of freedom. Bold pooled estimates indicate significant result.

3.4.3. Risk of bias in each meta-analysis

For each meta-analysis the trim and fill method was used by constructing funnel plots to identify how many, if any, studies might be missing from each analysis that would make the funnel plot symmetrical. Analyses were conducted using a random effects model and the unadjusted and adjusted pooled correlation coefficients along with 95% confidence intervals are presented in **Table 3.5.** Each funnel plot can be visually inspected in **Appendix D**. Briefly, the range of missing studies for ARMS participants was 1 to 3. As can be seen in **Table 3.5** below, the adjusted pooled estimates were not largely different than unadjusted estimates. Similarly, the range of number of missing studies for FEP participants was between 1 to 4. The adjusted estimates were each within the same range as unadjusted estimates. Taken together, this suggests that publication bias may not have had a major effect on the pooled estimates. However, as fewer studies were included for ARMS participants, caution is needed in drawing this conclusion.

Table 3.5. Summary table of risk of bias funnel plot analysis showing adjusted and unadjusted pooled estimate effect sizes for each meta-analysis in ARMS and FEP participants

Social Cognitive Domain	Outcome Measure	ARMS Number of missing studies	ARMS Unadjusted Pooled Estimate (95% CI)	ARMS Adjusted Pooled Estimate (95% CI)	FEP Number of missing studies	FEP Unadjusted Pooled Estimate (95% CI)	FEP Adjusted Pooled Estimate (95% CI)
Overall Social Cognition	Social Functioning	3	0.118 (0.023 to 0.210)	0.149 (0.064 to 0.233)	3	0.205 (0.143 to 0.266)	.187 (0.127 to 0.246)
	Positive Symptoms	1	-0.144 (-0.315 to 0.035)	-0.114 (-0.284 to -0.062)	1	-0.178 (-0.245 to 0.109)	-0.157 (-0.224 to -0.088)
	Negative Symptoms	1	-0.131 (-0.277 to 0.021)	-0.124 (-0.245 to -0.00003)	4	-0.211 (95% CI: -0.282 to -0.137)	-0.257 (-0.334 to -0.176)
Emotion Recognition	Social Functioning	1	0.131 (0.031 to 0.228)	0.146 (0.031 to 0.052)	2	0.222 (0.141 to 0.299)	0.211 (0.134 to 0.285)
	Positive Symptoms	2	-0.144 (-0.315 to 0.035)	-0.055 (-0.02 to -0.096)	1	-0.166 (-0.234 to 0.069)	-0.177 (-0.268 to -0.082)
	Negative Symptoms	1	-0.11 (-0.201 to -0.017)	-0.102 -0.163 to -0.041)	3	-0.211 (-0.283 to -0.137)	-0.237 (-0.305 to -0.167)
ToM	Social Functioning	1	0.178 (0.043 to 0.306)	0.191 (0.059 to 0.315)	1	0.208 (0.138 to 0.276)	0.198 (0.126 to 0.269)
	Positive Symptoms	0	0.033 (-0.301 to 0.36)	-	2	-0.189 (-0.288 to -0.085)	-0.141 (-0.274 to -0.004)
	Negative Symptoms	-	-	-	2	-0.3 (-0.396 to -0.198)	-0.334 (-0.445 to -0.213)

3.4.4. Effect of Group on the Relationship between social cognition, social functioning and psychotic symptoms

There were no significant group differences between ARMS and FEP participants on the relationship between social cognition, ER or ToM and social functioning and psychotic symptoms (see **Table 3.6.** for details). Note, ToM and negative symptoms were not included as fewer than three studies reported this relationship in ARMS participants. This suggests that the strength of relationship between each social cognitive measure and outcomes is similar in ARMS and FEP

participants. However, the pattern of results indicates a small, but consistent difference with a stronger relationship apparent in each analysis for FEP participants when compared to ARMS participants.

Table 3.6. Group differences on overall correlation coefficient in ARMS versus FEP participants

Social Cognitive Domain	Outcome Measure	K studies	ARMS *N*	FEP *N*	Pooled Estimate (95% CI)		Q	Df	ARMS vs. FEP p- value
					ARMS	FEP			
Overall Social Cognition	Social Functioning	21	446	965	0.118 (0.023 to 0.210)	0.205 (0.143 to 0.266)	2.345	1	0.126
	Positive Symptoms	22	940	833	-0.144 (-0.315 to 0.035)	-0.178 (-0.245 to 0.109)	0.121	1	0.728
	Negative Symptoms	18	885	973	-0.131 (-0.277 to 0.021)	-0.211 (95% CI: -0.282 to -0.137)	0.882	1	0.348
Emotion Recognition	Social Functioning	13	396	577	0.131 (0.031 to 0.228)	0.222 (0.141 to 0.299)	1.98	1	0.159
	Positive Symptoms	12	913	459	-0.144 (-0.315 to 0.035)	-0.166 (-0.234 to 0.069)	0.05	1	0.823
	Negative Symptoms	13	945	677	-0.11 (-0.201 to -0.017)	-0.211 (-0.283 to -0.137)	2.862	1	0.091
ToM	Social Functioning	14	217	767	0.178 (0.043 to 0.306)	0.208 (0.138 to 0.276)	1.56	1	0.69
	Positive Symptoms	11	790	465	0.033 (-0.301 to 0.36)	-0.189 (-0.288 to -0.085)	1.485	1	0.223

ARMS, at risk mental state; DF, degrees of freedom; FEP, first episode psychosis; ToM, Theory of Mind.

3.4.5. Meta Regression: Factors explaining between study heterogeneity

Sample size (Q(1)=11.18, p=0.008) was a significant predictor of between study variance for the relationship between social cognition and positive psychotic symptoms. Adding study quality to the model (Q(2)= 8.48, p=0.014) explained 87% of between study variance. Similarly, sample size and study quality combined (Q(2)=11.46, P=0.032) explained 100% of the variance in the relationship between emotion recognition and positive psychotic symptoms. A combined model of sample size and publication year (Q(2)=6.93, P=0.0313) accounted for 71% of the between study variance in studies reporting the relationship between ToM performance and positive psychotic symptoms. Taken together, the results from this meta-regression suggest that much of the between study variance can be accounted for by sample size and study quality. That publication year accounts for some variance may suggest a difference between more recent and earlier studies regarding variables such as psychometrically sound outcomes measure. However, this hypothesis was not tested in the current study due to a limited range of studies and outcome measures available.

3.5. Discussion

Main Findings

This study aimed to identify the degree to which social cognitive functioning, and subdomains, were related to social functioning and psychotic symptoms in participants defined as ARMS and having experienced a FEP. Overall better social cognition was associated with better social functioning in ARMS and FEP participants, with a small effect size in both groups. Better overall social cognition was significantly related to lower positive and negative psychotic symptoms in FEP but not ARMS participants. In both groups the overall effect size was small but it is noteworthy that the direction of effect was the same in both groups. A similar pattern was identified when each social cognitive subdomain was analysed. In ARMS participants, better emotion recognition and ToM performance were significantly related to better social functioning, while the relationship between ER and ToM was not significant for psychotic symptoms. In contrast, enhanced ER and ToM performance were significantly associated with improved social functioning and lower psychotic symptoms in FEP participants. The strongest relationship was identified for ToM and negative symptoms in FEP participants (r=-0.3). Although effect sizes remained in the small range, they were as predicted, in that better social cognitive functioning was associated with better social functioning and lower positive and negative symptomatology.

Our findings are in line with a previous meta-analysis conducted on studies with patients with chronic course schizophrenia (Fett et al., 2011). In this study, the largest effect size was for the relationship between ToM and community functioning (r= 0.48). This effect size is larger than that identified in the current study for the relationship between ToM and social functioning in FEP (r=0.208)

and ARMS participants (r=0.178). Our findings are in line with a previous meta-analysis demonstrating that ER and ToM performance are significantly related to psychotic symptoms in a mixed sample of FEP and longer duration psychotic disorder (Fett, Maat, & Investigators, 2011). In this analysis, the effect sizes were similarly small and showed an inverse relationship between social cognitive functioning, and positive and negative psychotic symptoms.

We did not find any significant differences between the pooled estimates for overall social cognition, or subdomains, and outcome measures in at risk and FEP participants. This may indicate that social cognitive impairments impact on social functioning and level of psychotic symptoms similarly before and after the onset of frank psychosis. However, this conclusion should be treated with caution as all data included in our meta-analyses were cross-sectional and future longitudinal studies are needed to confirm this conclusion. In addition, although group differences were not significant, there was a consistent difference in magnitude of relationship between ARMS and FEP participants in each meta-analysis.

Heterogeneity between studies was generally low when ARMS and FEP groups were combined in each meta-analysis. However, within the ARMS group greater between study heterogeneity was identified. This may reflect that this population of individuals are more heterogeneous as regards a range of psychological factors, including level of psychotic symptomatology and social functioning. However, it is likely to reflect that there smaller number of ARMS studies that were different to one another in terms of sample sizes. As there were a limited number of studies in the ARMS group for some subdomains, we choose to carry out meta-regression analyses on the groups combined, so as to increase statistical power. This showed that sample size and study quality moderated the relationship between social cognition (explained variance=87%), emotion recognition

(explained variance=100% of variance) and positive symptoms. Similarly, the combined model of sample size and publication year moderated the relationship between ToM performance and positive psychotic symptoms (explained variance=71%). Unfortunately, many studies did not report important variables that may have been significant moderators such as neuropsychological function (Fett et al., 2011), duration of illness (Savla et al., 2012), and medication usage in both ARMS and FEP participants. In addition, few studies reported mental health diagnoses in ARMS participants which is likely to be an important moderator of the relationship between social cognitive functioning, social functioning and psychotic symptoms. It has been shown that social cognitive impairments are evident to varying degrees in all the major psychiatric diagnosis (Cotter et al., 2018). As such, the degree to which social cognitive deficits ARMS participants is a function of the underlying aetiology of psychosis, or reflects the severity of psychopathology in general, is unclear. Psychosis, or psychotic symptoms, may be viewed as a marker of severe psychopathology (Guloksuz & van Os, 2018), and it is important to note that not all individuals identified as being ARMS subsequently transition to full have a full psychotic episode (estimated at 36% after 3 years; Fusar-Poli, Bonoldi, et al., 2012). A such, although the current findings suggest that the effect of social cognitive performance on social functioning and psychotic symptoms is similar before and after the onset of psychosis, future investigation is needed to confirm if this remains the case when co-morbidity and general psychological distress is factored into the analysis.

Theoretical Links

The mechanisms by which social cognitive abilities influence social functioning likely involves the individual being able to predict others' behaviour, understand others' emotional state, intentions, desires, wants and needs, thus conferring positive social experiences and reinforcing the pursuit of social interactions. If an individual struggles to make sense of others, the social world may be confusing and lead to social misperceptions, unexpected responses and actions by others, and eventually social withdrawal, as social interactions are experienced as unpleasant (Couture et al., 2006). The mechanisms involved in how social cognitive functioning and psychotic symptoms are related to one another have been described in psychological models of psychosis. These models indicate that aspects of social cognition, including ToM, influence the expression of both positive and negative symptoms before the onset of frank psychotic symptoms, and that social functioning difficulties may be related to these symptoms (Beck et al., 2011; Frith, 1992; Garety et al., 2001; Morrison, 2001; Rector et al., 2005). There is a significant literature indicating that certain attributional biases, such as jumping to conclusions, are related to paranoia and delusions in psychosis (Ross et al., 2015), and negative appraisals of expectancy of pleasure, success, acceptance and perceived resources influence the expression of negative symptoms, which lead to social functioning impairments (Beck et al., 2011; Rector et al., 2005). The processes involved in how ER influences psychotic symptoms has not yet been fully delineated, and it is important to note that poorer ER performance may be an outcome of increased psychotic symptoms (Bliksted, Videbech, Fagerlund, & Frith, 2017). Nevertheless, if an individual views social interactions as anxiety provoking and confusing or threatening, this may trigger positive symptoms such as paranoia and delusions which left unchallenged, may become problematic (Arguedas, Green, Langdon, & Coltheart, 2006; Garety et al., 2001).

Strengths and Methodological Limitations

To the best of our knowledge, this is the first comprehensive review of the literature and detailed meta-analysis of the relationship between overall social cognitive functioning, ER and ToM, social functioning and psychotic symptomatology in ARMS and FEP. There was only a small amount of between study heterogeneity with combined sample sizes large enough to provide accurate correlational point estimates. In addition, our analysis allowed to us to determine if ARMS and FEP participants significantly differed regarding the strength of relationship between social cognition and social functioning and psychotic symptoms. However, there are some important methodological limitation that should be considered when interpreting these findings. As noted above, many studies did not report data for important moderator variables, and future studies are needed in which these factors are accounted for in the analysis. Another major limitation in this study is the total number of studies for ARMS participants in each meta-analysis conducted. It is clear that while a sufficient number of independent studies have investigated the relationship between social cognition, functional outcomes and psychotic symptoms, in FEP, but further studies are needed in ARMS to determine the consistency of findings. Similarly, due to a limited number of studies that met inclusion criteria we weren't able to include performance on tests of social perception and attributional bias in our analysis, and this is an important area for future study. Finally, we aimed to be inclusive as regards the particular test used to assess social cognitive performance in each domain. However, there is a lack of consistency between studies in which test is used to assess ER and ToM, and the presumption is that each test will measure an

underlying psychological function in a similar manner. However, the degree to which this assumption is valid should be tested in future studies.

Clinical Implications

The findings presented in the current study suggest that targeting social cognition, particularly ER and ToM, may have beneficial effects on social functioning and psychotic symptomatology. These findings are consistent with prior research in longer duration schizophrenia, in which it has been reported that various psychological interventions, such as cognitive remediation, can lead to significant improvements in ER performance which is associated with a large increase in social functioning (Bordon et al., 2017). Similarly, a meta-analysis reported that social cognitive training produces significant improvements in ER and ToM in individuals diagnosed with schizophrenia (Grant et al., 2017). However, the authors of this report found limited evidence for concurrent improvements in functional outcomes. In ARMS participants, few studies have investigated the effects of social cognition targeted interventions (Glenthøj et al., 2017). Taken together, while there is evidence that social cognition targeted interventions may improve performance on particular tests in individuals with longer duration schizophrenia, it is unclear if a similar effect is apparent in FEP or ARMS participants. Moreover, the degree to which improving social cognition positively effects functioning and psychotic symptomatology is unclear at present. The current findings indicate that the relationship between social cognition, social functioning and psychotic symptoms in ARMS and FEP is small, and the clinical relevance of this relationship is unclear. Nevertheless, social cognitive targeted interventions may form part of multicomponent interventions to improve outcomes in ARMS and FEP.

Conclusions

This meta-analytic study has demonstrated that better social cognitive performance is related to increased social functioning and lower psychotic symptomatology. Although the overall effect sizes were small, our findings were consistent in ARMS and FEP participants when a combined social cognition measure was used. The clinical utility of modulating social cognition to improve outcomes in ARMS and FEP participants has yet to be determined but studies in longer term schizophrenia suggest that improving ER or ToM may prove beneficial in enhancing recovery for these individuals. Finally, future studies are needed to delineate the influence of co-morbidity in ARMS participants, in addition to accounting for other important moderating factors.

Chapter 4

General Discussion

4.1. Overview and summary

In this thesis, we have identified that the current evidence base supporting psychological therapy for improving social functioning in ARMS participants, or having developed a FEP, is limited. For ARMS *participants, there is evidence that cognitive remediation therapy improves social functioning. Whilst in FEP, there is evidence that a number of different therapeutic approaches confer beneficial effects for social functioning. Further, in this thesis we have identified that social cognition is significantly, but differentially, depending on social cognitive sub domain, related to psychotic symptomatology and social functioning in ARMS and FEP participants. These findings add to a growing literature identifying the importance of social cognition in psychosis, and highlight where future effort should be focused to improve social functioning outcomes across the psychosis continuum.*

The importance of social cognition in functional outcomes, particularly social functioning, in psychosis has gained an increasing amount of attention in recent years (Pinkham et al., 2014). These developments owe much to the introduction of the Clinical Staging Model (McGorry et al., 2006), the view of psychosis or psychotic disorders as continuum of interrelated conditions (Guloksuz & van Os, 2018), and a shift in focus to prevention and early intervention. However, despite increased efforts to enhance outcomes for ARMS and FEP participants, the state of the current evidence base for psychological interventions to improve social functioning has not been subject to systematic analysis and synthesis. Moreover, whilst individual studies have reported the relationship between social cognition, psychotic symptoms and social functioning in ARMS and

FEP, this data had not yet been quantitatively synthesised to determine the size and direction of effect between these two factors.

To this end, we conducted a systematic review of the literature to determine which psychological therapies had demonstrated efficacy in improving social functioning in ARMS and FEP. Furthermore, we conducted a meta-analysis of studies which have measured social cognition and social functioning, and provided correlational data, in ARMS and FEP. In Chapter 2, we identified that in ARMS participants there is evidence from two of three included studies that CRT therapy is effective in improving social functioning (Choi et al., 2017; Piskulic et al., 2015) with one study reporting a large effect size (g= 1.0; Choi et al., 2017). Group level effects for CBT interventions did not reach statistical significance indicating there is currently no evidence that CBT focused interventions had any beneficial effect for social functioning in ARMS participants. Effect sizes for CBT were small (g= -0.1 to 0.41). In contrast, three of five studies in FEP utilising a CBT model reported a beneficial effect in FEP participants studies (Fowler et al., 2018; Fowler et al., 2009; Jackson et al., 2008), with small effect sizes (g=0.39). Only one of three CRT studies (Lee et al., 2013) reported a beneficial outcome for social functioning in FEP participants with a small effect size (g=0.21). Two included multicomponent interventions (Penn et al., 2011; Petersen et al., 2005) and service level interventions (Craig et al., 2014; Garety et al., 2006) reported a significant beneficial outcome for social functioning in FEP with small to moderate effect sizes (range: 0.29 to 0.69). With the exception of two studies (Fowler et al., 2018; van der Gaag et al., 2012), the methodological quality was poor and risk of bias high across CBT, CRT, multicomponent and service level trials. As such, findings from these studies should be interpreted with caution.

In **Chapter 3**, our quantitative analysis identified some differential findings between ARMS and FEP participants in the relationship between social cognition, psychotic symptoms and social functioning. Better overall social cognitive performance, emotion recognition and ToM was associated with enhanced social functioning in ARMS and FEP participants, with small effect sizes in each group. For psychotic symptoms, findings were mixed between groups. In ARMS, better overall social cognitive performance was not significantly related to positive or negative symptoms. However, better emotion recognition performance was significantly related to lower negative symptoms in ARMS participants. In FEP, better emotion recognition and ToM performance were significantly associated with lower psychotic symptomatology. Effect sizes for the relationship between social cognition and psychotic symptoms were small in each meta-analysis. The strongest effect size was identified for the relationship between ToM and negative psychotic symptoms in FEP (r= -0.3). Interestingly, we found no significant between group differences (ARMS versus FEP) in the overall effect sizes in each meta-analysis of the relationship between social cognition, and subdomains, social functioning and psychotic symptoms.

4.2. Improving social functioning outcomes in psychosis: More trials or a new approach?

The role for psychological therapy in psychosis is a topic which has resulted in significant controversy and debate over recent years (Jauhar et al., 2014; Lynch, Laws, & McKenna, 2010). Much of this debate has centred on the efficacy of psychological therapy, particularly CBT-p, in reducing psychotic symptomatology (Birchwood, Shiers, & Smith, 2014). While a full discussion of this debate is

beyond the scope of this thesis, it is suffice to say that there has been a change in our understanding of what constitutes 'Recovery' (Roberts & Boardman, 2013) and what outcomes should be the focus of psychological interventions.

The empirical evidence reviewed above and in **Chapter 2** supports that for FEP, there are effective treatments for improving social functioning. In ARMS participants, the evidence is limited to one CRT trial (Choi et al, 2017). As such, the current evidence indicates that for FEP, more trials utilising social recovery focused CBT within a multidisciplinary care context would lend greater support for this approach to be rolled out to the wider population (Roberts & Boardman, 2013). For ARMS participants, much work is still yet to be done. Considering current CBT approaches have not proved effective in improving social functioning, a new approach may be necessary. Replication of the results by Choi et al., (2017) is an important next step to determine the potential role for CRT. However, it appears that future trials of social recovery focused CBT, or a similar approach provided within a multidisciplinary care context, are a necessary next step in determining the best psychological intervention for improving social functioning in ARMS participants.

4.3. Social cognitive impairments in psychosis: A viable therapeutic target to improve social functioning?

Of the studies included in **Chapter 2** for systematic synthesis, none specifically targeted social cognitive performance. One study utilised a CRT intervention which targeted different domains of neuropsychological function and social cognition in FEP participants (Fernandez-Gonzalo et al., 2015), but did not report a statistically significant effect on social functioning. As such, it is currently unclear if targeting social cognition in the earlier stages of psychosis has beneficial effects on social functioning. However, drawing on the literature in longer duration schizophrenia, there is reason to propose that

explicitly targeting social cognition should be a focus of future study. In longer duration schizophrenia, social cognitive remediation therapy has been shown to improve social cognitive performance, which was associated with improvements in social functioning. Thus applying the social cognitive remediation approaches already established with longer duration schizophrenia, to ARMS and FEP populations, may prove to be effective for improving both social cognitive performance and social functioning. Although these studies may be warranted, it is important to hold in mind that the overall effect sizes we identified in **Chapter 3** in the relationship between social cognitive performance, psychotic symptoms and social functioning were small. The results presented in **Chapter 3** certainly suggest that in ARMS and FEP participant's social cognition is an important variable related social functioning, but not the only variable. As such, modulating social cognition may have only small effects on social functioning in ARMS and FEP. The question for future study is what impact a small change in social cognition and social functioning has for ARMS and FEP participants. Another important question that follows, is what other variables may be involved in the relationship between social cognition and social functioning? Important psychological variables that may mediate this relationship include meta-cognition (Bright et al., 2018), self-efficacy (Kurtz, Olfson, & Rose, 2013), and emotion regulation (Kimhy et al., 2016). Future studies should aim to test the mediating relationship of these variables in the relationship between social cognition and social functioning.

4.4. Social cognition and social functioning: Issues with measurement

A range of different measures of social cognition and social functioning are utilised in the literature with varying psychometric quality and validation which

may lead to a lack of accurate measurement, and the ability to meaningfully draw comparisons between individual studies. Indeed, the range of measures used in **Chapter 2** and **3** to measure social function and social cognition respectively, was broad, and this is an important consideration when interpreting these findings.

The Social Cognition Psychometric Evaluation (SCOPE) study was designed to address the measurement issue in studies aiming to characterise and develop interventions, for social cognition in schizophrenia (Pinkham et al., 2014). This study had five phases; 1. Identify the core domains of social cognition in schizophrenia and the best existing measures of each domain through consultation with experts in this area; 2. Short list the best tasks within each domain based on expert consensus; 3. Determine the reliability and validity of each task in a sample of individuals diagnosed with schizophrenia; 5. Modify and re-test measures with poor psychometric quality; 5. Large validation study of final selected measures including determining the correlation with functional measures (Pinkham et al., 2014). The SCOPE study published the final phase of findings last year and produced a finalised list of social cognitive tests that have appropriate psychometric properties and are predictive of functional outcomes (Pinkham, Harvey, & Penn, 2018). As these recommendations have only recently been published, many of the studies included in **Chapter 3** did not use measures as per these guidelines. Moving forward, it will be important that studies in ARMS and FEP participants follow the guidelines produced by the SCOPE study so that consistency can be achieved between studies, and accurate and replicable results can be produced.

As discussed in **Chapter 2**, a wide of range of measures of social functioning are utilised in the literature. These measures vary based on whether they are clinician rated, self-report or performance based. Current psychometric data indicates that performance based measures such as the Social Skills Performance Assessment (SSPA), may be most

reliable and valid in assessing social functioning in psychosis (Patterson et al., 2001). Indeed, the SCOPE study utilised the SSPA in each phase of this project. In addition, the investigators utilised the UCSD Performance-Based Skills Assessment, Brief (UPSA-B; Mausbach, Harvey, Goldman, Jeste, & Patterson, 2007) and the informant reported Specific Level of Functioning Scale (SLOF; Schneider & Struening, 1983). Most studies measure social functioning using one approach; self-report, clinician rated or performance based. Self-report and clinician rated measures have the limitation of relying on memory recall and may be subject to a degree of recall bias (Coughlin, 1990). However, such measures tend to be quick and cost effective to administer. In contrast, performance based measures may provide a more accurate picture of real world functioning and are not limited by recall bias. Moreover, some such as the SSPA are short to administer (~12 minutes; Pinkham et al., 2018) but rely on an expert rater to code and score. Informant reported measures such as the SLOF may be an important adjunct to performance based measures. However, there may still be a degree of recall bias when using these measures and they rely on an available informant to complete the measure so will not be practical in all studies. The evidence reviewed in this thesis indicates that a measure, such as the Time Use Survey (TUS), which identifies average number of hours per week spent doing a range of structured activities might be more sensitive to intervention effects and may be more appropriate to what outcomes an individual may want to change when engaged in a therapeutic intervention (Hodgekins et al., 2015). Moreover, cut-off scores for clinical and non-clinical samples have been identified for the TUS which increases its utility as a measure of social functioning (Hodgekins et al., 2015).

In summary, there is now a published battery of social cognitive tests along with psychometric data that should be used in future studies investigating social cognitive performance in ARMS and FEP participants. Social functioning measures have not been subject to such extensive validation and it would be pertinent that future research should aim to define the key domains of social functioning that are important for the psychosis continuum, which measures are best suited to characterise these domains, and which are reliable enough to show changes due therapeutic intervention.

4.5. Limitations of the reported studies

Whilst the studies reported in this thesis add novel and important information to the evidence base, there are a number of limitations that must be borne in mind when interpreting these findings. In **Chapter 2**, many different treatment modalities were used and the target of each intervention varied. As such, generalising from these studies is limited. Moreover, the methodological quality of many of the studies was poor and there was a high risk of bias. Only three included studies had social functioning as the primary outcome measure and many did not report a sample size calculation. As such, it is not clear if they were powered to detect an effect on social functioning. As discussed above, there was a variety of social functioning measures utilised across studies and standardisation of outcomes is a necessary future development.

In **Chapter 3** a wide range of social cognitive tests were used between studies, and as noted above, not all have been subject to full psychometric validation. Of the studies included in our meta-analysis, many did not report important data such as medication usage, neuropsychological function, duration of illness and co-morbid mental health diagnoses. As such, these factors could not be entered into the analysis as moderator variables. This is a significant limitation which should be addressed in future when a

sufficient number of studies have been conducted that report this additional data to determine the degree to which these factors explain between study variance. Nonetheless, it should be noted that the between study variance was generally small in each meta-analysis in **Chapter 3** for FEP participants. The total number of studies of ARMS studies in **Chapter 3** was small and further analysis should be conducted when more studies are available to determine the consistency of the findings reported. In addition, we were unable to conduct an analysis of studies into social perception and attributional bias in **Chapter 3**, and this is an important goal once more data is available.

4.6. Conclusions and Clinical Implications

With the noted limitations in mind, our results nevertheless indicate that social functioning impairments in ARMS and FEP are amenable to psychological intervention. In addition, the results presented in this thesis indicate that better social cognition is significantly related to better social functioning and lower psychotic symptomatology. Regarding psychological interventions for social functioning, there is still much work to be done as studies specifically targeting social functioning in ARMS participants are currently non-existent. However, there is an ongoing multi-centre trial- the PRODIGY trial- which aims to determine the efficacy of Social Recovery CBT in young people with attenuated psychotic symptoms and complex mental health problems (Fowler et al., 2017). The results from this trial will be critical in determining if targeting social functioning in ARMS participants confers beneficial outcomes. If successful, this trial may lead to a wider implementation of Social Recovery CBT for young people identified as being ARMS for developing psychosis.

There is sufficient evidence from the analysis reported in **Chapter 3** to establish a consistent, but small, relationship between social cognition, social functioning and psychotic symptomatology in ARMS and FEP. However, the clinical implications of this relationship are unclear at present. As an important next step, intervention trials which specifically target social cognition should be conducted to determine the magnitude of change in social functioning due to modulating social cognition. It is unlikely that the effects will be very large. However, social cognitive training may prove to be useful as an adjunct to other therapeutic approaches, such as Social Recovery CBT. The cost effectiveness of such approaches will of course play a major role in what becomes available for day to day clinical practice.

Despite many important advances in recent decades in our understanding of psychosis and psychotic disorders, there is still much improvement to be made. The points discussed herein are important developments which should be undertaken to further expand the evidence base, with the ultimate aim of promoting the best possible outcomes for individuals along the psychosis continuum.

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Appendix A

Clinical Psychology Review, Author Guidelines for Chapter 2

CLINICAL PSYCHOLOGY REVIEW

AUTHOR INFORMATION PACK

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Supplementary material such as applications, images and sound clips, can be published with your article to enhance it. Submitted supplementary items are published exactly as they are received (Excel or PowerPoint files will appear as such online). Please submit your material together with the article and supply a concise, descriptive caption for each supplementary file. If you wish to make changes to supplementary material during any stage of the process, please make sure to provide an updated file. Do not annotate any corrections on a previous version. Please switch off the 'Track Changes' option in Microsoft Office files as these will appear in the published version.

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This journal encourages and enables you to share data that supports your research publication where appropriate, and enables you to interlink the data with your published articles. Research data refers to the results of observations or experimentation that validate research findings. To facilitate reproducibility and data reuse, this journal also encourages you to share your software, code, models, algorithms, protocols, methods and other useful materials related to the project.

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Appendix B

Chapter 3: Journal of Consulting and Clinical Psychology, Author Guidelines

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Journal of Consulting and Clinical Psychology®

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Call for Papers

- Responding to the Opioid Crisis (/pubs/journals/ccp/call-for-papers-opioid-crisis)

Description

The *Journal of Consulting and Clinical Psychology® (JCCP)* publishes original contributions on the following topics:

the development, validity, and use of techniques of diagnosis and treatment of disordered behavior

studies of a variety of populations that have clinical interest, including but not limited to medical patients, ethnic minorities, persons with serious mental illness, and community samples

studies that have a cross-cultural or demographic focus and are of interest for treating behavior disorders

studies of personality and of its assessment and development where these have a clear bearing on problems of clinical dysfunction and treatment

studies of gender, ethnicity, or sexual orientation that have a clear bearing on diagnosis, assessment, and treatment

studies of psychosocial aspects of health behaviors

Studies that focus on populations that fall anywhere within the lifespan are considered.

JCCP welcomes submissions on treatment and prevention in all areas of clinical and clinical–health psychology and especially on topics that appeal to a broad clinical–scientist and practitioner audience.

JCCP encourages the submission of theory–based interventions, studies that investigate mechanisms of change, and studies of the effectiveness of treatments in real-world settings.

JCCP recommends that authors of clinical trials pre-register their studies with an appropriate clinical trial registry (e.g., ClinicalTrials.gov, ClinicalTrialsRegister.eu) though both registered and unregistered trials will continue to be considered at this time.

Studies on the following topics will be considered if they have clear implications for clinical research and practice:

epidemiology

use of psychological services

health care economics for behavioral disorders

Although *JCCP* largely publishes research that is empirical and quantitative in method, rigorous theoretical papers on topics of broad interest to the field of clinical psychology

Social Work Abstracts

Studies on Women and Gender Abstracts

TOC Premier

Women's Studies International

Manuscript Submission

Prior to submission, please carefully read and follow the submission guidelines detailed below. Manuscripts that do not conform to the submission guidelines may be returned without review.

Submission

To submit to the Editorial Office of Joanne Davila, please submit manuscripts electronically through the Manuscript Submission Portal.

SUBMIT MANUSCRIPT (HTTPS://WWW.EDITORIALMANAGER.COM/CCP/DEFAULT.ASPX)

General correspondence may be directed to the Editorial Office via email (mailto:joanne.davila@stonybrook.edu) .

Journal of Consulting and Clinical Psychology® is now using a software system to screen submitted content for similarity with other published content. The system compares the initial version of each submitted manuscript against a database of 40+ million scholarly documents, as well as content appearing on the open web. This allows APA to check submissions for potential overlap with material previously published in scholarly journals (e.g., lifted or republished material).

Masked Review

This journal uses a masked reviewing system for all submissions. The first page of the manuscript should omit the authors' names and affiliations but should include the title of the manuscript and the date it is submitted.

Footnotes containing information pertaining to the authors' identities or affiliations should not be included in the manuscript, but may be provided after a manuscript is accepted.

Make every effort to see that the manuscript itself contains no clues to the authors' identities.

Please ensure that the final version for production includes a byline and full author note for typesetting.

Keep a copy of the manuscript to guard against loss.

Cover Letter

The cover letter accompanying the manuscript submission must include all authors' names and affiliations to avoid potential conflicts of interest in the review process. Addresses and phone numbers, as well as electronic mail addresses and fax numbers, if available, should be provided for all authors for possible use by the editorial office and later by the production office.

Length and Style of Manuscripts

Full-length manuscripts should not exceed 35 pages total (including cover page, abstract, text, references, tables, and figures), with margins of at least 1 inch on all sides and a standard font (e.g., Times New Roman) of 12 points (no smaller). The entire paper (text, references, tables, etc.) must be double spaced.

Instructions on preparing tables, figures, references, metrics, and abstracts appear in the *Publication Manual of the American Psychological Association* (/pubs/books/4200066) (6th edition).

Authors submitting manuscripts that report new data collection, especially randomized clinical trials (RCTs), should comply with the newly developed APA Journal Article Reporting Standards (PDF, 98KB) (/pubs/authors/jars.pdf) (JARS; see *American Psychologist*, 2008, *63*, 839–851 or Appendix in the *APA Publication Manual*).

For papers that exceed 35 pages, authors must justify the extended length in their cover letter (e.g., reporting of multiple studies), and in no case should the paper exceed 45 pages total. Papers that do not conform to these guidelines may be returned without review.

The References section should immediately follow a page break.

Brief Reports

In addition to full-length manuscripts, the *JCCP* will consider Brief Reports of research studies in clinical psychology. The Brief Report format may be appropriate for

findings that need further replication, or represent replications and extensions of prior published work.

Brief Reports are intended to permit the publication of soundly designed studies of specialized interest that cannot be accepted as regular articles because of lack of space.

Brief Reports must be prepared according to the following specifications: Use 12-point Times New Roman type and 1-inch (2.54-cm) margins, and do not exceed 265 lines of text including references. These limits do not include the title page, abstract, author note, footnotes, tables, or figures.

An author who submits a Brief Report must agree not to submit the full report to another journal of general circulation. The Brief Report should give a clear, condensed summary of the procedure of the study and as full an account of the results as space permits.

Commentaries

JCCP now publishes papers that are commentaries of previously published articles in this journal. Two types of commentaries will be considered:

Brief Comment

A Brief Comment would be written in response to a single article previously published in *JCCP*. The primary purpose would be to provide a meaningful insight, concern, alternative interpretation, clarification, or critical analysis. It is not intended to be pedestrian in nature (e.g., simply highlighting that a given study is statistically underpowered). Rather, its publication would provide for a richer and more comprehensive understanding of a methodological, conceptual, or professional issue that significantly adds to the literature.

Similar to a Brief Report, Brief Comments should not exceed 265 lines of text including references. This limit does not include the title page, abstract, or author notes. The title of a Brief Comment should include a subtitle reflecting the actual title and year of publication of the article that engendered the comment. For example—"The Importance of Focusing on External Validity: A Brief Comment on *Testing the Efficacy of Two Differing Types of Stress Management Interventions for the Treatment of Essential Hypertension* (Jones & Smith, 2012)."

Brief Comments should be submitted in a timely manner, no later than 9 months after publication of the original article. Upon acceptance of a Brief Comment, the author(s) of the original paper would be invited to submit a response, whereupon, if acceptable, both the Brief Comment and Response would be published together. Such Responses to a Brief Comment should also not exceed 265 lines of text including references.

Extended Comment

The purpose of this type of article is essentially similar to that of a Brief Comment (i.e., to provide a meaningful insight, concern, alternative interpretation, clarification, or

critical analysis), but would be written in response to a series of articles previously published in *JCCP* or that involves a more extensive and far-reaching conceptual or methodological issue. An example might include describing and analyzing the limitations of a particular statistical or methodological procedure used in several studies previously published in *JCCP*, provided along with meaningful recommendations.

This type of article should not exceed approximately one half the length of the original paper (note that 1 journal page equals approximately 3–3.5 manuscript pages). Unless permission from the editor is received, no Extended Comment should exceed 20 manuscript pages inclusive of all references, tables, and figures.

Similar to a Brief Comment, where and when appropriate, if such a paper is accepted, the author(s) of the original article(s) will be contacted to write a response, whereupon, if acceptable, both the Extended Comment and Response would be published together. This Invited Response should not exceed approximately one half the length of the Extended Comment.

The title of this type of article need not include a subtitle representing the original article(s). One important review criteria involves the timeliness of the topic and its potential contribution to the scientific literature base relevant to the scope of *JCCP* content.

Conceptual/Theoretical Papers

Whereas the majority of papers published in *JCCP* will involve descriptions of quantitatively-based investigations, this journal also considers conceptual articles on topics of broad theoretical, methodological, or practical interest that advance the field of clinical psychology. Examples might include describing a new methodological or statistical procedure, delineating methods of enhancing dissemination of research findings from the lab to real-world settings, or advocating the need to increase the profession's research efforts regarding a traditionally underserved population.

Similar formatting guidelines for submitting a full length research article would apply for these types of papers.

Registration of Clinical Trials

As of March 1, 2019 registration will be required for all clinical trials (studies designed to examine the efficacy or effectiveness of a treatment or preventive intervention) reporting primary outcome findings. Prospective registration (i.e., pre-registration) is required if recruitment began on or after March 1, 2019. Retrospective registration will be accepted only if recruitment began before this date.

Clinical trials must be registered at ClinicalTrials.gov or at another recognized registry. A complete list of acceptable trial registries can be found via the WHO International Clinical Trials Registry Platform. Differences between registered and reported methods or outcomes must be explained clearly and transparently in the manuscript.

Trial protocols, including statistical analysis plans, must be made available to readers. Both published and unpublished protocols are acceptable. Published protocols should be cited in the manuscript. Unpublished protocols may be provided in online-only supplements or made available by request. Use of the Standard Protocol Items: Recommendations for Intervention Trials (SPIRIT) checklist is recommended.

For secondary analyses of existing data sets, where primary analyses have already been published (or are in press), registration is not required. For such analyses, registration status must be made transparent in the manuscript, and authors must follow guidelines about data transparency provided on the JCCP website. The article(s) reporting the primary outcomes, and the findings, must be cited in the manuscript.

Manuscripts reporting long-term outcomes of studies for which the primary outcomes have already been published also will not require registration, but authors must follow the guidelines above for secondary analyses.

For studies that are not clinical trials, registration is encouraged, but not required.

Authors must note registration status in their cover letter, in the manuscript, and in the submission portal.

Required Use of JARS and MARS Guidelines

In order to maintain consistency and fairness in the review process and in the reporting of scientific findings, *JCCP* requires that ALL manuscripts conform to Journal Article Reporting Standards (JARS) and Meta-Analysis Reporting Standards (MARS) as described in Applebaum et al. (2018):

Applebaum, Cooper, Kline, Mayo-Wilson, Nezu, & Rao (2018). Journal Article Reporting Standards for Quantitative Research in Psychology: The APA Publications and Communications Board Task Force Report (/pubs/journals/releases/amp-amp0000191.pdf) . American Psychologist, 73, 3-25.

Upon submission, authors will be required to affirm (on the submission portal and in their cover letter) that they have followed JARS/MARS guidelines and that the submitted manuscript contains and/or addresses ALL required information as relevant for the study, including flow diagrams where relevant.

The editorial team will use consistency with the JARS/MARS guidelines as a review criterion, and manuscripts may be rejected if guidelines are not followed.

When deviating from JARS/MARS guidelines, authors must provide the rationale in their cover letter and describe the limitations of doing so in their manuscript.

Title of Manuscript

The title of a manuscript should be accurate, fully explanatory, and preferably no longer than 12 words. The title should reflect the content and population studied (e.g., "treatment of generalized anxiety disorders in adults").

If the paper reports a randomized clinical trial (RCT), this should be indicated in the title. Note that JARS criteria must be used for reporting purposes.

Abstract and Keywords

All manuscripts must include an abstract containing a maximum of 250 words typed on a separate page. After the abstract, please supply up to five keywords or brief phrases.

Manuscripts published in the *Journal of Consulting and Clinical Psychology* will include a structured abstract of up to 250 words.

For studies that report randomized clinical trials or meta-analyses, the abstract also must be consistent with the guidelines set forth by JARS or MARS (Meta-Analysis Reporting Standards) guidelines, respectively. Thus, in preparing a manuscript, please ensure that it is consistent with the guidelines stated below.

Please include an Abstract of up to 250 words, presented in paragraph form. The Abstract should be typed on a separate page (page 2 of the manuscript), and must include each of the following sections:

Objective: A brief statement of the purpose of the study

Method: A detailed summary of the participants (N, age, gender, ethnicity) as well as descriptions of the study design, measures (including names of measures), and procedures

Results: A detailed summary of the primary findings that clearly articulate comparison groups (if relevant), and that indicate significance or confidence intervals for the main findings

Conclusions: A description of the research and clinical implications of the findings

Public Health Significance Statements

Authors submitting manuscripts to the *Journal of Consulting and Clinical Psychology* are required to provide 2–3 brief sentences regarding the public health significance of the study or meta-analysis described in their paper. This description should be included within the manuscript on the abstract/keywords page. It should be written in language that is easily understood by both professionals and members of the lay public.

When an accepted paper is published, these sentences will be boxed beneath the abstract for easy accessibility. All such descriptions will also be published as part of the Table of Contents, as well as on the journal's web page. This new policy is in keeping with efforts to increase dissemination and usage by larger and diverse audiences.

Examples of these 2–3 sentences include the following:

"This study strongly suggests that (description of a given psychosocial treatment) is an effective treatment for anxiety, but only if it is of mild to moderate severity. For

persons with severe anxiety, additional treatments may be necessary."

"When treating individuals of (name of a particular ethnic minority group) who are experiencing PTSD, this study demonstrated the importance of taking into account cultural factors, especially those that involve one's spiritual beliefs."

"This study highlights the importance of directly including one's family in treatment when helping adults diagnosed with cancer overcome their depression."

To be maximally useful, these statements of public health significance should not simply be sentences lifted directly out of the manuscript.

They are meant to be informative and useful to any reader. They should provide a bottom-line, take-home message that is accurate and easily understood. In addition, they should be able to be translated into media-appropriate statements for use in press releases and on social media.

Prior to final acceptance and publication, all public health significance statements will be carefully reviewed to make sure they meet these standards. Authors will be expected to revise statements as necessary.

Participants: Description and Informed Consent

The Method section of each empirical report must contain a detailed description of the study participants, including (but not limited to) the following: age, gender, ethnicity, SES, clinical diagnoses and comorbidities (as appropriate), and any other relevant demographics.

In the Discussion section of the manuscript, authors should discuss the diversity of their study samples and the generalizability of their findings.

The Method section also must include a statement describing how informed consent was obtained from the participants (or their parents/guardians) and indicate that the study was conducted in compliance with an appropriate Internal Review Board.

Measures

The Method section of empirical reports must contain a sufficiently detailed description of the measures used so that the reader understands the item content, scoring procedures, and total scores or subscales. Evidence of reliability and validity with similar populations should be provided.

Statistical Reporting of Clinical Significance

JCCP requires the statistical reporting of measures that convey clinical significance. Authors should report means and standard deviations for all continuous study

variables and the effect sizes for the primary study findings. (If effect sizes are not available for a particular test, authors should convey this in their cover letter at the time of submission.)

JCCP also requires authors to report confidence intervals for any effect sizes involving principal outcomes (see Fidler et al., *Journal of Consulting and Clinical Psychology*, 2005, pp. 136–143 and Odgaard & Fowler, *Journal of Consulting and Clinical Psychology*, 2010, pp.287–297).

In addition, when reporting the results of interventions, authors should include indicators of clinically significant change. Authors may use one of several approaches that have been recommended for capturing clinical significance, including (but not limited to) the reliable change index (i.e., whether the amount of change displayed by a treated individual is large enough to be meaningful; see Jacobson et al., *Journal of Consulting and Clinical Psychology*, 1999), the extent to which dysfunctional individuals show movement into the functional distribution (see Jacobson & Truax, *Journal of Consulting and Clinical Psychology*, 1991), or other normative comparisons (see Kendall et al., *Journal of Consulting and Clinical Psychology*, 1999).

The special section of *JCCP* on "Clinical Significance" (*Journal of Consulting and Clinical Psychology*, 1999, pp. 283–339) contains detailed discussions of clinical significance and its measurement and should be a useful resource (see also Atkins et al., *Journal of Consulting and Clinical Psychology*, 2005, pp. 982–989).

Discussion of Clinical Implications

Articles must include a discussion of the clinical implications of the study findings or analytic review. The Discussion section should contain a clear statement of the extent of clinical application of the current assessment, prevention, or treatment methods. The extent of application to clinical practice may range from suggestions that the data are too preliminary to support widespread dissemination to descriptions of existing manuals available from the authors or archived materials that would allow full implementation at present.

Data Transparency

In order to reduce the likelihood of duplicate or piecemeal publication, authors are required to provide, in their cover letter, a list of published, in press, and under review studies that come from the same dataset as the one in the submitted manuscript, as well as a narrative description of how the submitted manuscript differs from the others.

This narrative description should include how the manuscript differs (or does not) in terms of research question and variables studied.

Authors also are required to submit a masked version of the narrative description that can be provided to reviewers. Please add this as an appendix table on the last page of the submitted manuscript. Please base your description on the following examples, edited according to your specific data circumstances.

Do not provide the title of the manuscript, authors, or journal in which it was published. Do provide the names of the relevant variables (i.e., substitute the numbers in the examples below for actual names, such as depressive symptoms, therapeutic alliance, etc.).

Narrative Example: Multiple uses of data collected from the same sample

> The data reported in this manuscript have been previously published and/or were collected as part of a larger data collection (at one or more points in time). Findings from the data collection have been reported in separate manuscripts. MS 1 (published) focuses on variables 1, 2, and 3; while MS 2 (in press) focuses on variables 4, 5, and 6. MS 3 (the current manuscript) focuses on variables 8, 9, and 15. MS 4 (soon to be submitted) will focus on variables 10, 12, and 14.

Narrative Example: Publicly available dataset

> The data reported in this manuscript were obtained from publicly available data, [name of project, along with website link to project description]. A bibliography of journal articles, working papers, conference presentations, and dissertations using the [name of project] is available at [website link to bibliography list]. The variables and relationships examined in the present article have not been examined in any previous or current articles, or to the best of our knowledge in any papers that will be under review soon. [Alternatively, clarify any overlap of variables, as done in the narrative example above].

Upon submission of the manuscript, authors will be required to attest to the provision of the required information described above.

Finally, upon acceptance of a manuscript, authors will be required to provide, as part of the Author Note, a list of related published papers that come from the same dataset, unless such papers are clearly described and referenced in the manuscript (specifically noting that findings come from the same dataset).

Data and Stimulus Materials

Should your paper ultimately be accepted for publication, *JCCP* would like to encourage you to determine if posting materials and/or data is right for your study and, if so, to make your data and materials publicly available, if possible, by providing a link in your paper to a third-party repository.

Making your data and materials publicly available can increase the impact of your research, enabling future researchers to incorporate your work in model testing, replication projects, and meta-analyses, in addition to increasing the transparency of your research.

The APA's data sharing policy does not require public posting, so you are free to decide what is best for your project in terms of public data, materials, and conditions on their use. Note, however, that APA policy does require that authors make their data available to other researchers upon request.

Manuscript Preparation

Prepare manuscripts according to the *Publication Manual of the American Psychological Association* (6th edition) (/pubs/books/4200066)

. Manuscripts may be copyedited for bias-free language (see Chapter 3 of the *Publication Manual*).
Review APA's Journal Manuscript Preparation Guidelines (/pubs/journals/resources/manuscript-submission-guidelines) before submitting your article.

Double-space all copy. Other formatting instructions, as well as instructions on preparing tables, figures, references, metrics, and abstracts, appear in the *Manual*. Additional guidance on APA Style is available on the APA Style website (http://www.apastyle.org/index.aspx) .

Below are additional instructions regarding the preparation of display equations, computer code, and tables.

Display Equations

We strongly encourage you to use MathType (third-party software) or Equation Editor 3.0 (built into pre-2007 versions of Word) to construct your equations, rather than the equation support that is built into Word 2007 and Word 2010. Equations composed with the built-in Word 2007/Word 2010 equation support are converted to low-resolution graphics when they enter the production process and must be rekeyed by the typesetter, which may introduce errors.

To construct your equations with MathType or Equation Editor 3.0:

Go to the Text section of the Insert tab and select Object.

Select MathType or Equation Editor 3.0 in the drop-down menu.

If you have an equation that has already been produced using Microsoft Word 2007 or 2010 and you have access to the full version of MathType 6.5 or later, you can convert this equation to MathType by clicking on MathType Insert Equation. Copy the equation from Microsoft Word and paste it into the MathType box. Verify that your equation is correct, click File, and then click Update. Your equation has now been inserted into your Word file as a MathType Equation.

Use Equation Editor 3.0 or MathType only for equations or for formulas that cannot be produced as Word text using the Times or Symbol font.

Computer Code

Because altering computer code in any way (e.g., indents, line spacing, line breaks, page breaks) during the typesetting process could alter its meaning, we treat computer code differently from the rest of your article in our production process. To that end, we request separate files for computer code.

In Online Supplemental Material

We request that runnable source code be included as supplemental material to the article. For more information, visit Supplementing Your Article With Online Material (/pubs/journals/resources/supplemental-material) .

In the Text of the Article

If you would like to include code in the text of your published manuscript, please submit a separate file with your code exactly as you want it to appear, using Courier New font with a type size of 8 points. We will make an image of each segment of code in your article that exceeds 40 characters in length. (Shorter snippets of code that appear in text will be typeset in Courier New and run in with the rest of the text.) If an appendix contains a mix of code and explanatory text, please submit a file that contains the entire appendix, with the code keyed in 8-point Courier New.

Tables

Use Word's Insert Table function when you create tables. Using spaces or tabs in your table will create problems when the table is typeset and may result in errors.

Academic Writing and English Language Editing Services

Authors who feel that their manuscript may benefit from additional academic writing or language editing support prior to submission are encouraged to seek out such services at their host institutions, engage with colleagues and subject matter experts, and/or consider several vendors that offer discounts to APA authors (/pubs/journals/resources/editing-services) .

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APA can place supplemental materials online, available via the published article in the PsycARTICLES® database. Please see Supplementing Your Article With Online Material (/pubs/journals/resources/supplemental-material) for more details.

References

List references in alphabetical order. Each listed reference should be cited in text, and each text citation should be listed in the References section.

Examples of basic reference formats:

Journal Article:
Hughes, G., Desantis, A., & Waszak, F. (2013). Mechanisms of intentional binding and sensory attenuation: The role of temporal prediction, temporal control, identity prediction, and motor prediction. *Psychological Bulletin, 139*, 133–151. http://dx.doi.org/10.1037/a0028566

Authored Book:
Rogers, T. T., & McClelland, J. L. (2004). *Semantic cognition: A parallel distributed processing approach*. Cambridge, MA: MIT Press.

Chapter in an Edited Book:
Gil, M. J., & Sypher, B. D. (2009). Workplace incivility and organizational trust. In P. Lutgen-Sandvik & B. D. Sypher (Eds.), *Destructive organizational communication: Processes, consequences, and constructive ways of organizing* (pp. 53–73). New York, NY: Taylor & Francis.

Figures

Graphics files are welcome if supplied as Tiff or EPS files. Multipanel figures (i.e., figures with parts labeled a, b, c, d, etc.) should be assembled into one file.

The minimum line weight for line art is 0.5 point for optimal printing.

For more information about acceptable resolutions, fonts, sizing, and other figure issues, please see the general guidelines (http://art.cadmus.com/da/guidelines.jsp) .

When possible, please place symbol legends below the figure instead of to the side.

APA offers authors the option to publish their figures online in color without the costs associated with print publication of color figures.

The same caption will appear on both the online (color) and print (black and white) versions. To ensure that the figure can be understood in both formats, authors should add alternative wording (e.g., "the red (dark gray) bars represent") as needed.

For authors who prefer their figures to be published in color both in print and online, original color figures can be printed in color at the editor's and publisher's discretion provided the author agrees to pay:

$900 for one figure

An additional $600 for the second figure

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Special issue of APA's Journal of Consulting and Clinical Psychology, Vol. 81, No. 2, April 2013. Includes articles about cultural and translation research considerations in behavioral medicine and clinical health psychology, as well as use in asthma, multiple sclerosis, smoking cessation, HIV/AIDS, cancer, obesity, and hepatitis C.

Impact of Childhood Psychopathology Interventions on Subsequent Substance Abuse (/pubs/journals/special/2067006)
Special issue of APA's Journal of Consulting and Clinical Psychology, Vol. 70, No. 6, December 2002. Includes articles about measuring risks and outcomes; community studies; review of the evidence base for treatment of internalizing and externalizing disorders; and policy implications and recommendations.

Behavioral Medicine and Clinical Health Psychology (/pubs/journals/special/2067003)

Special issue of APA's Journal of Consulting and Clinical Psychology, Vol. 70, No. 3, June 2002. Focusing on behavioral medicine and clinical health psychology, topics include sociodemographic diversity; cost-effectiveness; smoking cessation; obesity; exercise; immune function; heart disease; hypertension; cancer; diabetes; HIV/AIDS; arthritis; headache; chronic pain; asthma; renal disease; irritable bowel syndrome; reproductive health; organ transplant; genetic testing; emotional disorders; and somatoform disorders.

Behavioral Medicine (/pubs/journals/special/2066004)
Special issue of APA's Journal of Consulting and Clinical Psychology, Vol. 60, No. 4, August 1992. Includes articles about the role of behavior theory in behavioral medicine; the development of behavioral medicine; and behavioral and psychological treatment of obesity; smoking; chronic pain; headache; cancer; HIV/AIDS; insomnia; Type A behavior; gastrointestinal disorders; arthritis; diabetes; and asthma.

Appendix C

Forrest plots for each meta-analysis in Chapter 3

Overall Social Cognition and Social Functioning in ARMS and FEP

A total of seven studies reported the correlation coefficient between at least one social cognitive measure and social functioning in ARMS participants (see **Figure C1**) which ranged from -0.062 to 0.177 with a significant (Z=2.443, p=0.015) positive pooled correlation coefficient of 0.118 (95% CI: 0.023 to 0.210,) indicating a small effect size. Heterogeneity between and within studies was very low (Q (6) = 2.458, p=0.873, I^2=0%, Tau^2= 0.00).

A total of 14 studies reported the correlation coefficient between at least one social cognitive measure and social functioning in FEP participants (see **Figure C1**) with a range of 0.076 to 0.38 and a significant (Z=6.327, p<0.001) positive pooled correlation coefficient of 0.205 (95% CI: 0.143 to 0.266,) indicating a small to medium effect size. Heterogeneity of variance between studies was low (Q (13) = 7.448, p=0.878, I^2=0%, Tau^2= 0.00).

The overall pooled correlation coefficient for ARMS and FEP studies combined was positive and significant at 0.178 (Z=6.607, p<0.001) indicating a small effect size with low heterogeneity (Q (20) = 12.251, p=0.907, I^2=0%, Tau^2= 0.00).

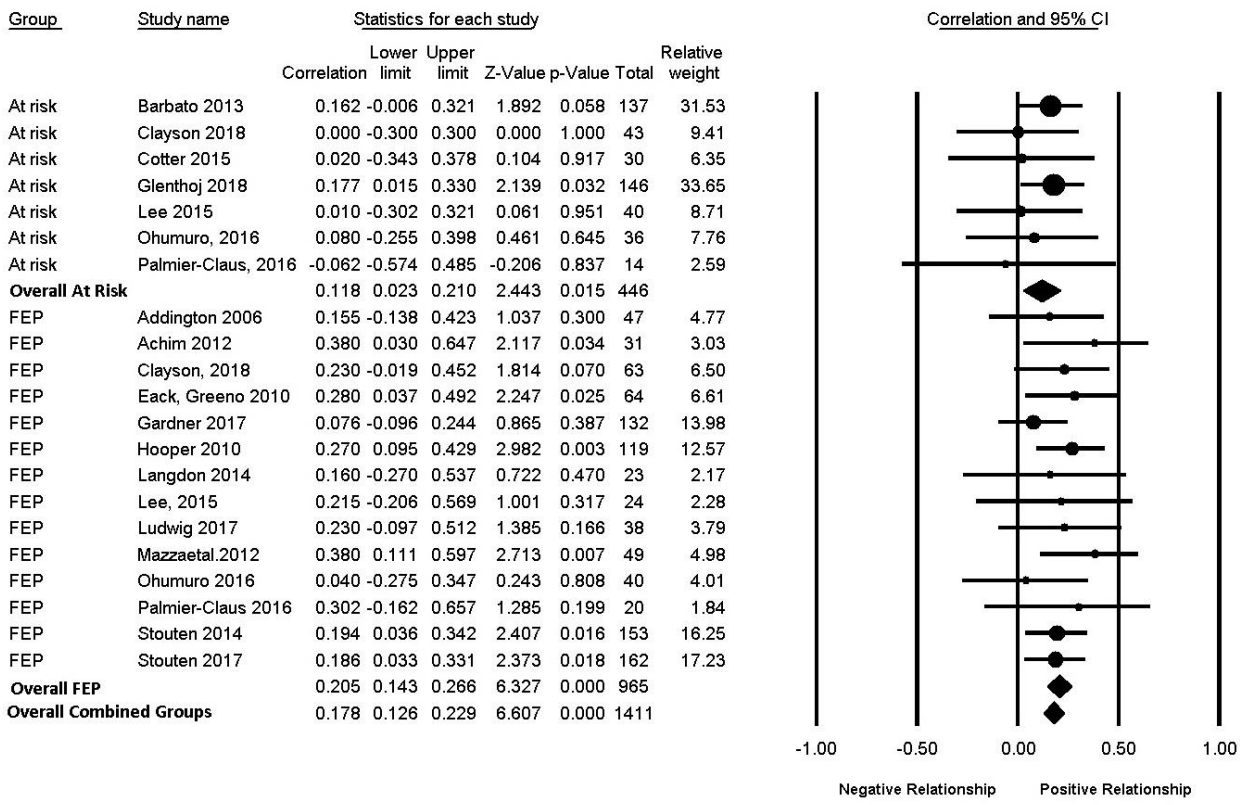

Figure C1. Forest plot for meta-analysis of the strength (r) and direction of relationship between overall social cognition and social functioning in ARMS and FEP participants.

Overall Social Cognition and Positive Psychotic Symptoms in ARMS and FEP

A total of six studies reported the correlation coefficient between at least one social cognitive function test and positive psychotic symptoms in ARMS participants (see **Figure C2**). The range was from -0.01 to -0.427 with a non-significant (Z=-1.575, p=0.115) negative pooled correlation coefficient of -0.144 (95% CI: -0.315 to 0.035) indicating a small effect size. There was moderate between study heterogeneity (Q (5) = 12.141, p=0.033, I^2=58.82%, Tau^2= 0.025).

A total of 15 studies reported the correlation coefficient between at least one social cognitive function test and positive psychotic symptoms in FEP participants (see **Figure C2**). The range was from -0.57 to 0.028 with a significant (Z=-5.036, p<0.001) positive pooled correlation coefficient of -0.178 (95% CI: -0.245 to -0.109) indicating a small effect

size. Heterogeneity of variance was very low (Q (15) = 13.405, p=0.571, I^2=0%, Tau^2= 0.00).

The overall pooled correlation coefficient for ARMS and FEP studies combined was negative and significant at -0.173 (Z=-5.036, p<0.001) indicating a small effect size with low heterogeneity (Q (21) = 32.951, p=0.047, I^2=36.268%, Tau^2= 0.009).

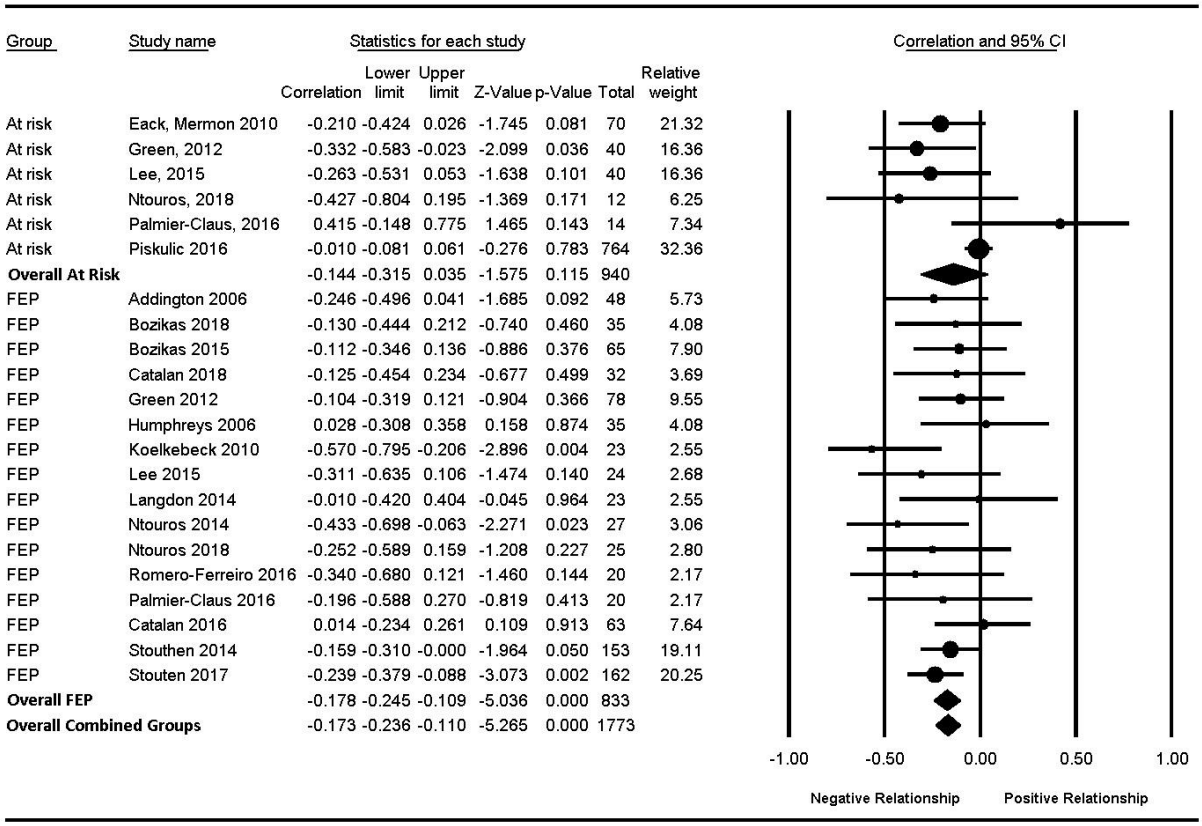

Figure C2. Forest plot for meta-analysis of the strength (r) and direction of relationship between Overall social cognition and positive psychotic symptoms in ARMS and FEP participants.

Overall Social Cognition and Negative Psychotic Symptoms in ARMS and FEP

A total of four studies reported the correlation coefficient between at least one social cognitive functioning test and negative psychotic symptoms in ARMS

participants (see **Figure C3**). The range was from -0.0425 to 0.042 with a non-significant (Z=-1.691, p=0.091) negative pooled correlation coefficient of -0.131 (95% CI: -0.277 to 0.021) indicating a small effect size. There was low to moderate heterogeneity between (Q (3) = 5.01, p=0.171, I^2=40.11%, Tau^2= 0.01).

A total of 14 studies reported the correlation coefficient between emotion recognition performance and positive psychotic symptoms in FEP participants (see **Figure C3**). The range was from -0.5 to 0.04 with a significant (Z=-5.514, p<0.001) positive pooled correlation coefficient of -0.211 (95% CI: -0.282 to -0.137) indicating a small effect size. Heterogeneity of variance was very low (Q (13) = 16.086, p=0.245, I^2=19.18%, Tau^2= 0.004).

The overall pooled correlation coefficient for ARMS and FEP studies combined was negative and significant at -0.195 (Z=-5.69, p<0.001) indicating a small effect size with low heterogeneity (Q (17) = 28.778, p=0.037, I^2=40.927%, Tau^2= 0.008).

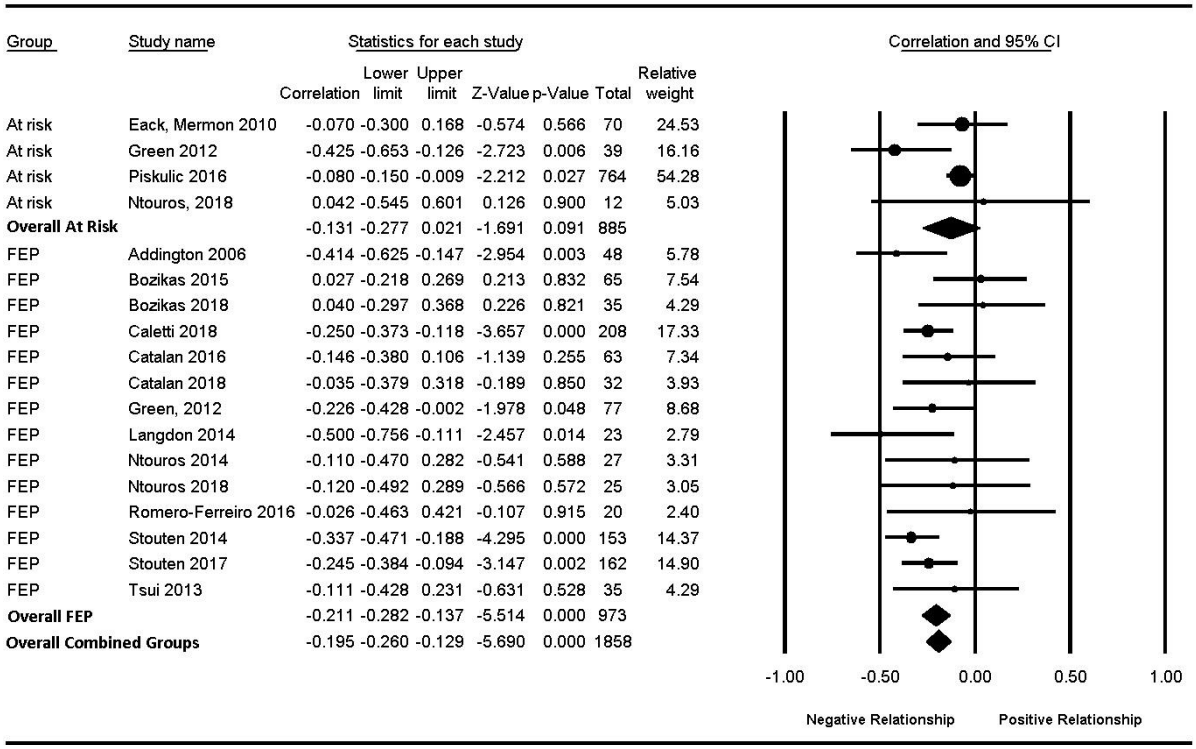

Figure C3. Forest plot for meta-analysis of the strength (r) and direction of relationship between Overall social cognition and negative psychotic symptoms in ARMS and FEP participants

Emotion Recognition

Emotion Recognition and Social Functioning in ARMS and First Episode Psychosis

A total of five studies reported the correlation coefficient between emotion recognition performance and social functioning in ARMS participants (see **Figure C4**). The range was from 0 to 0.181 with a significant (Z=2.571, p=0.01) positive pooled correlation coefficient of 0.131 (95% CI: 0.031 to 0.228) indicating a small effect size. Heterogeneity was very low (Q (4) = 1.651, p=0.8, I^2=0%, Tau^2= 0.00).

A total of eight studies reported the correlation coefficient between emotion recognition performance and social functioning in FEP participants (see **Figure C4**). The range was from 0.154 to 0.31 with a significant (Z=5.3, p<0.001) positive pooled correlation coefficient of 0.222 (95% CI: 0.141 to 0.299,) indicating a small to medium effect size. Heterogeneity of variance was very low (Q (7) = 1.097, p=0.993, I^2=0%, Tau^2= 0.00).

The overall pooled correlation coefficient for ARMS and FEP studies combined was positive and significant at 0.185 (Z=5.721, p<0.001) indicating a small effect size with low heterogeneity (Q (12) = 4.728, p=0.966, I^2=0%, Tau^2= 0.00).

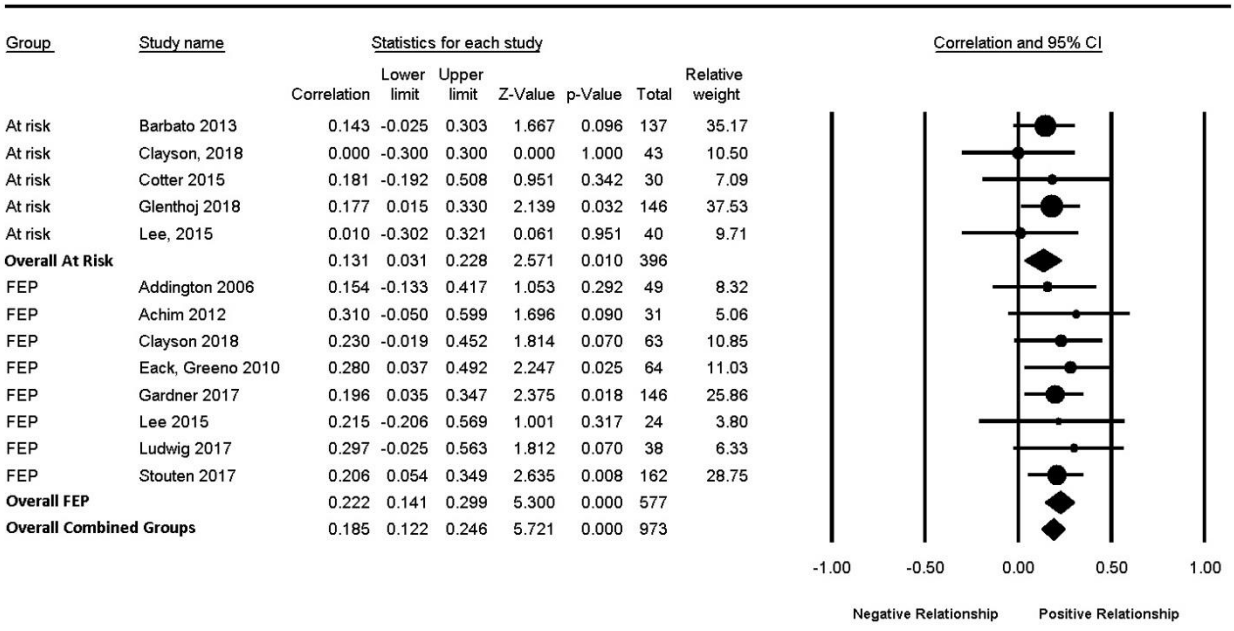

Figure C4. Forest plot for meta-analysis of the strength (r) and direction of relationship between emotion recognition and social functioning in ARMS and FEP participants

Emotion Recognition and Positive Psychotic Symptoms in ARMS ***and FEP***

A total of four studies reported the correlation coefficient between emotion recognition performance and positive psychotic symptoms in ARMS participants (see **Figure C5**). The range was from -0.427 to -0.01 to with a non-significant (Z=-1.575, p=0.115) negative pooled correlation coefficient of -0.144 (95% CI: -0.315 to 0.035) indicating a small effect size. There was moderate heterogeneity between studies (Q (5) = 12.141, p=0.033, I^2=58.82%, Tau^2= 0.025).

A total of eight studies reported the correlation coefficient between emotion recognition performance and positive psychotic symptoms in FEP participants (see **Figure C5**). The range was from -0.433 to 0.028 with a significant (Z=-4.633, p<0.001) positive pooled correlation coefficient of -0.166 (95% CI: -0.234 to 0.069) indicating a small effect size. Heterogeneity of variance was very low (Q (14) = 8.914, p=0.836, I^2=0%, Tau^2= 0.00).

The overall pooled correlation coefficient for ARMS and FEP studies combined was negative and significant at -0.163 (Z=-4.888, p<0.001) indicating a small effect size with low heterogeneity (Q (20) = 27.068, p=0.133, I^2=26.11%, Tau^2= 0.005).

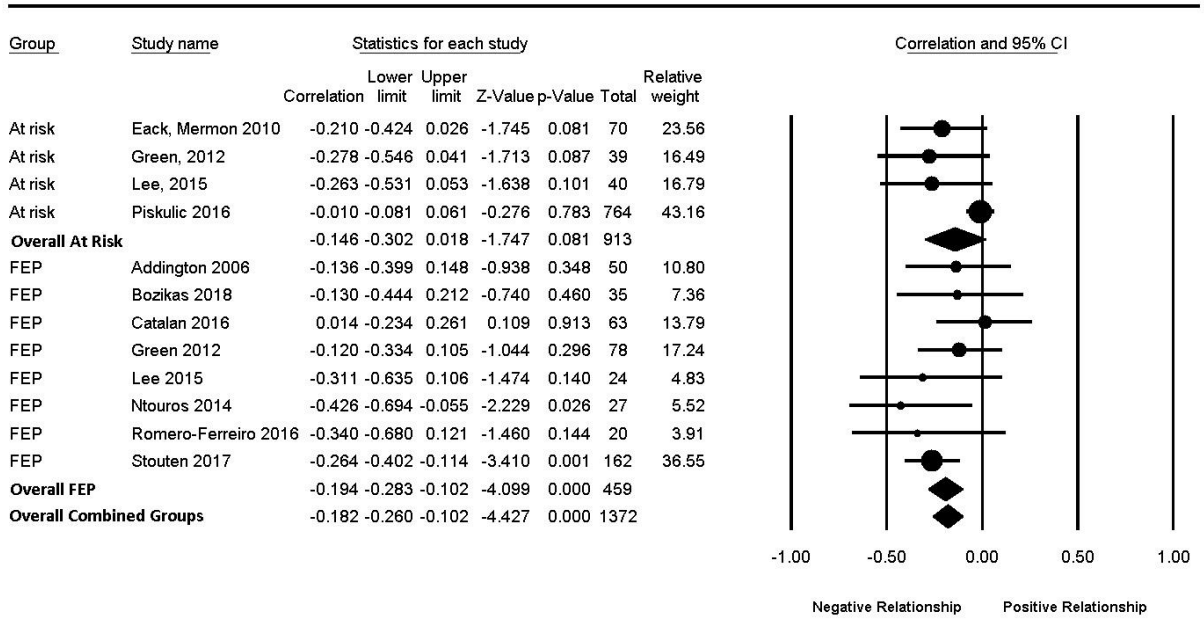

Figure C5. Forest plot for meta-analysis of the strength (r) and direction of relationship between emotion recognition and positive psychotic symptoms in ARMS and FEP participants

Emotion Recognition and Negative Psychotic Symptoms in ARMS and FEP

A total of four studies reported the correlation coefficient between emotion recognition performance and negative psychotic symptoms in ARMS participants (see **Figure C6**). The range was from -0.07 to 0.393 with a significant (Z=-2.317, p=0.021) negative pooled correlation coefficient of -0.11 (95% CI: -0.201 to -0.017) indicating a small effect size with low heterogeneity (Q (3) = 3.64, p=0.303, I^2=17.59%, Tau^2= 0.002).

A total of nine studies reported the correlation coefficient between emotion recognition performance and negative psychotic symptoms in FEP participants (see **Figure C6**). The range was from -0.355 to 0.04 with a significant (Z=-5.465, p<0.001) negative pooled correlation coefficient of -0.211 (95% CI: -0.283 to -0.137) indicating a small effect size. Heterogeneity of variance was low (Q (8) = 6.086, p=0.638, I^2=0%, Tau^2= 0.00).

The overall pooled correlation coefficient for at risk and FEP studies combined was negative and significant at –0.17 (Z=-5.69, p<0.001) indicating a small effect size with low heterogeneity (Q (12) = 14.716, p=0.257, I^2=18.454%, Tau^2= 0.002).

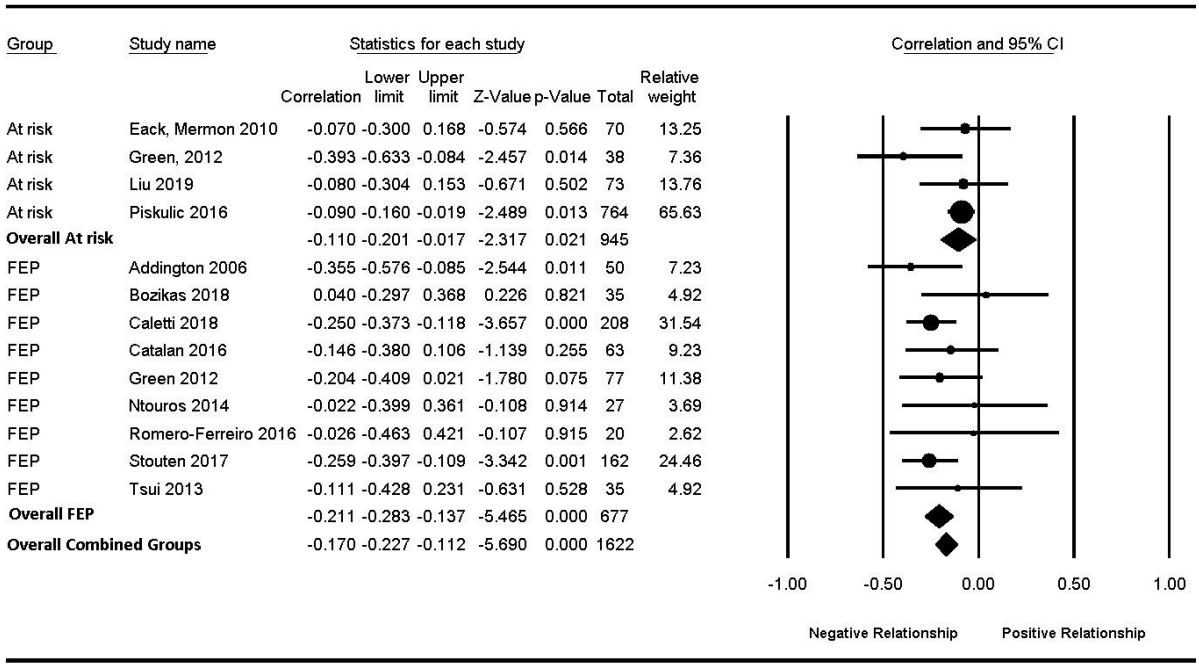

Figure C6. Forest plot for meta-analysis of the strength (r) and direction of relationship between emotion recognition and negative psychotic symptoms in ARMS and FEP

Theory of Mind

Theory of Mind and Social Functioning in ARMS and FEP

A total of four studies reported the correlation coefficient between theory of mind performance and social functioning in ARMS participants (see **Figure C7**). The range was from -0.062 to 0.369 with a significant (Z=2.571, p=0.01) positive pooled correlation coefficient of 0.178 (95% CI: 0.043 to 0.306) indicating a small effect size. Heterogeneity was very low (Q (3) = 2.134, p=0.545, I^2=0%, Tau^2= 0.00).

A total of 10 studies reported the correlation coefficient between theory of mind performance and social functioning in FEP participants (see **Figure C7**). The range was from 0.04 to 0.45 with a significant (Z=5.72, p<0.001) positive pooled correlation coefficient of 0.208 (95% CI: 0.138 to 0.276,) indicating a small to medium effect size. Heterogeneity of variance was very low (Q (9) = 8.262, p=0.508, I^2=0%, Tau^2= 0.00).

The overall pooled correlation coefficient for ARMS and FEP studies combined was positive and significant at 0.201 (Z=6.258, p<0.001) indicating a small effect size with low heterogeneity (Q (13) = 10.552, p=0.648, I^2=0%, Tau^2= 0.00)

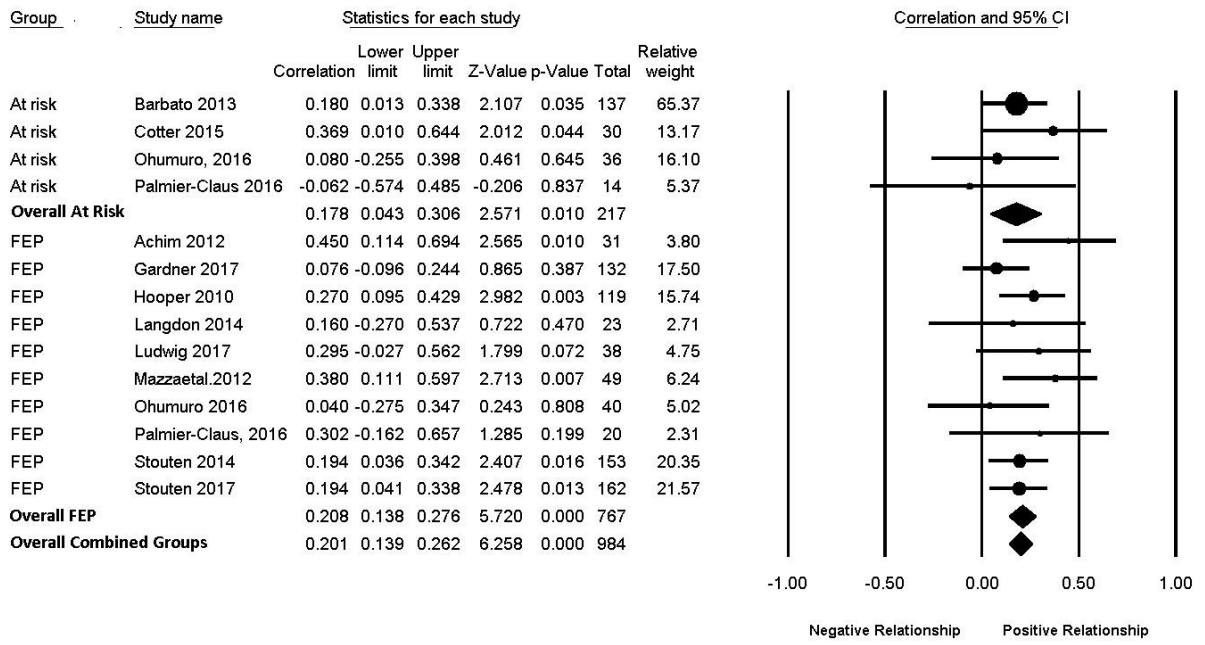

Figure C7. Forest plot for meta-analysis of the strength (r) and direction of relationship between Theory of Mind and social functioning in ARMS and FEP participants

Theory of Mind and Positive Psychotic Symptoms in ARMS and FEP

A total of three studies reported the correlation coefficient between theory of mind performance and positive psychotic symptoms in ARMS participants (see **Figure C8**). The range was from -0.427 to 0.415 with a non-significant (Z=0.187, p=0.851) negative pooled correlation coefficient of 0.033 (95% CI: -0.301 to 0.36) indicating a small effect size. There was low to moderate heterogeneity of variance (Q (2) = 3.991, p=0.136, I^2=49.882%, Tau^2= 0.051).

A total of eight studies reported the correlation coefficient between theory of mind performance and positive psychotic symptoms in FEP participants (See **Figure C8**). The range was from -0.57 to 0.01 with a significant (Z=-3.547, p<0.001) positive pooled correlation coefficient of -0.189 (95% CI: -0.288 to -0.085) indicating a small effect size. Heterogeneity of variance very low (Q (7) =7.843, p=0.347, I^2=10.74%, Tau^2= 0.003).

The overall pooled correlation coefficient for ARMS and FEP studies combined was negative and significant at -0.17 (Z=-3.337, p=0.001) indicating a small effect size with moderate heterogeneity (Q (10) = 25.703, p=0.004, I^2=61.09%, Tau^2= 0.022).

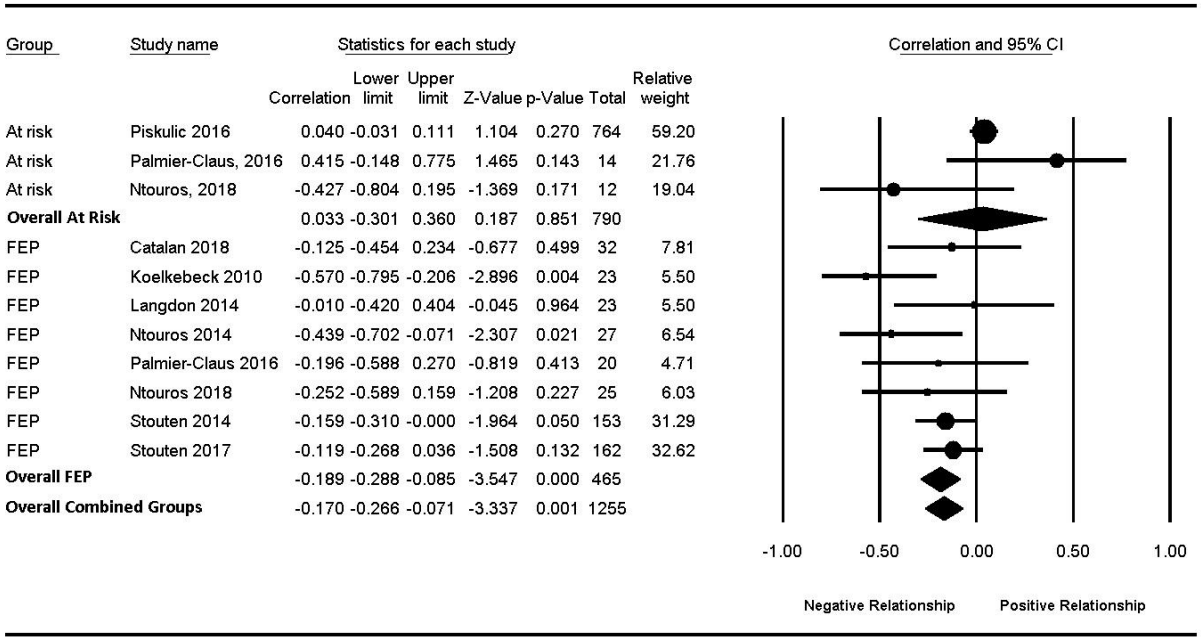

Figure C8. Forest plot for meta-analysis of the strength (r) and direction of relationship between theory of mind and positive psychotic symptoms in ARMS and FEP participants

Theory of Mind and Negative Psychotic Symptoms in ARMS and FEP

A total of five studies reported the correlation coefficient between theory of mind performance and negative psychotic symptoms in FEP participants (see **Figure C9**). The range was from -0.365 to -0.035 with a significant (Z=-5.555, p<0.001) negative pooled correlation coefficient of -0.3 (95% CI: -0.396 to -0.198) indicating a small effect size. Heterogeneity of variance was low (Q (4) = 4.389, p=0.356, I^2=8.87%, Tau^2= 0.002).

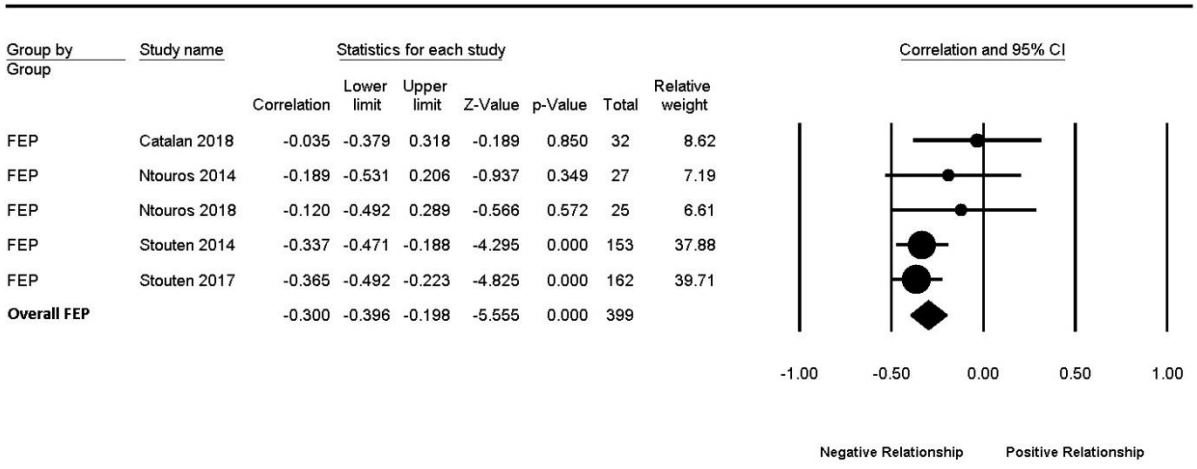

Figure C9. Forest plot for meta-analysis of the strength (r) and direction of relationship between theory of mind and negative psychotic symptoms in FEP participants

Appendix D

Risk of bias analysis and funnel plots from Chapter 3.

Risk of Bias for studies investigating overall social cognition and social functioning in ARMS and FEP

The trim and fill method for studies investigating overall social cognition and social functioning in ARMS participants indicated three potentially missing studies that would need to fall to the right of the mean to make the funnel plot symmetrical (see **Figure D1**). Assuming a random-effects model, the new pooled correlation coefficient increased to 0.149 (95 CI: 0.064 to 0.233).

The trim and fill method for studies investigating overall social cognition and social functioning in participants with FEP indicated three potentially missing studies that would have to fall to the left of the pooled mean to make the funnel plot symmetrical (see **Figure D2**). Assuming a random effects model, the new pooled correlation coefficient decreased to 0.187 (95% CI: 0.127 to 0.246).

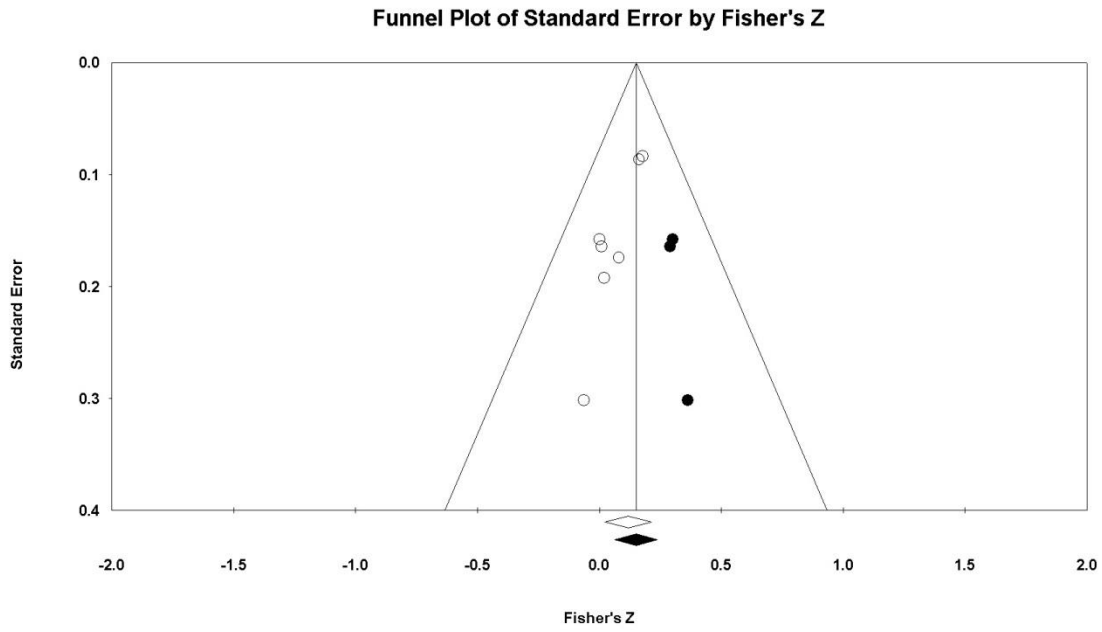

Figure D1. Risk of bias funnel plot for meta-analysis of the relationship between overall social cognition and social functioning in ARMS participants

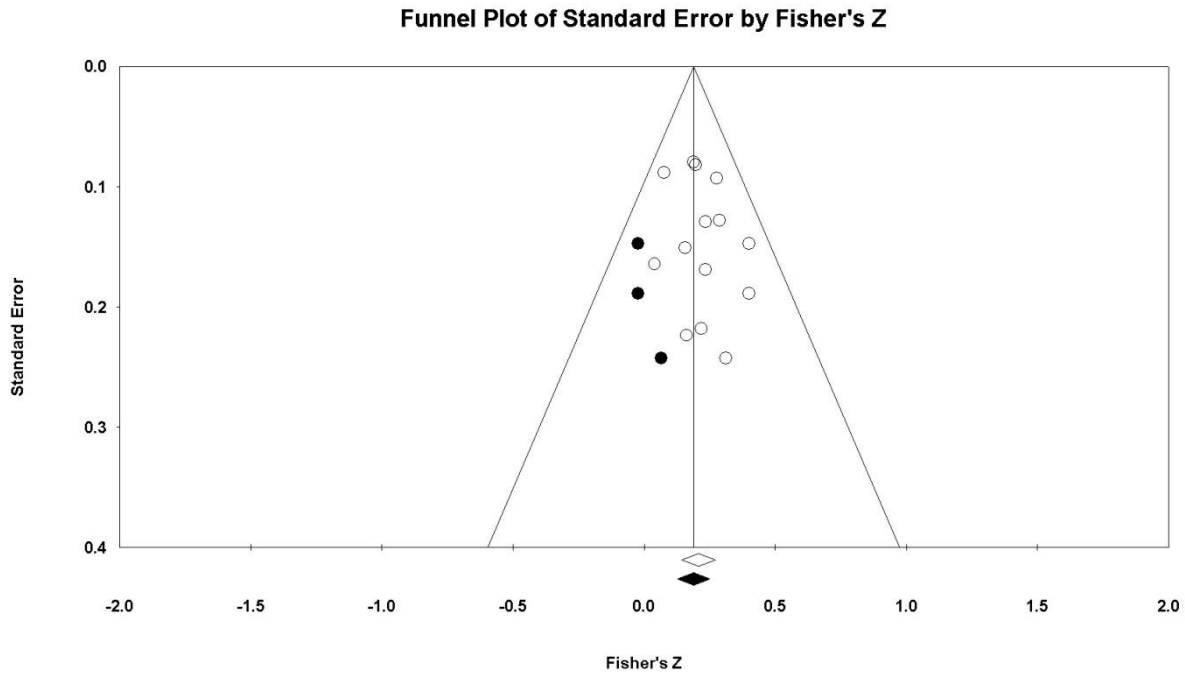

Figure D2. Risk of bias funnel plot for meta-analysis of the relationship between social cognition and overall social functioning in FEP participants

Risk of Bias for studies investigating overall social cognition and positive psychotic symptoms in ARMS and FEP

The trim and fill method for studies investigating overall social cognition and positive psychotic symptoms in ARMS participants indicated one potentially missing study that would need to fall to the right of the mean to make the funnel plot symmetrical (see **Figure D3**). Assuming a random-effects model, the new pooled correlation coefficient decreased to -0.114 (95 CI: -0.284 to -0.062). The trim and fill method for studies investigating overall social cognition and positive psychotic symptoms in participants with FEP indicated one potentially missing study that would have to fall to the right of the pooled mean to make the funnel plot symmetrical (see **Figure D4**). Assuming a random effects model, the new pooled correlation coefficient decreased to -0.157 (95% CI: -0.224 to -0.088).

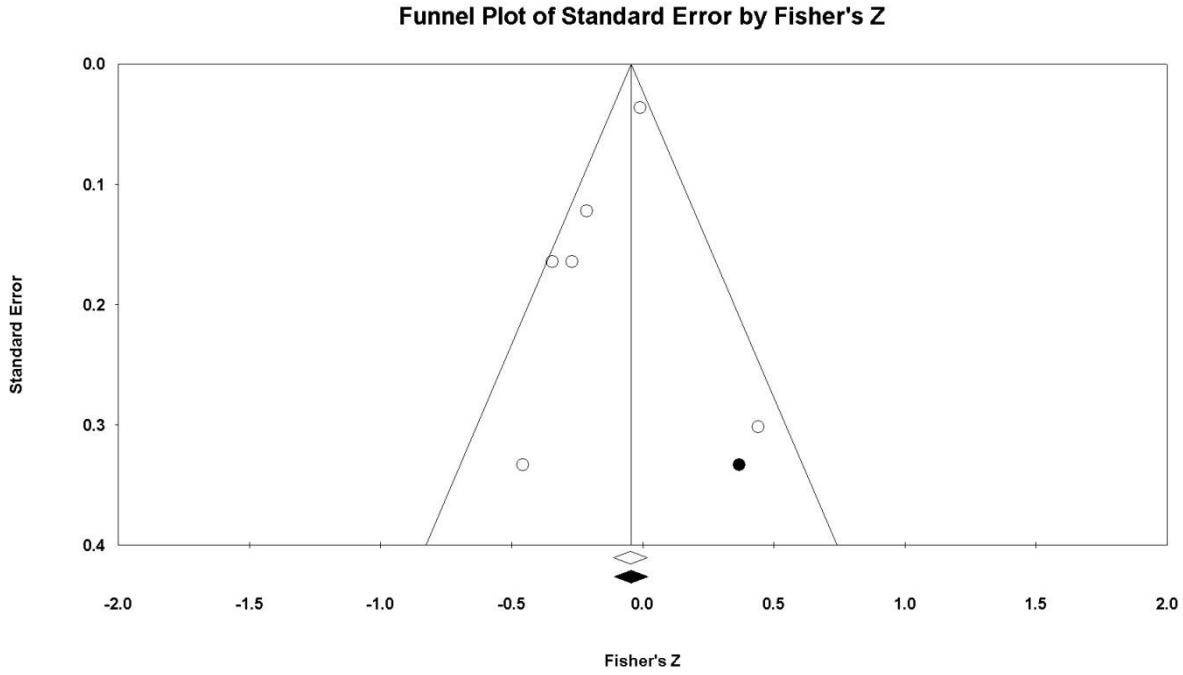

Figure D3. Risk of bias funnel plot for meta-analysis of the relationship between overall social cognition and positive psychotic symptoms in ARMS participants

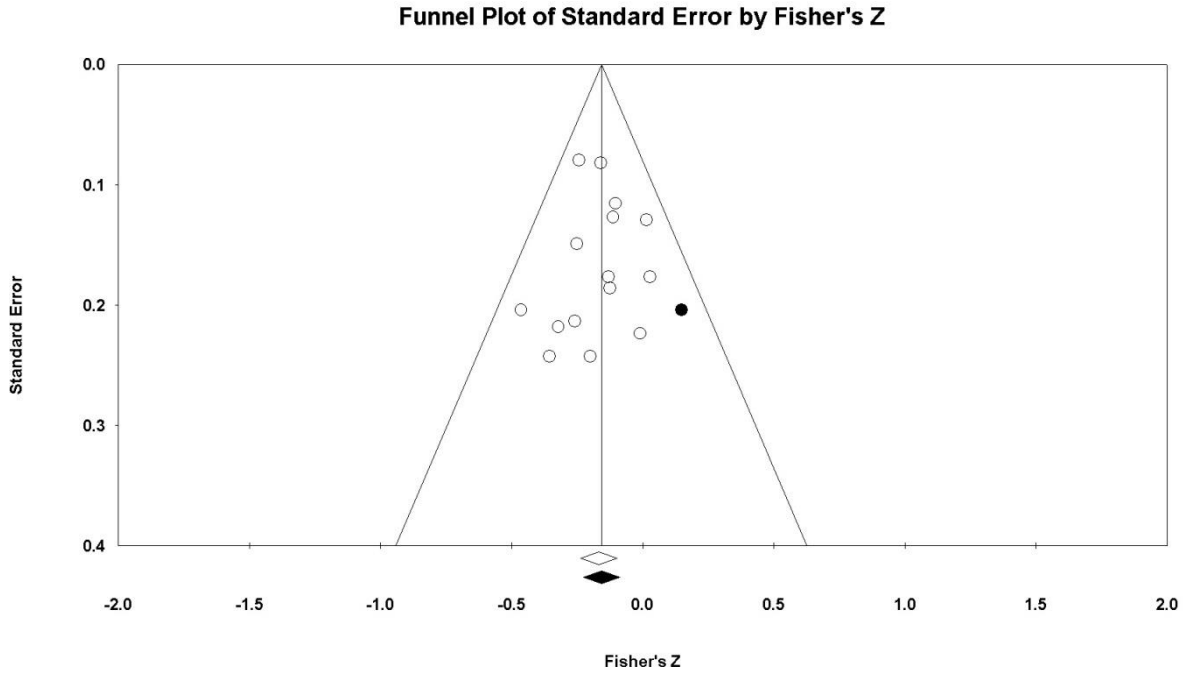

Figure D4. Risk of bias funnel plot for meta-analysis of the relationship between overall social cognition and positive psychotic symptoms in FEP participants

Risk of Bias for studies investigating overall social cognition and negative psychotic symptoms in ARMS and FEP

The trim and fill method for studies investigating overall social cognition and negative psychotic symptoms in ARMS participants indicated one potentially missing study that would need to fall to the left of the mean to make the funnel plot symmetrical (see **Figure D5**). Assuming a random-effects model, the new pooled correlation coefficient decreased to -0.124 (95 CI: -0.245 to -0.00003). The trim and fill method for studies investigating overall social cognition and negative psychotic symptoms in participants with FEP indicated four potentially missing study that would have to fall to the left of the pooled mean to make the funnel plot symmetrical (see **Figure D6**). Assuming a random effects model, the new pooled correlation coefficient increased to -0.257 (95% CI: -0.334 to -0.176).

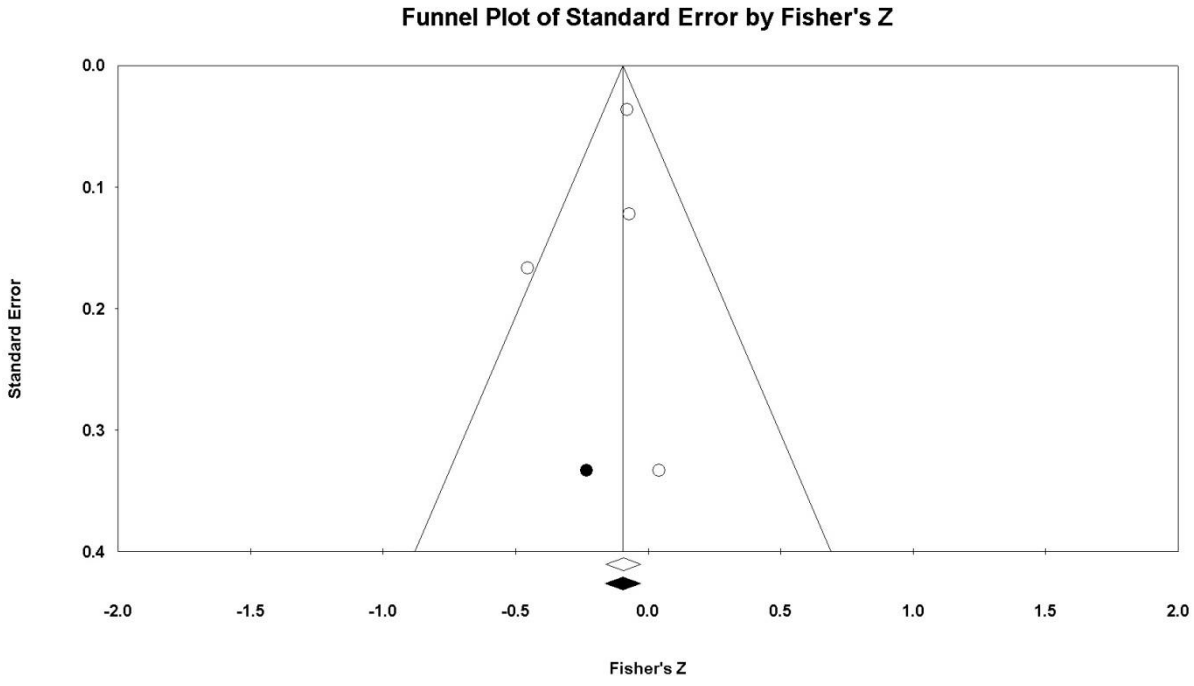

Figure D5. Risk of bias funnel plot for meta-analysis of the relationship between overall social cognition and negative psychotic symptoms in ARMS participants

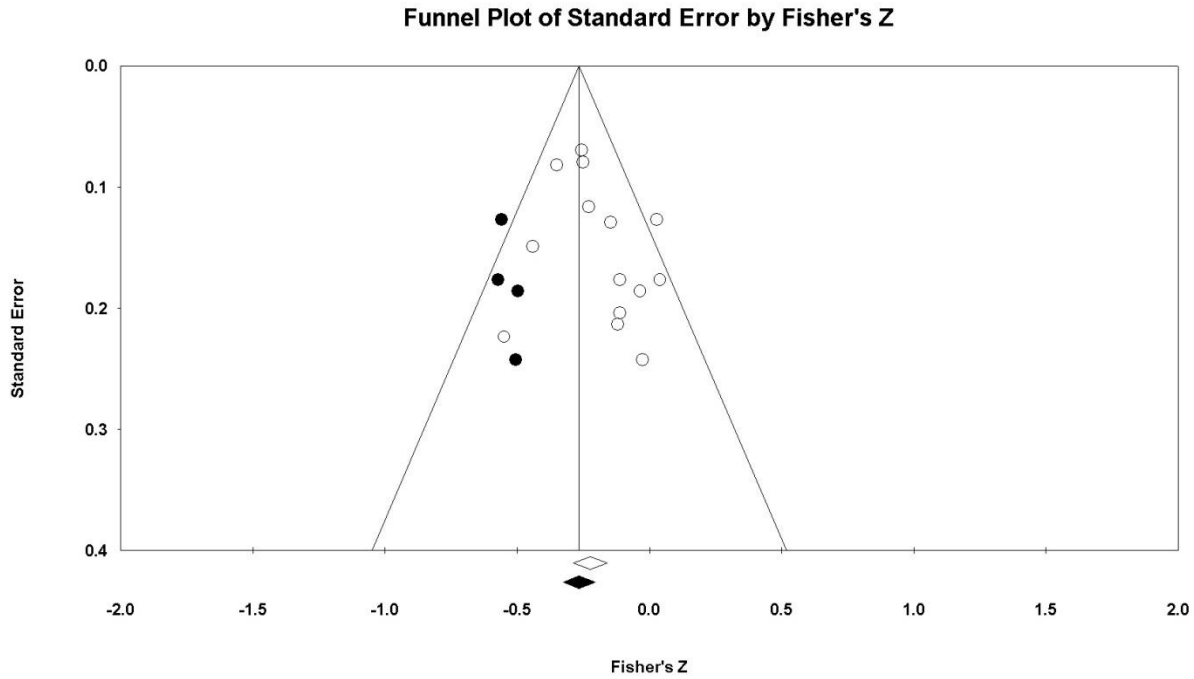

Figure D6. Risk of bias funnel plot for meta-analysis of the relationship between overall social cognition and negative psychotic symptoms in FEP participants

Risk of Bias for studies investigating emotion recognition and social functioning in ARMS and FEP

The trim and fill method for studies investigating emotion recognition and social functioning in ARMS participants indicated one potentially missing study that would need to fall to the right of the mean to make the funnel plot symmetrical (see **Figure D7**). Assuming a random-effects model, the new pooled correlation coefficient increased to 0.146 (95 CI: 0.031 to 0.052). The trim and fill method for studies investigating emotion recognition and social functioning in participants with FEP indicated two potentially missing studies that would have to fall to the left of the pooled mean to make the funnel plot symmetrical (see **Figure D8**). Assuming a random effects model, the new pooled correlation coefficient decreased to 0.211 (95% CI: 0.134 to 0.285).

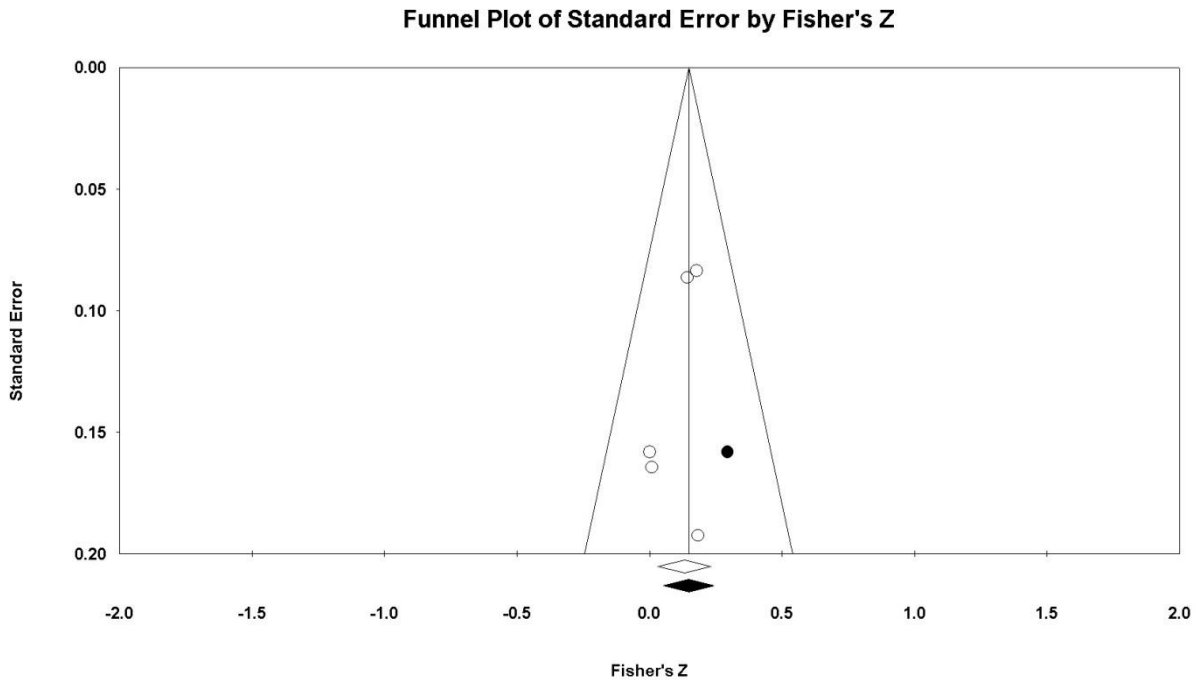

Figure D7. Risk of bias funnel plot for meta-analysis of the relationship between emotion recognition and social functioning in ARMS participants

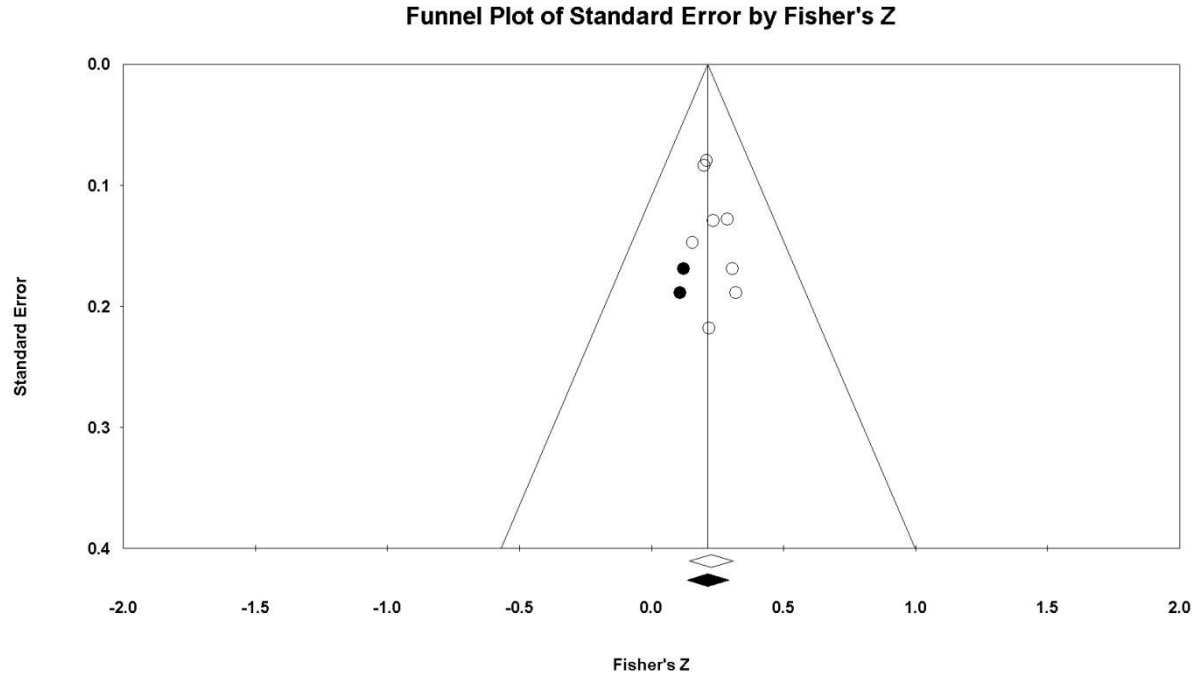

Figure D8. Risk of bias funnel plot for meta-analysis of the relationship between emotion recognition and social functioning in FEP participants

Risk of Bias for studies investigating emotion recognition and positive psychotic symptoms in ARMS and FEP

The trim and fill method for studies investigating emotion recognition performance and positive psychotic symptoms in ARMS participants indicated two potentially missing study that would need to fall to the right of the mean to make the funnel plot symmetrical (see **Figure D9**). Assuming a random-effects model, the new pooled correlation coefficient decreased to -0.055 (95 CI: -0.02 to -0.096). The trim and fill method for studies investigating emotion recognition performance and positive psychotic symptoms in participants with FEP indicated one potentially missing study that would have to fall to the right of the pooled mean to make the funnel plot symmetrical (see **Figure D10**). Assuming a random effects model, the new pooled correlation coefficient decreased to -0.177 (95% CI: -0.268 to -0.082).

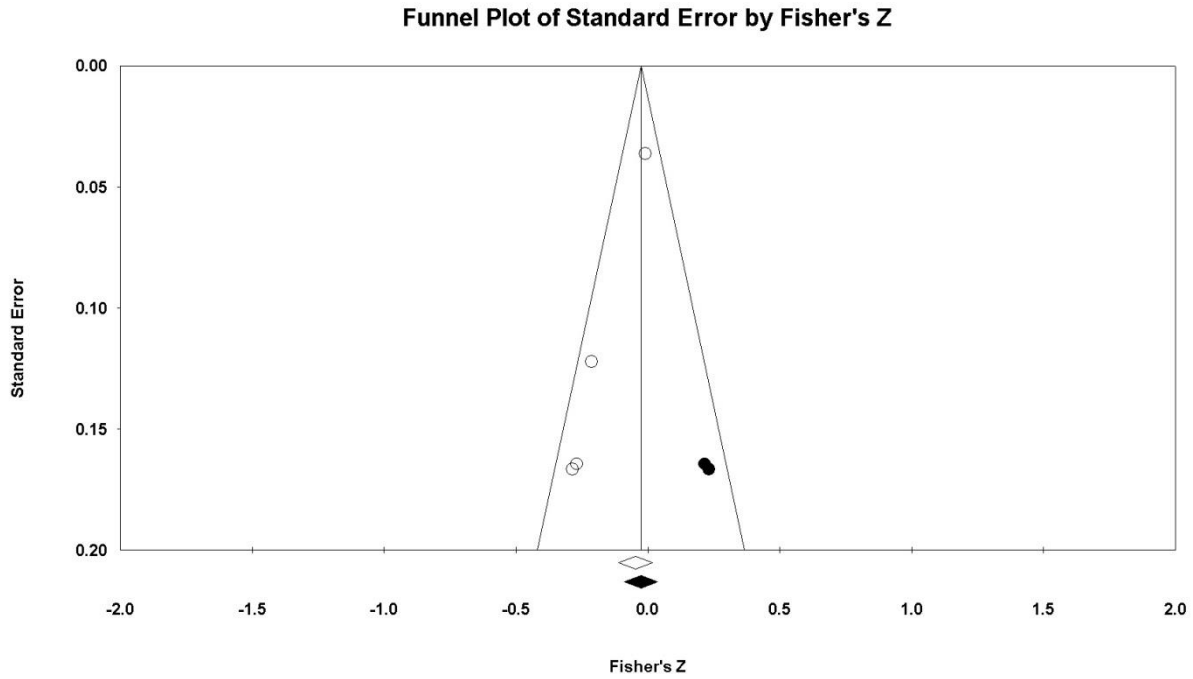

Figure D9. Risk of bias funnel plot for meta-analysis of the relationship between emotion recognition and positive psychotic symptoms in ARMS participants

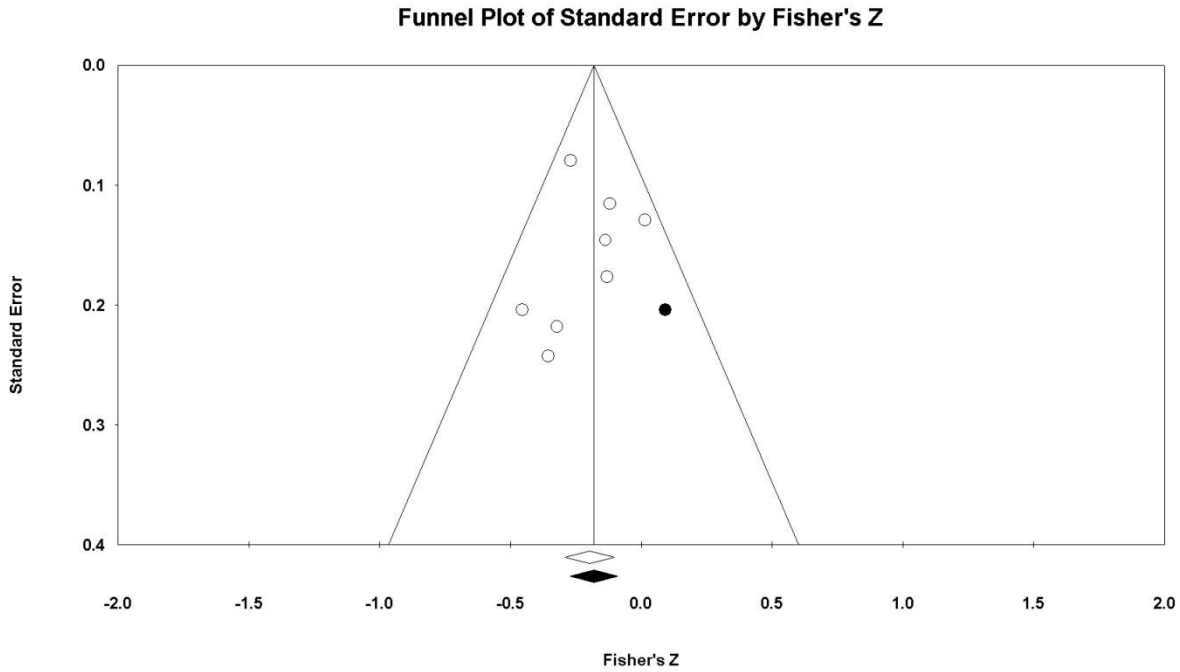

Figure D10. Risk of bias funnel plot for meta-analysis of the relationship between emotion recognition and positive psychotic symptoms in FEP participants

Risk of Bias for studies investigating emotion recognition and negative psychotic symptoms in ARMS and FEP

The trim and fill method for studies investigating emotion recognition performance and negative psychotic symptoms in ARMS participants indicated one potentially missing study that would need to fall to the left of the mean to make the funnel plot symmetrical (see **Figure D11**). Assuming a random-effects model, the new pooled correlation coefficient decreased to -0.102 (95 CI: -0.163 to -0.041). The trim and fill method for studies investigating social cognition and negative psychotic symptoms in participants with FEP indicated three potentially missing studies that would have to fall to the left of the pooled mean to make the funnel plot symmetrical (see **Figure D12**). Assuming a random effects model, the new pooled correlation coefficient increased to -0.237 (95% CI: -0.305 to -0.167).

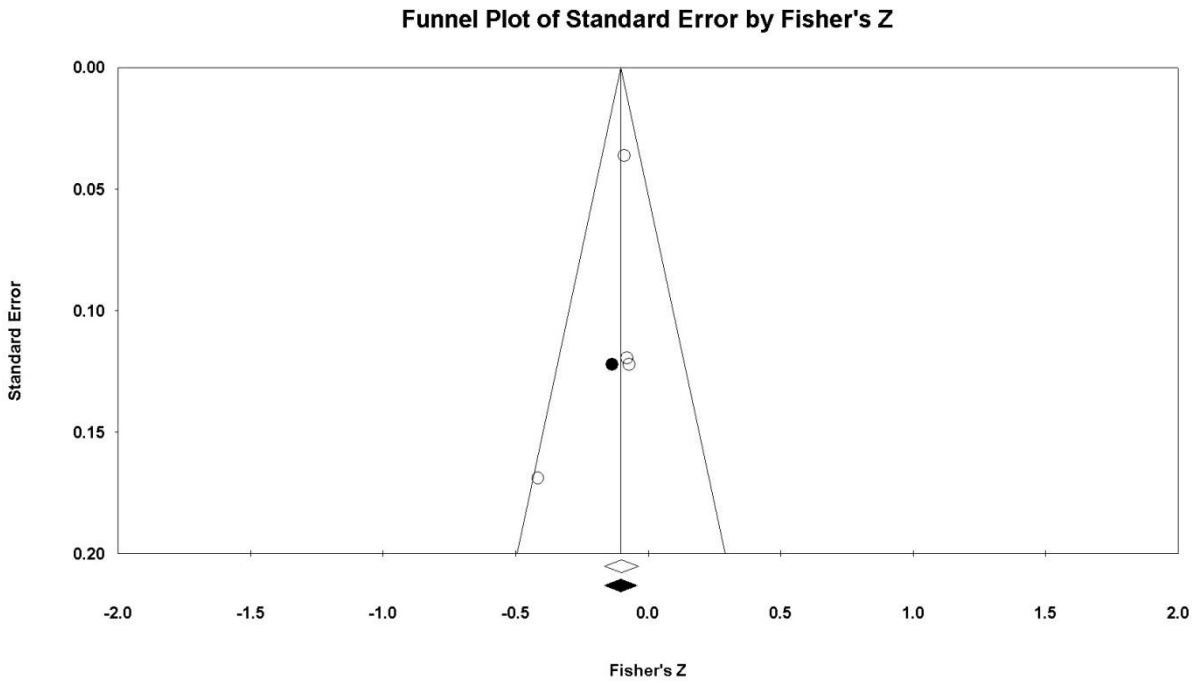

Figure D11. Risk of bias funnel plot for meta-analysis of the relationship between emotion recognition and negative psychotic symptoms in ARMS participants

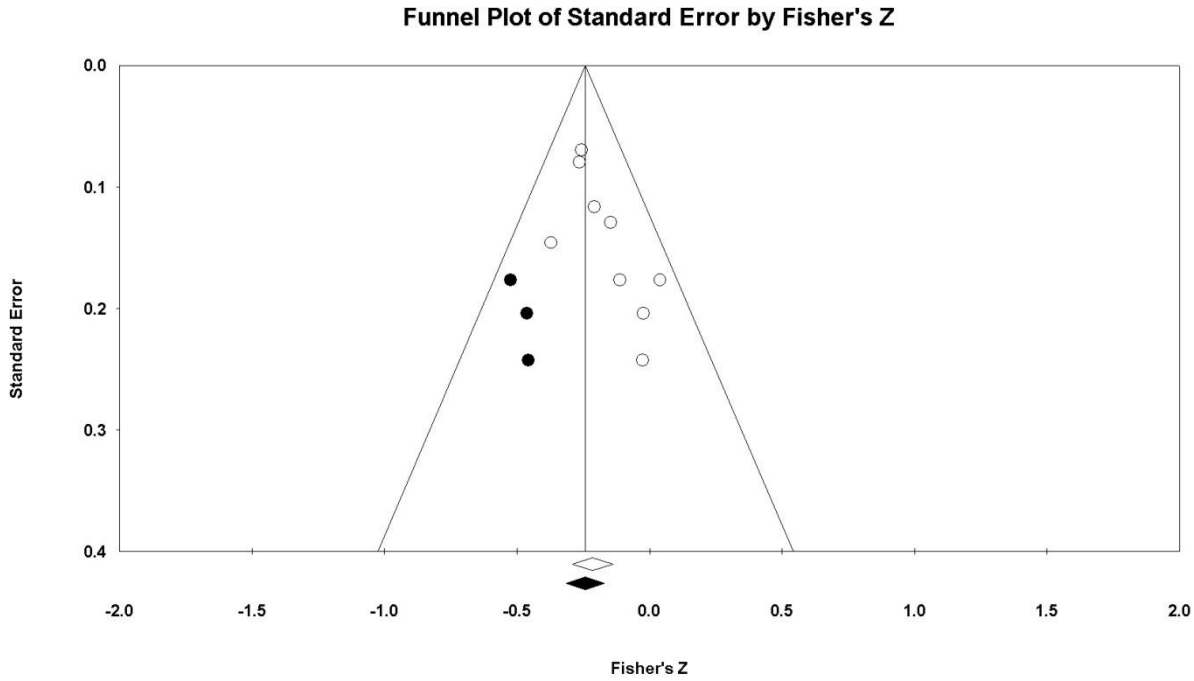

Figure D12. Risk of bias funnel plot for meta-analysis of the relationship between emotion recognition and negative psychotic symptoms in FEP participants

Risk of Bias for studies investigating theory of mind and social functioning in at risk and FEP

The trim and fill method for studies investigating theory of mind and social functioning in ARMS participants indicated one potentially missing study that would need to fall to the right of the mean to make the funnel plot symmetrical (see **Figure D13**). Assuming a random-effects model, the new pooled correlation coefficient increased to 0.191 (95 CI: 0.059 to 0.315). The trim and fill method for studies investigating theory of mind and social functioning in participants with FEP indicated one potentially missing study that would have to fall to the left of the pooled mean to make the funnel plot symmetrical (see **Figure D14**). Assuming a random effects model, the new pooled correlation coefficient decreased to 0.198 (95% CI: 0.126 to 0.269).

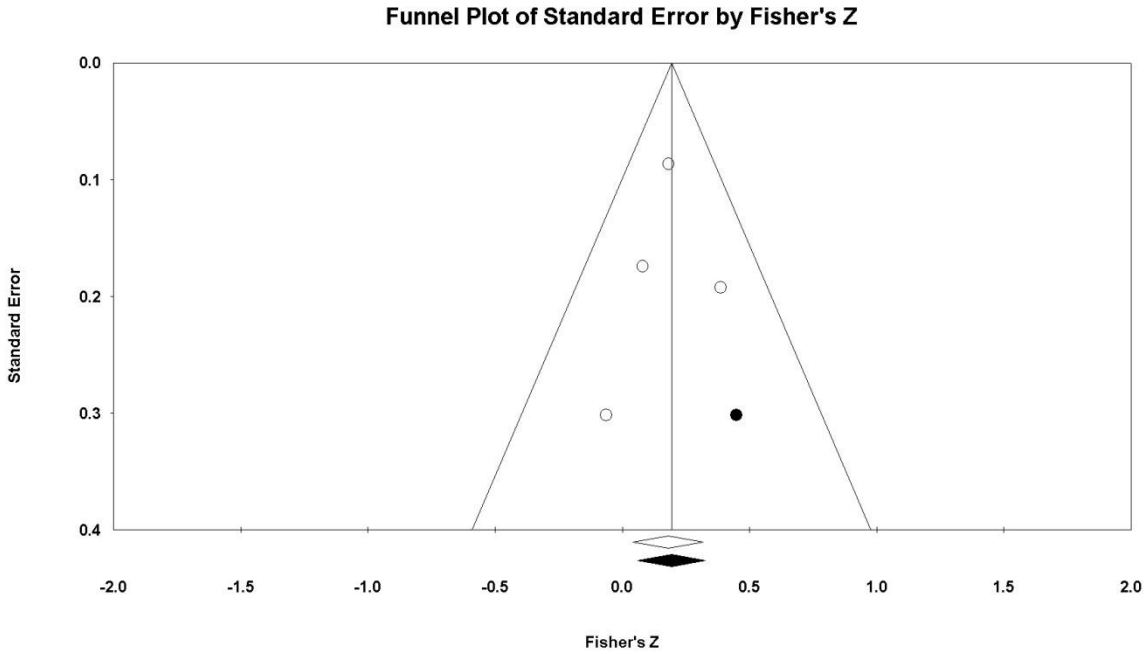

Figure D13. Risk of bias funnel plot for meta-analysis of the relationship between theory of mind and social functioning in ARMS participants

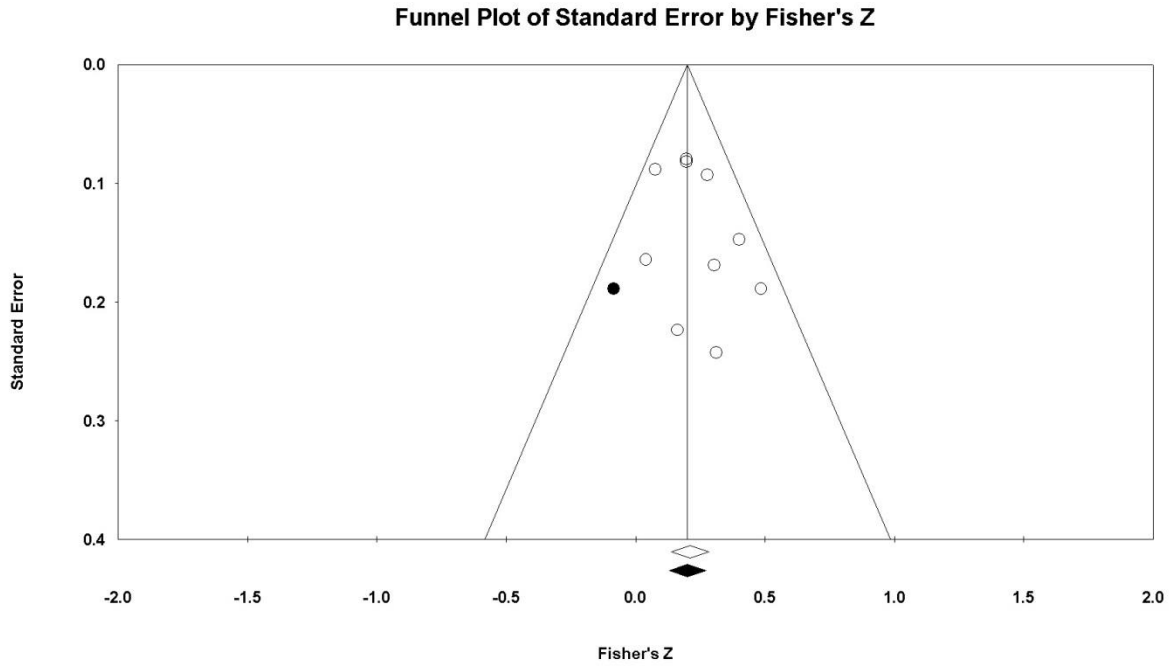

Figure D14. Risk of bias funnel plot for meta-analysis of the relationship between theory of mind and social functioning in FEP participants

Risk of Bias for studies investigating theory of mind and positive psychotic symptoms in ARMS and FEP

The trim and fill method for studies investigating theory of mind performance and positive psychotic symptoms in ARMS participants indicated zero potentially missing studies to make the funnel plot symmetrical (see **Figure D15**). The trim and fill method for studies investigating theory of mind performance and positive psychotic symptoms in participants with FEP indicated two potentially missing study that would have to fall to the right of the pooled mean to make the funnel plot symmetrical (see **Figure D16**). Assuming a random effects model, the new pooled correlation coefficient decreased to -0.141 (95% CI: -0.274 to -0.004).

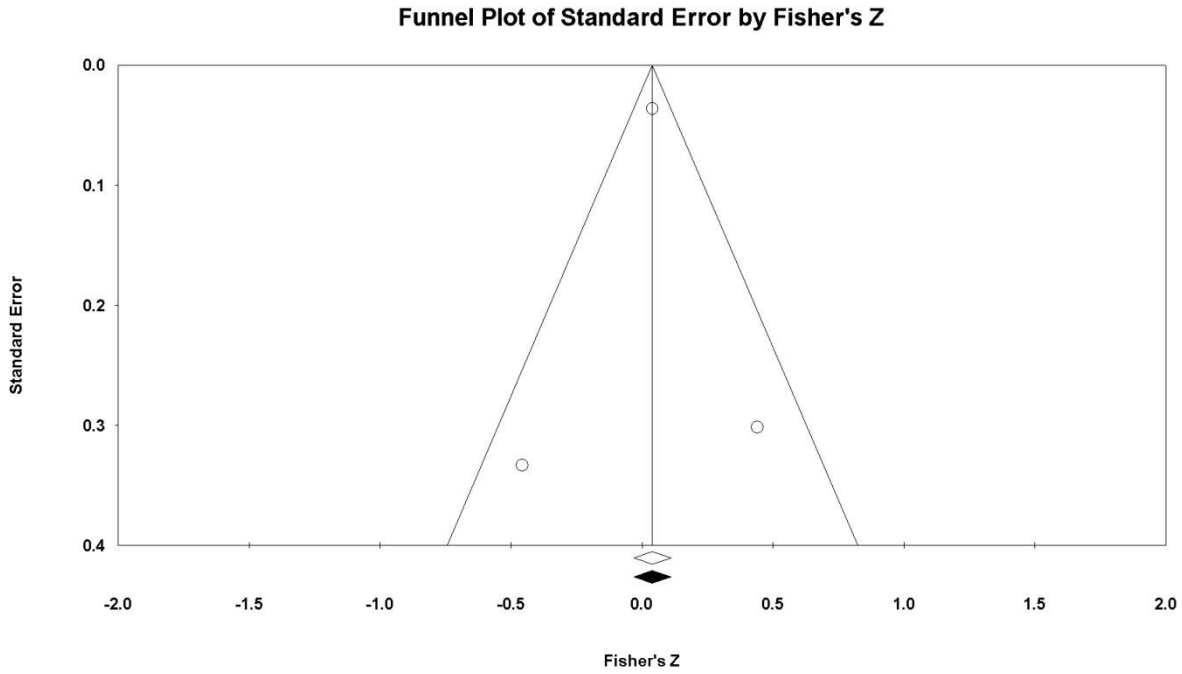

Figure D15. Risk of bias funnel plot for the relationship between theory of mind and positive psychotic symptoms in ARMS participants

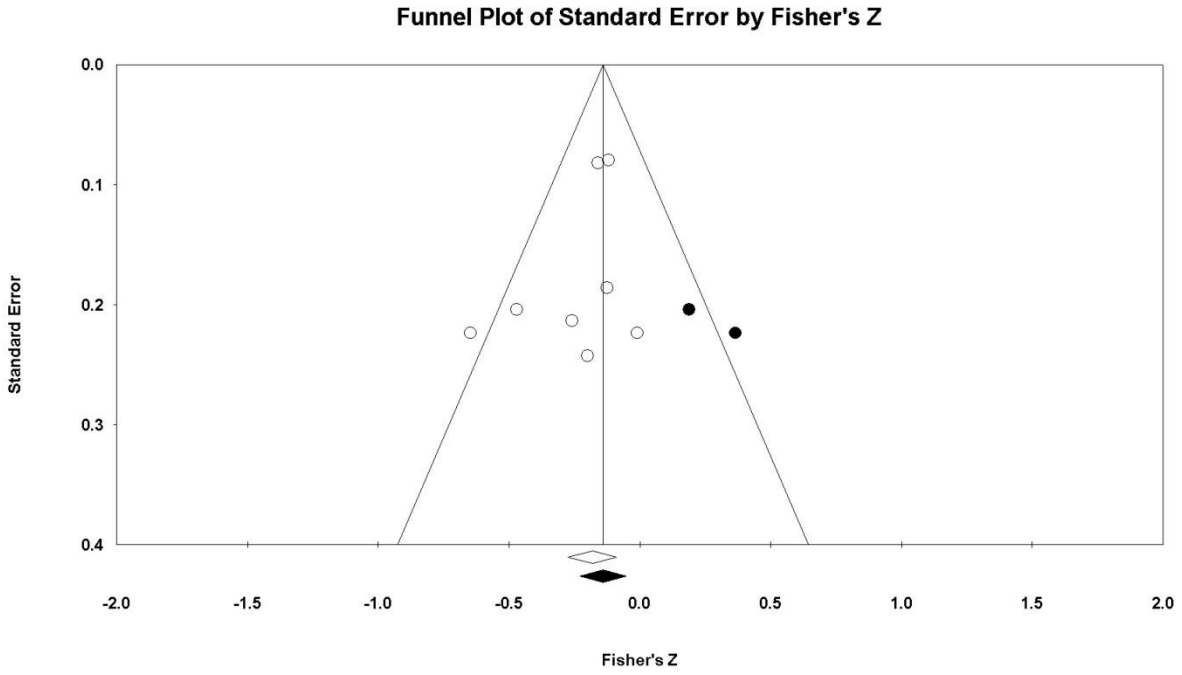

Figure D16. Risk of bias funnel plot for meta-analysis of the relationship between theory of mind and positive psychotic symptoms in FEP participants

Risk of Bias for studies investigating theory of mind and negative psychotic symptoms in ARMS and FEP

The trim and fill method for studies investigating social cognition and negative psychotic symptoms in participants with FEP indicated two potentially missing studies that would have to fall to the left of the pooled mean to make the funnel plot symmetrical (see **Figure D17**). Assuming a random effects model, the new pooled correlation coefficient increased to -0.334 (95% CI: -0.445 to -0.213).

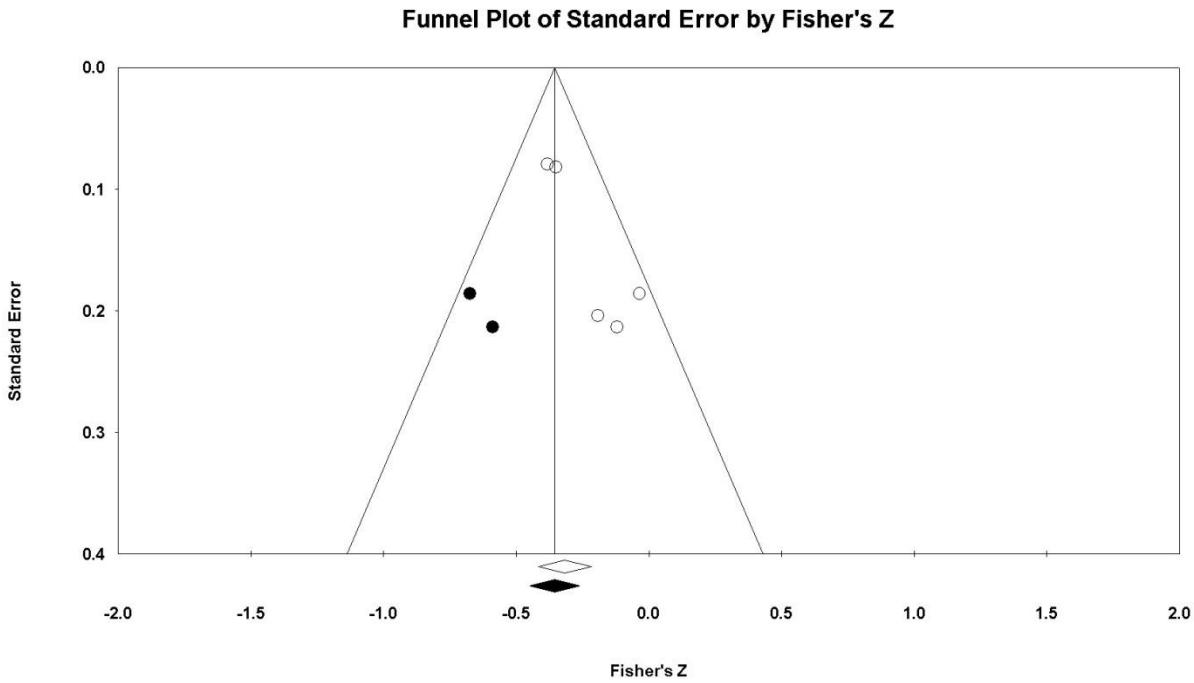

Figure D17. Risk of bias funnel plot for meta-analysis of the relationship between theory of mind and negative psychotic symptoms in FEP participants