

**Meta-cognition and Psychopathology in Children and
Adolescents**

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CATHERINE L KAY

School of Health Sciences

Division of Psychology and Mental Health

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Paper 1

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Abstract

Understanding of the cognitive mechanisms of psychopathology in adults has contributed to the development of promising advances in treatment. There remains a dearth of similar evidence in child and adolescent psychopathology. There are calls to bridge developmental and clinical approaches to research and a move to consider the applicability of adult models of psychopathology. This thesis explores the contribution of two related aspects of cognitive function that represent core components of the Self-Regulatory Executive Function (S-REF) model of adult psychopathology (Wells, 2009) in child and adolescent populations: executive function (EF) and meta-cognition.

Paper one systematically reviews the evidence that EF assessed at ≤ 5 years is associated with symptoms of internalizing psychopathology to test for prospective associations and determine which dimensions of EF are most predictive of symptoms. Fourteen studies that included 3428 participants used longitudinal multi-panel designs and administered a performance measure of EF at ≤ 5 years. Statistics from tests of association between EF and a subsequently administered measure of internalizing psychopathology were examined. Overall, poorer performance on EF measures was associated with increased risk for internalizing problems, particularly anxiety. Measures of complex response inhibition such as the day/night task most consistently demonstrated significant association with psychopathology. However, the direction of effects varied as a function of child temperament and parenting experiences. Higher levels of response inhibition were associated with increased risk for psychopathology in children with temperamental vulnerability and experience of over-controlling parenting. The ability to flexibly shift attention was protective in similar contexts. The reviewed evidence indicates that measures of EF in early childhood could indicate risk for internalizing problems. Response inhibition and attention shifting may provide a target for early intervention. Future research should select, assess and report on specific EF components in relation to outcomes.

Meta-cognitive beliefs (MCB) - implicit and explicit beliefs about cognition have been associated with psychopathology in adults and adolescents (Sun et al., 2018). Paper two aimed to test the independent contribution of MCB over and above theory of mind (ToM) to psychopathology in a high-risk adolescent sample. We assessed MCB in 41 adopted adolescents who were participating in a longitudinal study of outcomes in adoption. ToM was assessed during middle childhood and parents reported on child psychopathology during middle childhood and again in adolescence. We found no association between MCB and ToM. MCB but not ToM were positively correlated with psychopathology. Furthermore, adolescent reports of dysfunctional MCB were significantly positively associated with parent reported internalizing psychopathology independent of ToM, demographics and language. There was no linear association between MCB, ToM and extent of early maltreatment or adversity. This is consistent with previous studies of ToM and suggests that future research should focus on alternative aetiological mechanisms (e.g., emotion socialization). Findings suggest that the S-REF model of psychopathology may provide a useful framework for understanding the mechanisms of internalizing disorder in adolescent maltreated populations, which has important theoretical and clinical implications. Paper three provides an overview of the theoretical underpinnings of the thesis, methodological strengths and weaknesses of each paper and the implications of the findings for theory and clinical practice.

Declaration

No portion of the work referred to in this thesis has been submitted in support of an application for another degree or qualification of this or any other university or other institute of learning.

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Dedication

This thesis is dedicated to David George Kay.

I'm so glad to have made you proud funny little man.

Paper 1

Do measures of executive functioning in infancy and preschool predict internalizing problems: A systematic review.

Catherine Kay, Jonathan Green and Adrian Wells

University of Manchester, UK.

Abstract

We describe a systematic review of studies that test longitudinal associations between executive function (EF) measured during preschool with subsequent internalizing psychopathology. We explore prospective associations and determine which dimensions of EF are most predictive of symptoms. Fourteen studies (n = 3428) administered a performance measure of EF at ≤ 5 years in longitudinal multi-panel designs. Overall, poorer performance on EF measures was associated with increased risk for internalizing problems, particularly anxiety. Response inhibition tasks (e.g., the day/night task) most consistently demonstrated significant associations. However, direction of effect varied as a function of child temperament and parenting experiences. Higher levels of response inhibition were associated with increased risk for psychopathology in children with temperamental vulnerability and experience of overcontrolling parenting. The ability to flexibly shift attention was protective in similar contexts. The reviewed evidence indicates that measures of EF in early childhood could indicate risk for internalizing problems. Response inhibition and attention shifting may provide a target for early intervention. We discuss the theoretical and clinical implications of these findings within the context of psychological models of emotional disorder. Future research should select, assess and report on specific EF components in relation to outcomes.

Keywords: Executive Function, Preschool, Infancy, Internalizing, Psychopathology

Introduction

We aimed to conduct a systematic review of studies testing longitudinal associations between executive function (EF) measured in infancy and preschool with subsequent internalizing psychopathology. EF's are a group of higher order cognitive processes that enable adaptive goal-directed behaviour and overriding of automatic responses (Garon, Bryson & Smith, 2008; Hughes, 2011). The increased availability of valid and reliable methods of assessment of EF for infant and preschool age children has enabled important insights into the emergence, development and correlates of EF in very early childhood. Evidence suggests that EF represents a unitary construct with partially dissociable components including sustained attention, working memory, the ability to inhibit a pre-potent response (response inhibition), planning and attention shifting (Garon et al., 2008). EF is thought to play a crucial role in the regulation of behaviour and is positively associated with academic attainment (e.g., Allan, Hume, Allan, Farrington, & Lonigan, 2014). Deficits in EF are implicated in a range of externalizing psychopathology, including anti-social behaviour and Attention Deficit Hyperactivity Disorder (Hughes & Ensor, 2008; Moffitt et al., 2011; Pennington & Ozonoff, 1996). Less is understood regarding the role of EF in internalizing disorder (e.g., depression and anxiety). Theory regarding the cognitive mechanisms and maintenance of internalizing psychopathology in adults indicates a key role for the flexible regulation of attention (Wells & Matthews, 1996). Studies that assess EF in early childhood may shed light on the developmental mechanisms of internalizing psychopathology and the predictive significance of EF. We first discuss evidence concerning the development and structure of EF before considering theories and evidence suggesting a role of EF in internalizing psychopathology that inform the aims of the systematic review.

Development of executive function in infancy and preschool

EF is linked to the prefrontal cortex, which undergoes several growth spurts within the first 3 years of life (Romine & Reynolds, 2005). EF development appears to fit within a cascading pathway model, whereby emergent skills are reliant on the mastery of simpler abilities (Cummings, Davies, & Campbell, 2000).

Attention and memory. Sustained attention is one of the earliest emerging components of EF, serving as a backdrop for the development of more complex skills. Orientation is influenced by external factors in infancy and becomes increasingly voluntary throughout preschool. The ability to modulate attention according to task demands develops at around 42 months (Ruff & Lawson, 1990). The ability to hold a representation in mind (working memory) develops before 6 months, whilst increasing working memory capacity and complexity of function develop during the preschool years (Garon et al., 2008).

Response inhibition. The ability to inhibit a prepotent response/behaviour (e.g., to wait for a treat) has been extensively studied in early childhood. A wide range of measures suitable for young children are available, which are broadly grouped into two categories: those that require minimal working memory demands, labelled simple response inhibition (SRI), and those that test the ability to hold in mind and exert a rule over behaviour - complex response inhibition (CRI) (Garon et al., 2008). Factor analysis of response inhibition measures and neuroimaging data during childhood support this distinction (e.g., Carlson & Moses, 2001). The simplest forms of response inhibition - stopping an enjoyable behaviour at the request of a caregiver - develops in the first year (Kochanska, Murray, & Harlan, 2000). Children can inhibit a response during delay paradigms (e.g., snack delay or delay of gratification) for extended periods of time by age 3 (Carlson, 2005; Kochanska et al., 2000). Children can pass CRI tasks such as the

day/night task (child is required to say ‘night’ when shown a picture of a sun) from 24 months, whilst the third year is characterized by rapid gains with pass rates rising from 51% to 76% across the third year (Carlson, 2005).

Attention shifting. The ability to ‘shift’ from one mental set (rule) to another requires the focusing of attention on relevant stimuli, holding a mental set in mind and overcoming conflict to shift to a new mental set (Garon et al., 2008). Infants as young as 12 months old can shift from one set to another but perseverative errors are common until age 5 years, with marked improvement at age 4. It has been suggested that 3-year-olds may lack the ability to implement higher order multiple “if and if-then” rules (Kloo & Perner, 2005), sufficient working memory capacity (Munakata, 2001) or attentional skills (Kirkham & Diamond, 2003) that may result in difficulty overcoming the conflict posed by shifting tasks (Garon et al., 2008).

Planning. The ability to plan to solve a problem is thought to be sub-served by several domains of EF including response inhibition, working memory and attention, and reflect function of the frontal lobes (Shallice, 1982). The Tower of Hanoi task (Simon, 1975) is frequently used to assess planning ability in children (Bishop, Aamodt-Leeper, Creswell, McGurk, & Skuse, 2001; Byrnes & Spitz, 1979; Welsh, 1991). To solve the problem, the participant must generate a sequence of moves, monitor effectiveness of moves and flexibly revise the sequence as necessary (Humes, Welsh, Retzlaff, & Cookson, 1997). Three-year-old children often demonstrate perseverative errors and fail to self-correct. Simple planning skills are demonstrated by 4-year-olds, and 6-year-olds can solve puzzles involving more moves (Welsh, 1991).

In summary, the development of EF is marked by continued refinement of acquired skills along with integration and coordination of multiple functions.

Toddlerhood appears to be a particularly critical period for the development of EF

skills, with emergent individual differences subsequently appearing stable over time (Garon et al., 2008).

Association of executive function with psychopathology

Deficits in EF are associated with poor control and regulation of behavior, are implicated in externalizing disorder in adults (Morgan & Lilienfeld, 2000) and in children and adolescents (Pennington & Ozonoff, 1996). A meta-analysis of studies examining EF in preschool children with externalizing behavior problems found an overall medium effect of EF and response inhibition with smaller effects for working memory and cognitive flexibility. Effects were stronger for older children and clinic samples (Schoemaker, Mulder, Deković, & Matthys, 2013). Fewer studies have examined the role of EF in internalizing disorder despite a strong theoretical rationale for links.

The self-regulatory executive function model (S-REF: Wells & Matthews, 1996) of psychological disorder was developed as a model of generalized anxiety disorder and has subsequently been applied to depression (Wells, 2008), PTSD (Wells & Sembi, 2004) and OCD (Solem, Myers, Fisher, Vogel, & Wells, 2010). Executive control is said to play a central role in the development and maintenance of psychological disorder (Wells & Matthews, 1994.). Thought that is characterized by perseverative conceptual processing (worry or rumination), an attentional focus on threat and maladaptive coping behaviors such as avoidance and thought suppression is transdiagnostic (Wells, 2008). This activity is labelled the Cognitive-Attentional Syndrome, which leads to extended negative emotional experience and difficulty with regulation of thoughts and emotions (Wells, 2008). In support of this, the ability to shift attention from negative thoughts and focus on neutral or positive thoughts is associated with lower levels of anger, anxiety and depression (Derryberry & Rothbart, 1988; Derryberry & Reed, 2002; Silk,

Steinberg, & Morris, 2003). Similarly, shifting attention away from negative stimuli is associated with decreased distress in children as young as 6 months old (Crockenberg, Leerkes, & BÁrrig JÓ, 2008; Johnson, Posner, & Rothbart, 1991) and orienting toward negative stimuli is associated with increased distress (Crockenberg et al., 2008; Kiel & Buss, 2010).

However, many studies fail to report deficits in response inhibition, attention shifting and working memory in children and adolescents with depressive disorders (Vilgis, Silk, & Vance, 2015). This is contrary to findings from adult clinical populations where EF deficits and biases are common (Wagner, Muller, Helmreich, Huss, & Tadic, 2015). In a systematic review, Vilgis et al. (2015) cite several methodological problems including small sample sizes, inconsistent use of medication, differing inclusion criteria, comorbidities and heterogeneous assessment methods for EF (Vilgis et al., 2015). In a non-clinical early school age sample greater parent report and observed inhibitory control was associated with fewer internalizing problems (Eisenberg et al., 2001). Riggs, Blair and Greenberg, (2003) found that early school age sequencing performance, which requires ordering, recalling and reconstructing information to achieve a goal, predicted declines in internalizing problems.

Does executive function mediate or moderate risk for psychopathology?

Effortful control is a construct emerging from theories of temperament and personality development (Rothbart & Bates, 2006). Individual differences in emotionality, sociability and activity (Derryberry & Rothbart, 1988) have been associated with functional adaptation and psychopathology (Svihra & Katzman, 2004). Effortful control is described as a regulatory system consisting of the ability to inhibit a pre-potent response (response inhibition) and to focus and shift attention (components of EF) that is thought to modulate the effects of temperamental vulnerability (Rothbart

& Bates, 2006). For example, a large body of evidence links behavioral inhibition to subsequent internalizing problems, particularly anxiety (Svihra & Katzman, 2004). Behaviorally inhibited children show greater physiological arousal in novel situations including increases in salivary cortisol, heart rate and muscle tension that may indicate lower thresholds for limbic and hypothalamic activation (Kagan, Reznick, & Snidman, 1987). It is hypothesized that children who are behaviorally inhibited and have poor effortful control are more vulnerable to psychopathology, whilst higher levels of effortful control will provide a buffering effect. Until recently, much of the research in this area has used parent report measures of effortful control and focused on relationships with externalizing psychopathology (Eiden, Colder, Edwards, & Leonard, 2009; Kochanska, Barry, Aksan, & Boldt, 2008; Kochanska, Kim, & Boldt, 2013; Rydell, Berlin, & Bohlin, 2003). Increased availability of behavioral measures of EF that are suitable for use in preschool aged children has enabled renewed study of components of effortful control in relation to other forms of psychopathology (e.g., White et al., 2011).

There is also a growing body of evidence showing that environmental factors are associated with variance in performance on measures of executive function. Experience of early institutional care has been associated with poor performance on a range of executive function measures (Colvert et al., 2008; Bos, Fox, Zeanah & Nelson, 2009). Parenting behavior such as scaffolding (Lowe, Erickson, MacLean, Duvall, Ohls & Duncan, 2014), sensitive responding (Sulik, Blair, Mills-Koonce, Berry & Greenberg, 2015) and maternal support for autonomy (Bernier, Carlson & Whipple, 2010) have been associated with better performance on executive function measures in children. Bindman and colleagues (2015) found that maternal support for autonomy during the first 3 years of life was associated with enhanced response inhibition, delay of

gratification and sustained attention prior to school entry as well as subsequent academic achievement in high school. Executive function mediated this association (Bindman, Pomerantz & Roisman, 2015). It is possible that executive function may mediate associations between early experience and subsequent internalizing problems.

Aims of the review

Research on the mechanisms of psychopathology has tended to focus on adulthood. In order to understand the developmental mechanisms of psychopathology, there is a need to bridge developmental and clinical psychology via the merger of theoretical constructs, aims and methods (Frick, 2004; Rutter & Sroufe, 2000). There are clear links between theories of temperament and the role of effortful control (Rothbart & Bates, 2006) with adult models of psychopathology, such as the S-REF model (Wells & Matthews, 1996). Both propose a central role of attention regulation in the development and maintenance of psychopathology. Furthermore, there is overlap in the methods used to assess EF and effortful control. Study of the role of early EF in the emergence of internalizing psychopathology may therefore provide a bridge between developmental and clinical models of emotional disorder.

Cross-sectional study of the relationship between EF and internalizing problems limits inference regarding the direction of effects. The use of parent report measures of EF – common in the temperament literature – may introduce common reporter biases and there are questions regarding the validity of such measures as an assessment of cognitive process (Allan et al., 2014). Review of studies that use objective behavioral measures of EF will facilitate bridging of the developmental and clinical literature – with comparable measures available across childhood, adolescence and adulthood. This further facilitates inference regarding the developmental continuity and change in EF and its correlates. Studies that have assessed EF in clinical populations during

childhood are limited by the heterogenous nature of these samples (Vilgis et al., 2015), which impacts on the generalizability of findings and conclusions concerning direction of effects.

Considering these factors, we aim to systematically review studies that assess EF using performance measures during infancy and preschool in typically developing samples, and report on association with subsequently administered measures of internalizing symptoms. A focus on EF assessed prior to school age will facilitate conclusions on the very early effects of EF, prior to engagement in formal education. We review the literature with the following questions in mind: i) does executive function measured during preschool (≤ 5 years) predict internalizing problems? ii) Which aspects of EF show robust association with internalizing problems? iii) Is there evidence that EF mediates or moderates risk for psychopathology?

Method

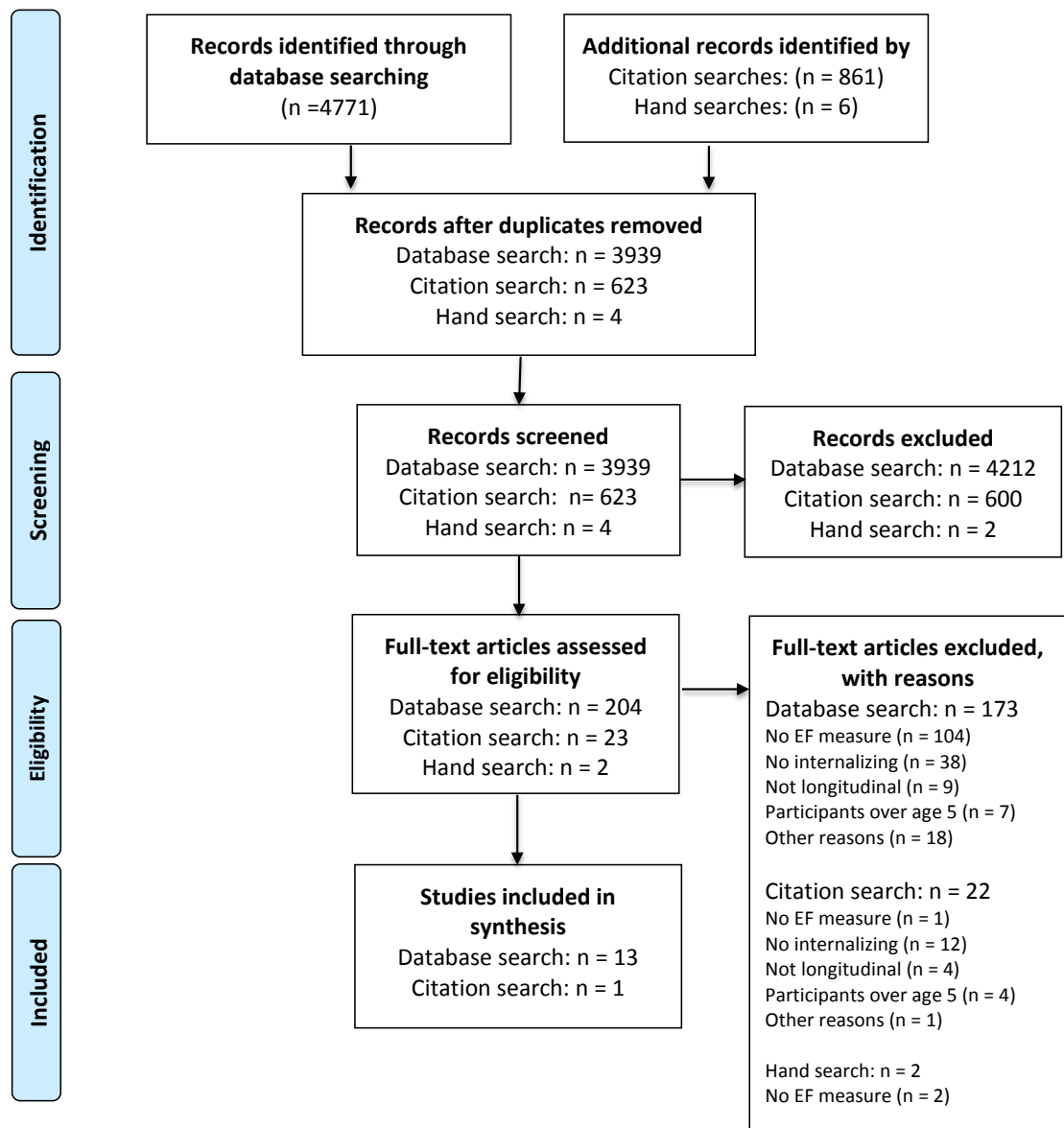
Search strategy

PsycINFO, MEDLINE and Embase were systematically searched using the following keywords: (“*executive function*” or “working memory” or “*short term memory*” or planning or “response inhibition” or “inhibitory control” or “*set shifting*” or “set shift*” or “*task switching*” or “task switch*” or neuropsychologic* or *attention* or “*cognitive control*” or “executive dysfunction” or *self-control* or “*delay of gratification*” or “effortful control” or *self-regulation* or “cognitive flexibility” or “attention control” or *temperament* or BRIEF-P or inhibition) AND (“*psychosocial development*” or “*child psychiatry*” or “*psychiatric symptoms*” or “*adjustment disorders*” or “*mental health*” or *psychopathology* or “*child psychopathology*” or “emotional disorder” or “*emotional disturbances*” or “*mental disorders*” or “*affective disorders*” or “affective symptoms” or *internalization* or internalisation or internalizing or internalising or worry or *rumination* or mood or “*major depression*” or *depression* or dysthymia or “*dysthymic disorder*” or “unipolar depression” or depressive or *anxiety* or “*separation anxiety disorder*” or “*anxiety disorders*” or “*social anxiety*” or “*social phobia*” or “*generalized anxiety disorder*” or “generalised anxiety”). MeSH terms used in PsycINFO are indicated using italics. See Appendix 1 for a list of terms used in each database. In all databases the search was limited to English language records between 1990 and 21 Dec 2017 reporting human populations in the age groups of infancy (1 to 23 months) and preschool (24 months to 5 years [6 years on Embase]).

Database searches yielded 4771 records. Following removal of duplicates, 3939 records were screened using the inclusion and exclusion criteria outlined below (Figure 1). To ensure that studies reporting on follow-up of samples were identified, search of articles that cited studies included in the review was conducted using Scopus. This

identified 623 novel records that were screened using an identical procedure (Figure 1). Results are presented in line with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement (Moher, Liberati, Tetzlaff, & Altman, 2009). The review was registered on PROSPERO (reference: CRD42018086822).

Figure 1: Selection flow chart



Inclusion and exclusion criteria

The following inclusion criteria were applied to the search results:

1. Studies include performance measure(s) of EF administered at a mean age of ≤ 5 years old.
2. A measure of internalizing psychopathology (anxiety, depression, rumination, emotional disorder) is administered at a subsequent time-point.
3. Association between EF and internalizing is reported.

Performance measures of EF were defined as standardized experimental paradigms that assess performance in a core domain of executive function including attention, working memory, response inhibition, attention shifting and planning (Garon et al., 2008).

Studies reporting association between a composite measure of EF that incorporated a self-report measure only were not included ($n = 2$). A minimum length of time between administration of EF and internalizing measures was not specified due to a lack of evidence to guide a-priori hypotheses.

To maximize the generalizability of findings to a typically developing population and allow for the temporal association between early EF and internalizing problems to be explored the following exclusion criteria were applied:

1. Studies reporting on atypical population groups only.
2. Participants were involved in an intervention trial.

All records were screened by the first author and 1000 records were additionally screened by an independent reviewer. The independent reviewer holds a BSc in Psychology and was an Assistant Clinical Psychologist. The kappa coefficient was used to measure agreement between reviewers. There was 99.8% agreement ($k = .67, n = , p < .000$). There were 2 occasions of disagreement, which were resolved by discussion. Following the screening process, 14 studies were included in the final sample (Figure 1).

Quality assessment

The Quality Assessment Tool for Studies of Diverse Designs (Sirriyeh, Lawton, Gardner, & Armitage, 2012) was used to rate the quality of included papers. Studies were not excluded from the review based on quality assessment. The assessment indicates the congruency, consistency, and transparency of the study. The assessment includes 16 items that are scored on a 4-point Likert scale, of which 14 are relevant to quantitative designs and were used in the current review. These include mention of theoretical framework; statement of aims; description of research setting; adequacy of sample size; description of sample characteristics; description of data collection procedures; rationale for choice of measures; recruitment data; statistical assessment of reliability and validity of measures; fit of methodology and analysis to research question; justification of analytic strategy; evidence of user involvement in design and discussion of strengths and limitations. Scores ranged from 0 to 42, with scores over 30 indicating very good methodological robustness (see Appendix 2 for an example of a completed quality assessment).

Quantitative synthesis

Correlation and regression coefficients were extracted as measures of the magnitude of association between EF and subsequent internalizing. Comparison statistics (e.g., t-tests and analyses of variance) and their effect sizes are also reported where relevant.

Results

Sample characteristics

Fourteen studies reported on thirteen unique samples. Eisenberg, Spinrad and Eggum, (2010) report a follow-up of the sample ($n = 256$) described in Spinrad et al. (2007). The studies included 3428 participants in total. Sample characteristics are presented in Table 1.

Age of samples. Three studies measured EF in infancy, up to 23 months (Brooker et al., 2014; Eisenberg et al., 2010; Spinrad et al., 2007). Two studies first assessed EF between 2 and 3 years (Murray & Kochanska, 2002; Roman et al., 2016). The remainder assessed EF between 3 and 5 years old (Table 1). Six studies assessed EF at more than one timepoint (Table 1). Follow-up was conducted between 17 months and 15 years old. All but one study (Hilt, Armstrong, & Essex, 2012) conducted follow-up at ≤ 8 years old. The number of assessment points ranged from two to four (Table 1).

Sample selection. Most papers reported on prospective longitudinal studies of typically developing children recruited from the general population (Table 1). One study included a sample of children who were domestically adopted within the US before 3 months old (Brooker et al., 2014) and another on children residing in Turkish institutional care (Selcuk, Yavuz, Etel, Harma, & Ruffman, 2018). Roman et al. (2016) sampled mothers and children from deprived areas of the UK and support groups for young mothers. Ezpeleta, Granero, de la Osa, and Domènech (2017) selected 622 high and low scorers on the Strengths and Difficulties Questionnaire (SDQ) measure of emotional and behavioral problems, from a sample of 1341 children to perform growth mixture modelling of psychopathology. Thorell, Bohlin and Rydell (2004) selected 151

children consisting high, low and intermediate scorers on a measure of inhibition to the unfamiliar from 705 children. White et al. (2011) selected 156 from 779 infants to reflect the range of reactivity to auditory and visual stimuli assessed at 4 months. All studies excluded children with developmental and physical disabilities.

Location of studies. Eight studies were conducted in the US, two in the UK, one in Sweden, Spain and Turkey, respectively (Table 1). Ethnicity was not reported in two studies (Selcuk et al., 2018; Thorell et al., 2004). All other samples consisted of more than 70% White participants (range 72% - 97%). The percentage of female participants ranged from 20% to 58%, with a mean of 45% (SD = 9). Seven studies reported a mixed profile of socioeconomic status (SES), including participants of low, middle and high SES. Three included predominantly middle SES participants and two included low SES participants. Two did not provide SES information (Table 1).

Use of EF and internalizing measures. EF measures have been categorized and coded herein according to the theoretical framework provided in Garon et al. (2008). EF constructs and internalizing measures used in each study are listed in Table 1. Table 2 provides further detail of EF measures used across studies. Three studies (n = 1320) report on measures of attention; three (n = 562) on simple response inhibition (SRI); four (n = 910) on complex response inhibition (CRI); one on attention shifting (n = 152) and planning (n = 247). Four studies (n = 1093) report on composite variables of multiple EF components (Table 1). Seven studies report association between EF and anxiety measures: two with depression and five with an internalizing composite measure (e.g., including symptoms of anxiety and depression) (Table 1).

Quality scores

Quality scores range from 24 to 33 (Table 3) out of a possible 42 (M = 30.2 SD = 2.8). This indicates that studies were of moderate to very good quality. The main

quality issues relating to each study are described in Table 1 and further expanded in Table 3.

Table 1: Study characteristics

Authors and reference number	Sample characteristics	Design characteristics	EF constructs measured	Internalizing measure (informant)	Statistical analysis	Quality assessment issues related to this review
Murray & Kochanska (2002)	N = 103 50% female SES = 2 Predominantly White US sample.	Assessment points = 3 Baseline <i>M</i> 32.86 months (<i>SD</i> 4.09 months) FU1 <i>M</i> 46.01 months (<i>SD</i> 2.62) FU2 <i>M</i> 65.89 months EF measures repeated at each time point. Internalizing measure administered at FU 2 only	CRI SRI Composite from 32-month assessment based on factor analysis.	CBCL internalizing scale (Parent report)	Between subjects MANOVA ANOVA Post-hoc Tukey's	Does not include a measure of adaptive functioning. Does not report direct association between EF and internalizing scale score. Does not control for baseline levels of internalizing.
Thorell et al. (2004)	N = 151 50% female Swedish sample Purposive sampling for range of scores on inhibition to the unfamiliar questionnaire; 20% high, 20% low and 60% intermediate scorers selected from larger sample (n = 705).	Assessment points = 2 Baseline <i>M</i> 5 years 3 months (<i>SD</i> 1.12 months). FU1 at <i>M</i> 8 years (<i>SD</i> 2 months). EF measures administered at baseline only.	CRI	Social anxiety scale constructed for this study. (Parent report)	Bivariate correlation Hierarchical regression EXACON analysis.	Group n's become small in EXACON analysis. Limited justification for cut-off used in formation of subgroups. Covariates not controlled in EXACON analysis
Spinrad et al. (2007)	N = 256, 45% female SES = 4 81% White US sample	Assessment points = 2 Baseline <i>M</i> age = 17.8 months (<i>SD</i> 0.52 months) FU1 <i>M</i> 29.8 months (<i>SD</i> 0.65 months)	SRI	Infant/toddler social and emotional assessment (Briggs-Gowan, Carter, Irwin, Wachtel & Cicchetti, 2004) Separation distress scale. (Parent report)	Bivariate correlation.	EF measure was combined with parent report measure of EF for subsequent analysis that is not discussed in this review.

	Inclusion: Healthy, full term and adult parents recruited at birth. Follow-up of this sample reported in Eisenberg et al, 2010 also included in this review.	EF measure administered at both timepoints				Covariates not controlled in analysis.
Eisenberg et al. (2010)	N = 256 45% female SES = 4 81% White US sample Inclusion: Healthy, full term and adult parents recruited at birth.	Assessment points = 2 Baseline M 17.8 months (SD 0.52 months) FU1 M 29.8 months (SD 0.65 months) FU2 M 41.75 months (SD 0.65 months) EF measure administered at all timepoints.	SRI	Infant/toddler social and emotional assessment (Briggs-Gowan et al, 2004) Separation distress scale. (Parent report)	Bivariate correlation. EF measure was combined with parent report measure of EF for subsequent analysis that is not discussed in this review.	EF measure was combined with parent report measure of EF for subsequent analysis that is not discussed in this review. Covariates not controlled in analysis, e.g. baseline psychopathology.
Hughes & Ensor (2011)	N = 191 43% female SES = 3 97% Caucasian UK sample.	Assessment points = 2 Baseline M 4 years 3 months (SD 5 months) FU1 M 6 years (SD 4 months) EF measures administered at both time points.	WM CRI P Latent variable used in analysis	SDQ Emotional problems scale (Teacher report)	Latent growth modelling Linear regression analysis	No mention of statistical assessment of reliability of measures.
White et al. (2011)	N = 152 58% female SES = 2 72% White US sample. Typically developing infants. 4 excluded due to low IQ (below 85)	Assessment points = 4 Baseline age 24 months (M n/r). FU1 age 48 months FU 2 age = 4 years. FU 3 age = 5 years. EF measure administered at age FU1.	CRI AS	CBCL Anxiety subscale (Parent report)	Bivariate correlation Hierarchical regression analysis	Confidence intervals not reported. Concurrent EF not measured. Baseline psychopathology not measured.

	Screened for positive and negative affect and reactivity to visual and auditory stimuli and then selected to represent the full range of reactivity.					
Hilt et al. (2012)	<p>N = 337 51% Female SES = 2 90% White US sample</p> <p>Inclusion: mothers over 18 years old during 2nd trimester of pregnancy with study child, living with the child's father and working for pay or a full-time homemaker.</p>	<p>Assessment points = 3</p> <p>Baseline age 4.5 years (M n/r), FU1 = 13 years FU 2 = 15 years</p> <p>EF administered at baseline only.</p>	A	<p>Rumination on Sadness Scale (Conway, Csank, Holm & Blake, 2000). Mean score on brooding items (Self-report)</p>	<p>Bivariate correlation Hierarchical regression analysis.</p>	<p>Baseline psychopathology not measured.</p> <p>EF not measured at follow-up.</p> <p>Analysis of association between EF and depression performed but not reported.</p>
Moran et al. (2013)	<p>N = 306 50% female SES = 4 74% White US sample.</p> <p>Children with developmental disabilities and families where English was not the first language were excluded. Required female primary caregiver to participate. Recruited to be representative of the demographic of the area.</p>	<p>Assessment points = 2</p> <p>Baseline M 36.75 months (SD 1.31 months) FU1 M 45.94 months (SD 1.57)</p> <p>EF administered at both time points.</p>	<p>A SRI CRI</p> <p>EF composite and CRI variables used in analysis.</p>	<p>CBCL Sum of anxiety and depression scales. (Parent report)</p>	<p>Bivariate correlation Hierarchical regression analysis.</p>	<p>Analysis carried out on skewed data (internalizing).</p> <p>Limited variance in internalizing measure used in longitudinal analysis.</p> <p>Relatively short follow-up.</p>

Brooker et al. (2014)	N = 361 45% female SES = 4 71.7% White (birth mother). US sample Sample of adopted children, their adoptive parents and birth parents. Domestic adoptions within US, adopted within 3 months of birth, no known medical conditions in child, parental ability to read English at 8 th grade level.	Assessment points = 3 Baseline <i>M</i> 8.81 months (SD 0.96). FU1 <i>M</i> 17.82 months (SD 1.59). FU2 <i>M</i> 27.20 months (SD 1.31). EF administered at baseline only.	A	CBCL Internalizing scale (Parent report)	Bivariate correlation Hierarchical regression analysis testing interactions between birth parent anxiety, adoptive parent anxiety, EF and child internalizing.	Not all points are referenced in the introduction Did not discuss alternative analysis approaches, e.g. path analysis Confidence intervals not reported
Bufferd et al. (2014)	N = 541 46% female SES = 4 95% White US sample. Inclusion: at least one biological parent required to take part, no significant developmental disorders of medical conditions.	Assessment points = 2 Baseline <i>M</i> 3.6 years (SD 0.3 months) FU1 <i>M</i> 6.1 years (SD 0.4 months) EF measure administered at baseline only	SRI CRI Composite variable based on factor analysis.	PAPA (Parent report) Depression diagnosis at age 6 (binary).	Logistic regression with FU1 depression as DV.	More description of scoring and variables used in analysis required, e.g. low inhibitory control. EF not assessed at follow-up.
Nozadi et al. (2015)	N = 199 44% female SES = 4 85.9% White US sample Children with developmental delay excluded.	Assessment points = 3 Baseline <i>M</i> 53.89 months (SD .80 months) FU1 <i>M</i> 78.16 (SD 1.49 months) FU2 <i>M</i> 84.86 (SD 2.80 months) EF measure administered at FU1.	P	Child Symptom Inventory (Sprafkin, Gadow, Salisbury, Schneider & Loney, 2010). General anxiety symptom severity score. (Parent report)	Bivariate correlation Path analysis testing mediation of maternal depression on child general anxiety by EF.	No mention of statistical power calculation

Roman et al. (2016)	N = 143 39% female SES = 3 95% White UK sample. Children aged 24-36 months in family where English is first language. Recruited from deprived areas and support groups for young mothers.	Assessment points = 3 Baseline at 24 months (M n/r) FU1 at 36 months (M n/r) FU2 at 6 years (M n/r) EF measures completed at all timepoints. Internalizing measure completed at FU 2 only.	WM CRI P AS Composite variable based on factor analysis.	SDQ Internalizing composite (Teacher report)	Autoregressive longitudinal mediation model	No baseline measure of internalizing.
Ezpeleta et al. (2017)	N = 622 50% female SES = 4 95.5% White Spanish sample Selected based on high and low SDQ score from larger sample (n = 1341).	Assessment points = 4 Baseline at 4 years (M n/r). FU1 at 5 years (M n/r). FU2 at 6 years (M n/r). FU3 at 7 years (M n/r). EF measures administered at baseline only.	A	CBCL Anxiety subscale (Parent report)	Growth mixture modelling, Logistic regression and general linear models	Sample sizes small in subgroup analysis Number of problems not controlled in analysis of group difference
Selcuk et al. (2018)	N = 66 20% female SES = n/r ethnicity = n/r Turkish sample Children recruited from Turkish institutional care. Children with developmental delay were excluded.	Assessment points = 2 Baseline M = 57.82 months (SD 9.20 months). FU 1 M 69.58 months (SD 5.45 months) EF administered at both timepoints.	CRI	PIPPS Disconnection subscale (Experimenter observation) SCBE Anxiety-withdrawal scale. (Caregiver report) Composite score used in analysis.	Bivariate correlation Path analysis	Small sample size

Demographics/general abbreviations: SES = socioeconomic status; EF = executive function; nr = not reported. Executive Function constructs: SRI = simple response inhibition; CRI = complex response inhibition; WM = working memory; P = planning; AS = attention shifting; A = attention; P = planning. Measures: CBCL = Child

Behavior Checklist (Achenbach & Edelbrock, 1983); SDQ = Strengths and Difficulties Questionnaire (Goodman, Ford, Simmons, Gatward & Meltzer, 2000); TBAQ = Toddler Behavior Assessment Questionnaire (Goldsmith, 1996); PAPA = Preschool Age Psychiatric Assessment (Egger & Angold, 2004). CBQ = Child Behavior Questionnaire (Rothbart, Ahadi, Hershey & Fisher, 2001); PIPPS = Penn Interactive Peer Play Scale (Fantuzzo et al, 1995); SCBE = Social Competence and Behavior Evaluation (LaFreniere & Dumas, 1996).

Table 2: Executive function measures

EF Category	Measure(s)	Description	Study
Attention	Rolling Wheel (subtest in LabTab ¹).	Children instructed to focus on a metal wheel rolling back and forth whilst the experimenter sat quietly for 2 minutes. DV = observed percentage of time child attends to object.	Hilt et al. (2012)
	Toy behind the barricade (LabTab ¹)	Child is shown an attractive toy with which they can play. Once engaged with the toy the experimenter placed it out of the child's reach whilst remaining visible for 30 seconds (frustration trial). The experimenter allowed the child to play with the toy 30 seconds (neutral trial). DV = mean of standardized ratings of toy engagement on neutral trials.	Brooker et al. (2014)
Working Memory	Continuous Performance Test ²	Children required to listen to a set of words and respond only when they hear a target word.	Moran et al. (2013) Ezpeleta et al. (2017)
	Beads ³	Children shown a photograph of an array of beads and asked to point to the bead/s that match those shown by the experimenter.	Hughes & Ensor (2011) Roman et al. (2016)
	Spin the pots ⁴	Objects are hidden under pots. Children must uncover each part and avoid going back to one that has already been uncovered. Pots are spun after every choice.	Roman et al. (2016)
SRI	Snack delay ⁵	Child must delay the urge to eat a treat until the experimenter rings a bell	Murray & Kochanska, (2002); Spinrad et al. (2007); Eisenberg et al. (2010); Buffred et al. (2014)
	Gift ⁵	Child is asked not to look while experimenter wraps are present. Peeking behavior is rated.	Murray & Kochanska, 2002); Moran et al. (2013)

	Dinky toys ⁵	Child is asked to decide and then tell the experimenter which toy they would like while keeping their hands on the table.	Murray & Kochanska (2002)
	Whisper ⁵	Child is asked to whisper the names of presented cartoon characters.	Murray & Kochanska (2002)
	Turtle rabbit ⁵	Child instructed to move a total figure as slowly and quickly as possible on a prescribed path.	Murray & Kochanska (2002)
	Walk-a-line ⁵	Child is asked to walk along a 12-foot line once at regular speed and twice slowly.	Murray & Kochanska (2002)
	Drawing ⁵	Child asked to trace a figure as slowly and quickly as possible.	Murray & Kochanska (2002)
CRI	Go/No Go ⁵	A stimulus is presented that encourages the participant to respond (Go). Another stimulus is associated with non-response (NoGo).	Murray & Kochanska (2002); Thorell et al. (2004)
	Baby stroop ⁴	Children are presented with a normal sized cup and spoon and a small cup and spoon. Children must name the large cup/spoon “mummy” and the small cup/spoon “baby”. In the second phase, children must use the opposite labels.	Roman et al. (2016)
	Day/Night ⁶	Children asked to say “day” for a picture of a moon and “night” for a picture of a sun.	Hughes & Ensor, (2011); White et al. (2011); Moran et al. (2013); Roman et al. (2016); Selcuk et al. (2018)
	Bear Dragon ⁵	Child must do what the bear asks and inhibit doing what the Dragon asks	Murray & Kochanska (2002); Moran et al. (2013)
	Peg tapping ⁷	Children are presented with a wooden peg and instructed to tap twice after the experimenter tapped once and tap once when the experimenter tapped twice.	Selcuk et al. (2018)

	Pinball ⁵	Child must hold a plunger connected to a sensor until the experimenter says “go!”	Murray & Kochanska (2002)
	Red-green sign ⁵	Child asked to lift their hand on the same side when the experimenter raised green sign and the opposite side when the experimenter raised a red sign.	Murray & Kochanska (2002)
	Shapes ⁵	Children are shown geometric pictures, animals, letters and numbers embedded in a larger picture and are asked to name or point to the small picture.	Murray & Kochanska (2002)
	Tower of patience ¹	Child must take turns with the experimenter to place blocks in a tower. DV = number of blocks placed by the experimenter.	Buffred et al. (2014)
	Circles ⁸	Children shown circles and squares and asked to label the shape in the opposite manner.	Moran et al. (2013)
	Heads, Toes, Knees, Shoulders (HTKS) ⁹	Children asked to follow instruction of experimenter but do the opposite of what is asked.	Moran et al. (2013)
Planning	Tower of London/Hanoi ¹⁰	Children asked to copy a goal arrangement by moving pieces one at a time.	Hughes & Ensor, (2011); Nozadi et al. (2015); Roman et al. (2016)
Attention shifting	Dimensional Change Card Sort (DCCS) ¹¹	Child is shown cards depicting colored shapes that can be sorted according to color or shape. Child must sort according to one dimension and then shift to sort according to the other dimension.	White et al. (2011); Moran et al. (2013)
	Trucks ⁴	Children must guess which of two pictures of trucks will lead to a reward. The first truck chosen by the child gives the rule in the first phase; the opposite truck gives the rule in the second phase.	Roman et al. (2016)

SRI = Simple Response Inhibition; CRI = Complex Response Inhibition

¹LabTab = Laboratory Temperament Assessment Battery (Gagne, Van Hulle, Aksan, Essex & Goldsmith, 2011); ²Conners & MHS Staff (2000); ³Thorndike, Hagen & Sattler (1986); ⁴Hughes & Ensor (2005); ⁵Kochanska, Murray, Jacques, Koenig & Vandegeest (1996); ⁶Gerstadt, Hong & Diamond (1994); ⁷Diamond & Taylor (1996); ⁸Korkman, Kirk & Kemp (1998); ⁹Ponitz et al (2008); ¹⁰Shallice (1982); ¹¹Frye, Zelazo & Palfai (1995).

Some descriptions cited from Garon et al., (2008)

Table 3: Quality analysis limitations and scores

Study authors (year)	Main limitations	Quality score	Quality band
Murray & Kochanska (2002)	Further information on sample recruitment required Further justification for analytic strategy required Does not include a measure of adaptive functioning No confidence intervals reported Does not control for baseline levels of internalizing Does not report results of all statistical analysis No mention of service user involvement	27	good
Thorell et al. (2004)	No power calculation reported Further mention of statistical assessment of reliability and validity of measures required Groups become small in EXACON analysis Limited justification for cut-off used in formation of subgroups No confidence intervals reported No mention of service user involvement	35	very good
Spinrad et al. (2007)	No mention of statistical power calculation Limited justification for selection of measures More detail of recruitment data (n approached) required Demographic factors not covaried in analysis No mention of user involvement	33	very good
Eisenberg et al. (2010)	No mention of statistical power calculation Limited justification for selection of measures Analysis not adjusted for baseline psychopathology More detail of recruitment data (n approached) required No mention of user involvement	32	very good
Hughes & Ensor (2011)	No mention of statistical power calculation Limited description of rationale for choice of measures More detail of recruitment data (n approached) required	29	good

	<p>No mention of statistical assessment of reliability or validity of measures</p> <p>No mention of service user involvement</p> <p>Further discussion of limitations required (e.g., sample size and measurement)</p>		
White et al. (2011)	<p>No mention of statistical power calculation</p> <p>Further detail of data collection procedure required</p> <p>Further mention of statistical assessment of reliability and validity of measures required</p> <p>Further justification of analytic strategy required</p> <p>No confidence intervals reported</p> <p>No mention of service user involvement</p>	29	good
Hilt et al. (2012)	<p>No mention of statistical power calculation</p> <p>Further detail of data collection procedure and rationale for selection of measures required</p> <p>More evidence of reliability and validity of measures required</p> <p>Baseline psychopathology not measured</p> <p>Follow-up EF not measured</p> <p>No confidence intervals reported</p> <p>Does not report results of all statistical analysis</p> <p>No mention of service user involvement</p>	31	very good
Moran et al. (2013)	<p>No mention of statistical power calculation</p> <p>More detail of recruitment data (n approached) required</p> <p>Short follow-up period</p> <p>Analysis carried out on skewed data (internalizing)</p> <p>Further discussion of limitations required</p> <p>No mention of user involvement</p>	32	very good
Nozadi et al. (2013)	<p>No mention of statistical power calculation</p> <p>Further information on sample recruitment required</p> <p>Further detail of data collection procedure required</p> <p>Further detail of rationale for selection of measures required</p> <p>Further description of statistical assessment of reliability and validity of measures required</p> <p>No mention of service user involvement</p> <p>Further discussion of strengths and limitations required</p>	29	good
Brooker et al. (2014)	<p>Not all points are referenced in the introduction</p> <p>Statistical power analysis referenced but not reported</p> <p>Further detail of data collection procedure required</p>	24	moderate

	<p>Further detail of rationale for selection of measures required</p> <p>Further information on sample recruitment required</p> <p>Further description of statistical assessment of reliability and validity of measures required</p> <p>Could have included measures of adaptive outcomes to test differential susceptibility hypothesis</p> <p>Did not discuss alternative analysis approaches (e.g., path analysis)</p> <p>Confidence intervals not reported</p> <p>No mention of service user involvement</p> <p>Further discussion of strengths and limitations required</p>		
Buffred et al. (2014)	<p>More discussion of theoretical framework required</p> <p>Further detail and justification of aims required</p> <p>Limited description of study setting</p> <p>No mention of statistical power calculation</p> <p>Further detail of data collection procedure and rationale for selection of measures required</p> <p>More detail of recruitment data (n approached) required</p> <p>More description of scoring and variables used in analysis required.</p> <p>No mention of user involvement</p>	27	good
Roman et al. (2016)	<p>Further detail of data collection procedure required</p> <p>Limited description of rationale for choice of measures</p> <p>Limited description of recruitment strategy</p> <p>Further mention of statistical assessment of reliability and validity of measures required</p> <p>Further justification for statistical analytic method required</p> <p>No mention of service user involvement</p>	31	very good
Ezpeleta et al. (2017)	<p>More discussion of theoretical framework required</p> <p>No statistical power calculation reported</p> <p>Further mention of statistical assessment of reliability and validity of measures required</p> <p>More detail of recruitment data (n approached) required</p> <p>Sample sizes small in subgroup analysis</p> <p>No mention of user involvement</p>	32	very good
Selcuk et al. (2018)	<p>No mention of statistical power calculation</p> <p>Small sample size</p>	31	very good

	Some further justification for selection of measures required No mention of statistical assessment of reliability or validity of measures No mention of user involvement		
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Overview of findings

EF appeared to show reliable prospective associations with internalizing problems. Eleven of the 14 studies included in this review reported a significant association between EF and internalizing problems in 10 independent samples; eight found significant main effects, six reported significant interactions and three reported a main effect and interaction. Seven studies reported main effects that were negative (Bufferd et al., 2014; Hilt et al., 2012; Hughes & Ensor, 2011; Nozadi et al., 2015; Selcuk et al., 2018; Thorell et al., 2004) - better performance on EF measures was associated with fewer internalizing problems. One study reported a positive main effect whereby better performance on EF measures were associated with higher internalizing scores (Murray & Kochanska, 2002). Three studies reported non-significant findings in two independent samples (Eisenberg et al., 2010; Moran, Lengua, & Zalewski, 2013; Spinrad et al., 2007).

The findings concerning interaction between EF and other variables were less straightforward. Two studies reported both positive and negative effects of EF on internalizing problems, with direction of effect related to temperament (Hilt et al., 2012) or the measure of EF under study (White et al., 2011). Another found both positive and negative effects in the context of a three-way interaction between genetic and environmental risk (Brooker et al., 2015). One study found a positive effect in the context of temperamental vulnerability (Thorell et al., 2004) and two found that EF

negatively mediated effects of early risk (Roman et al., 2016) and temperament (Nozadi et al., 2015) on internalizing problems.

Discussion of findings is organized around reporting of main and interaction effects in relation to EF constructs and internalizing outcomes.

Main effects

Statistics for all reported main effects of EF components on internalizing are summarised in Table 4.

Attention. Two of three studies found significant main effects using measures of focused and sustained attention. Hilt and colleagues (2012) found a significant negative effect of attention measured at 4 years using the rolling wheel task (see Table 2) on rumination at age 13 and 15 years ($r = -.11$). Ezpeleta et al (2017) found that children with a trajectory of increasing anxiety from 4 to 7 years of age coupled with callous-unemotional traits and oppositional behaviour ($n = 17$) made fewer omission errors ($d = 0.74, p < .002$) and more commission errors ($d = 0.53, p < .002$) on the kiddie continuous performance test (K-CPT; Table 2) administered at age 4 than children with callous-unemotional traits and oppositional behaviour only ($n = 54$). However, there was no significant difference in K-CPT scores between children with anxiety only ($n = 42$) and no symptoms ($n = 337$). Analyses adjusted for SES and comorbid psychopathology. Brooker et al (2014) did not find a direct correlation between attention assessed before 12 months using the toy behind the barricade task (Table 2) with an internalizing composite at 18 months.

Simple response inhibition (SRI). Three studies reporting on two samples used delay paradigms to measure SRI (e.g., the ability to wait for a treat) (see Table 2). None found a significant main effect in relation to measures of separation distress (Eisenberg

et al., 2010; Spinrad et al., 2007) or internalizing problems, before or after adjusting for gender, SES and baseline psychopathology (Moran et al., 2013).

Complex response inhibition (CRI). The day/night and similar CRI paradigms (see Table 2) involve holding a rule in mind, responding to the rule and inhibiting an overlearned response (e.g., say ‘night’ when presented with a picture of a sun) (Garon et al., 2008). Selcuk et al (2018) found a significant negative correlation between CRI measured at 58 months and socially withdrawn and anxious behaviour at 70 months ($-.31, p < .05$). This remained significant after adjusting for child age, duration of institutional care and caregiver to child ratio. Longitudinal path analysis found that higher baseline CRI predicted higher T2 CRI and lower follow-up levels of social withdrawal and anxiety ($\beta = -.15, SE = .07, p < .05, 95\% CI[-.30, -.01]$), adjusting for age, language and baseline anxiety. T2 EF significantly mediated the negative relationship between baseline EF and T2 anxiety. Bufferd et al. (2014) found higher odds of depression assessed using the Preschool Age Psychiatric Assessment (Egger & Angold, 2004) at age 6 in children with low CRI at age 3 ($OR = 1.58, p < .01, 95\% CI[1.12, 2.21]$). Low CRI remained an independent predictor of depression in multivariate analysis adjusted for other significant predictors, including baseline anxiety ($OR = 1.67, p < .01, 95\% CI[1.14-2.44]$). Children with depression at baseline ($n = 6$) were excluded from analysis.

Attention shifting. White et al. (2011) found no correlation between performance on the Dimensional Change Card Sort (See Table 2) at 48 months ((Frye, Zelazo, & Palfai, 1995) with anxiety at age 5 (.07).

Planning. Nozadi et al. (2013) reported a negative correlation between planning at age 6 years, measured using the Tower of Hanoi task, with parent reports of general anxiety at 7 years ($-.33, p < .01$).

Composite measures of EF. Three of four studies using composite measures of EF reported a significant main effect (Hughes & Ensor, 2011; Murray & Kochanska, 2002; Roman et al., 2016). Hughes and Ensor (2011) found that more rapid improvement in EF between 4 and 6 years, based on a latent growth model, was related to fewer teacher reported emotional symptoms at age 6 ($-.33, p < .01$). Analysis adjusted for concurrent EF and language. EF performance was based on latent variable analysis of measures of CRI, WM and planning administered at age 4 years and 6 years. Roman et al. (2016) tested whether scores on an EF composite derived from factor analysis (Hughes & Ensor, 2008) was associated with child internalizing problems at age 6 years in an autoregressive mediation model. Poorer EF at age three predicted more internalizing problems at age 6 ($\beta = -.32, p < .01$). However, EF at age 2 did not predict internalizing problems at age 6. Internalizing was only assessed at age 6 so baseline levels of internalizing were not covaried in analysis.

Murray and Kochanska (2002) reported a direct positive effect of EF on internalizing problems – high scores on EF measures were associated with higher scores on the internalizing subscale of the CBCL. A range of EF measures were administered to 103 children at 33, 46, and 66 months, including tests of SRI, CRI and RS (see Table 2). Parents completed the CBCL at 66 months. After identifying a non-linear association between EF and total problems on the CBCL (consisting externalizing and internalizing problems) the sample were divided in to high, medium and low EF scorers. A between subjects MANOVA found that EF group was a significant predictor of internalizing problems ($F(3, 96) = 2.87, p < .01$). An ANOVA with internalizing scale as dependent and EF as between subject IV was significant ($F(1, 98) = 3.28, p < .05$). Post-hoc Tukey's showed that high EF scorers showed more internalizing ($X = 0.18, SD = 1.2$) than moderate scorers ($X = -.044, SD = 0.5$).

One study failed to find an association between a composite EF variable derived from subscales of the NEPSY measuring CRI and AS (Moran et al., 2013). There was no direct association between EF and internalizing before or after adjusting for gender, SES and baseline levels of internalizing.

Interaction effects

Attention. Hilt et al. (2012) reported significant interactions between attention (assessed via attention to a rolling wheel – see Table 2), over-controlling parenting and child negative affect. There was no association between child negative affect and rumination in adolescence when attention was high at age 4 ($\beta = -.02$, $t(333) = -.44$, *ns.*). There was a significant positive association between negative affect and rumination when age four attention was low ($\beta = .10$, $t(333) = 2.30$, $p < .05$); children with high negative affect and poor attention showed the highest levels of adolescent rumination. Furthermore, over-controlling parenting was associated with increased risk for rumination when age four attention was high ($\beta = .17$, $t(333) = 3.71$, $p < .001$) but not low ($\beta = .02$, $t(333) = .54$, *ns.*).

Table 4: Summary statistics for main effects of EF components on internalizing

EF component	Study	Statistics
Attention	Hilt et al. (2012)	$r = -.11$
	Brooker et al. (2014)	<i>ns</i>
	Ezpeleta et al. (2017)	$[d] = 0.74$, $p < .002^1$
		$[d] = 0.53$, $p < .002^2$
SRI	Spinrad et al. (2007)	<i>ns</i>
	Eisenberg et al. (2010)	<i>ns</i>
	Moran et al. (2013)	<i>ns</i>
CRI	Selcuk et al. (2018)	$-.31$, $p < .05$
		$\beta = -.15$, $SE = .07$, 95% CI $[-.30, -.01]$, $p < .005^3$
	Buffred et al. (2014)	$OR = 1.67$, 95% CI $[1.14, 2.44]$, $p < .01$
	White et al. (2011)	<i>ns</i>
	Thorell et al. (2004)	<i>ns</i>
Attention shifting	White et al. (2011)	<i>ns</i>

Planning	Nozadi et al. (2015)	$-.33, p < .01$
EF Composites	Moran et al. (2013)	<i>ns</i>
	Hughes & Ensor (2011)	$-.33, p < .01$
	Roman et al. (2016)	$\beta = -.32, p < .01$
	Murray & Kochanska (2002)	$X = 0.18, SD = 1.2^4$
		$X = -.044, SD = 0.55$
	$F(1, 98) = 3.28, p < .056$	

¹Effect size based on general linear models testing group comparison in K-CPT omission scores

²Effect size based on general linear models testing group comparison in K-CPT commission scores

³ Statistics from longitudinal path analysis testing association between CRI and internalizing, adjusted for age, language and baseline anxiety. ⁴Statistics from Tukey's post-hoc test for children high in EF

⁵Statistics from Tukey's post-hoc test for children low in EF. ⁶Statistics from one-way ANOVA with internalizing as DV and EF score group as between-participants variable.

Brooker et al. (2014) found a significant three-way-interaction between birth parent anxiety, adoptive parent anxiety and attention in the prediction of child internalizing problems. Attention assessed using the Toy Behind the Barricade Task (Table 2) was unrelated to internalizing problems when birth parents reported low ($B = .66, SE = .42, \beta = .17, p > .10$) or mean ($\beta = -.13, SE = .29, \beta = -.04, p > .10$) levels of anxiety. There was a significant interaction between birth parent anxiety symptoms and attention at low ($B = -.09, SE = .03, \beta = -.22, p < .01$), but not at mean ($B = -.03, SE = .02, \beta = -.08, p > .10$), or high ($B = .02, SE = .03, \beta = .06, p > .10$) levels of adoptive parent anxiety symptoms. When birth parents reported high anxiety, children raised by adoptive parents with low anxiety who also had higher attention experienced fewer internalizing problems at 18 months ($\beta = -.93, SE = .40, \beta = -.24, p < .05$). The same relationship was observed for internalizing symptoms measured at 27 months. When 18 month internalizing was controlled in this model, the three-way-interaction was no longer significant, suggesting that the model did not extend to the prediction of change in internalizing from 18 to 27 months.

Complex response inhibition (CRI). Thorell et al. (2004) failed to find a significant main effect or interaction between inhibition to the unfamiliar (IU; a tendency to avoid novelty) with CRI in the prediction of social anxiety using hierarchical regression analysis. However, exploration of nonlinear relationships using EXACON analysis (Bergman, 1998) identified nine different profiles of CRI and IU in relation to hyperactivity and social anxiety. Children with medium levels of both CRI and IU were significantly less likely to have high levels of social anxiety. Children with both high CRI and high IU were more than five times more likely ($OR = 8.54$) to have social anxiety ($\chi^2 = 6.22, p < .01$). Children with low CRI and low IU were less likely to have social anxiety ($OR = 0.00, \chi^2 = 2.80, p < .05$). This analysis did not covary for baseline social anxiety. Similarly, White et al. (2011) did not find a main effect of 48 month CRI on age 6 anxiety, but found that high CRI coupled with high behavioral inhibition measured at 24 months predicted higher levels of anxiety at age 6 ($\beta = .49, t(125) = 3.69, p < .001$), adjusting for gender and IQ. Again, internalizing was not measured at age 24 or 48 months, nor was EF measured at age 6.

Attention shifting. White et al. (2011) also found that high levels of 24 month behavioral inhibition were related to age six anxiety only when children performed poorly on the Dimensional Change Card Sort (Table 2) measure of attention shifting ($\beta = .40, t(129) = 3.26, p < .01$). Behavioral inhibition was not associated with anxiety when children had good attention shifting performance ($\beta = .08, t(129) = 0.71, p = .48$). Baseline internalizing and age 6 attention shifting were not assessed.

Planning. In addition to a significant negative main effect, Nozadi et al. (2013) found an indirect effect of dispositional fear measured at 54 months on follow-up anxiety through planning measured using the Tower of Hanoi (Table 2; .16, 95% CI

[.04, .37]), adjusting for baseline anxiety. Planning accounted for 69% of the effect of dispositional fear on later anxiety.

Executive function composites. Roman et al. (2016) used an autoregressive longitudinal mediation model to test whether EF composite scores (see Table 1 for a list of EF constructs and Table 2 for corresponding measures) mediated the relationship between maternal depression at 24 months and child internalizing problems at 6 years. They found a marginally significant indirect effect of EF on the relationship between maternal depression and internalizing problems at age 3 ($\beta_{\text{ind}} = .06, p = .059, 95\% \text{ CI} [-0.00, 0.13]$). Maternal depression was associated with poorer EF at age 3, which was related to increased child internalizing problems at age 6. The findings were not accounted for by the effects of language or socioeconomic deprivation but baseline internalizing was not measured and the 95% confidence interval for β crosses 0. Moran et al. (2013) failed to find an interaction between EF and negative emotionality (indexed by parent reported fear and frustration at 37 months) in the prediction of internalizing.

Executive function and type of internalizing outcome

Anxiety. Seven studies report association between EF and anxiety (Table 1) in a total sample of 1494 children. Selcuk et al. (2018) found a significant negative association between CRI and social withdrawal/anxiety. Thorell et al. (2004) and White et al. (2011) found that high levels of temperamental inhibition and high CRI were associated with symptoms of social (Thorell et al., 2014) and general anxiety (White et al., 2011). Nozadi et al. (2013) find a negative association between planning and parent reports of general anxiety at age 6 and a significant indirect effect of dispositional fear on anxiety through planning.

Depression. Two studies ($n = 878$) reported significant positive association between attention (Hilt et al., 2012) and CRI (Bufferd et al., 2014) with depression.

Hilt et al. (2012) also reported a significant interaction between parental control, child temperament and attention in the prediction of adolescent rumination.

Internalizing composite measures. Five studies ($n = 1104$) report mixed findings on association with composite measures of internalizing (Table 1). Four use composite measures of EF (Table 1). Three report significant main effects: two negative (Hughes & Ensor, 2011; Roman et al., 2016) and one positive (Murray & Kochanska, 2002). Brooker et al. (2014) reported a significant interaction between parental anxiety and attention in the prediction of internalizing problems. Moran et al. (2013) failed to find any association.

Age at EF assessment

Eight studies reported on measures of EF assessed in children between ages 3 and 5 years old (Table 1). All but one of these found significant associations between EF and internalizing problems, with six reporting overall main effects that are negative (Table 4). One study reported a positive interaction between EF and temperament in the prediction of anxiety (Thorell et al., 2004). Two studies assessed EF in children between 2 and 3 years old using a range of measures across multiple time-points (Murray & Kochanska, 2002; Roman et al., 2016). One reported a significant negative association between EF and internalizing (Roman et al., 2016), whilst the other found a positive association (Murray & Kochanska, 2002). Three studies used measures of EF during infancy (Table 1). Two failed to report effects using delay measures (Eisenberg et al., 2010; Spinrad et al., 2007) and one reported a significant three-way-interaction (Brooker et al., 2014).

Discussion

We systematically reviewed the evidence for a relationship between executive function (EF) skills assessed using performance measures prior to age six (≤ 5 years) with subsequently measured internalizing psychopathology to test for prospective associations and determine which dimensions of EF are most predictive of symptoms. Searches identified 14 studies that include 3428 typically developing children in prospective longitudinal and multi-panel designs. Eight of these report significant main effects of EF in predicting internalizing problems. Six report significant interactions between EF and other factors, including three that failed to find a main effect. Only three studies failed to find any significant association (Eisenberg et al., 2010; Moran et al., 2013; Spinrad et al., 2007). Most significant main effects find that poorer EF abilities are associated with higher rates of a range of internalizing problems. However, there was some inconsistency here, both in the direction of main effects and interactions. Discussion of these findings may shed light on the direction and mechanism of association between EF and internalizing.

Are executive function components associated with internalizing psychopathology?

Attention. Two of the three studies that used measures of sustained attention found significant main effects of on internalizing symptoms (Ezpeleta et al., 2017; Hilt et al., 2012). Brooker et al. (2014) failed to find a main effect but reported a significant three-way-interaction between birth and adoptive parent anxiety and child sustained attention in the prediction of internalizing problems. When birth parent anxiety was high and adoptive parent anxiety was low, the ability to sustain attention in children predicted fewer internalizing problems. This was seen to support the differential susceptibility model of gene-environment interaction whereby genetic factors result in increased vulnerability to environmental influence - to both positive and detrimental

effect (Belsky & Pluess, 2009). When genetic risk (birth parent anxiety) was high and environmental risk (adoptive parent anxiety) was low, better sustained attention predicted fewer internalizing problems. Hilt et al. (2012) found that children with higher sustained attention and experience of over-controlling parenting reported more rumination in adolescence. Children with high negative affect and poor attention also showed high levels of adolescent rumination. These studies suggest that a tendency to sustain attention interacts with genetic and environmental risk to modulate outcomes, both positively and negatively.

Simple response inhibition (SRI). All studies that measured SRI failed to find either significant main effects or interactions in the prediction of internalizing problems (Eisenberg et al., 2010; Moran et al., 2013; Spinrad et al., 2007). These studies all used delay paradigms. Two rated observed level of restraint during a snack delay task at 18 months in the same sample (Eisenberg et al., 2010; Spinrad et al., 2007). Moran et al. (2013) rated peeking (frequency, degree, latency to peek) and observed difficulties (fidgeting, tensing, facial expressions) during a gift delay paradigm at 37 months. The findings may be incomparable to those that use latency as an indicator of delay ability. Delay paradigms are thought to differ from tasks that require the slowing of motor activity and CRI tasks through the involvement of a motivating reward. They may therefore tap less voluntary aspects of control, for example, impulsivity or a “hot” system of EF, which involves emotional processing (Garon et al., 2008). Findings here suggest that performance on delay tasks do not predict internalizing psychopathology.

Complex response inhibition (CRI). CRI tasks were more consistently associated with internalizing psychopathology in the reviewed studies. Four studies used measures of CRI and all found a significant association with internalizing problems. Two found significant main effects that were negative (Buffred et al., 2014;

Selcuk et al., 2018). The remaining two failed to report a main effect but reported significant interactions with child temperament (Thorell et al., 2004; White et al., 2011). Children showing more evidence of behavioral inhibition coupled with high scores on CRI measures had higher levels of internalizing psychopathology. These studies both purposively sampled for variation in temperamental characteristics (positive and negative affect and inhibition to the unfamiliar). It is possible that the sampling method contributed to the lack of main effects of EF on anxiety. Taken together, the reviewed evidence suggests that CRI tasks provide a measure of cognitive function that is salient in the prediction of internalizing problems.

Attention shifting. Only one study reported independent association between a measure of attention shifting and internalizing outcomes (White et al., 2011). There was no main effect on anxiety but children who were high in behavioral inhibition scored higher on measures of anxiety when they also had poor attention shifting ability. There was no association of behavioral inhibition with anxiety when attention shifting ability was good - indicating that the ability to flexibly shift attention may buffer against anxiety in these children (White et al., 2011). Children who are temperamentally vulnerable and unable to flexibly shift their attention may be more likely to experience psychopathology. The theoretical implications of this finding will be discussed further below.

Planning. Again, only one study reported independent association between planning measured using the Tower of Hanoi task and anxiety (Nozadi et al., 2013). Planning ability was negatively associated with anxiety and mediated the relationship between behavioral inhibition and anxiety.

Composites measures of EF. Four studies used composite measures of EF. Two reported significant negative main effects (Hughes & Ensor, 2011; Roman et al.,

2016) and one reported a positive effect (Murray & Kochanska, 2002). Murray and Kochanska (2002) tested the hypothesis that poor performance on EF measures would be associated with externalizing problems, whilst comparatively high scores would be associated with internalizing problems. To test this, they split the sample in to high, medium and low EF scorers. High EF scorers had higher scores on the internalizing subscale of the CBCL than those with moderate scores. Given the previously discussed evidence of a moderating role of EF, it is possible that dividing the sample according to the EF scores resulted in confounding effects by an unmeasured variable such as temperament. One study failed to report an association between a composite measure of EF with change in internalizing scores on the CBCL over a 9 month follow-up (Moran et al., 2013). CBCL scores were positively skewed at both time points and moderately to highly stable. This may have impacted on the analysis of prediction of change.

Depression. Only two studies included in this review tested association between EF and depression (Hilt et al., 2012; Buffred et al., 2014). It is striking that higher levels of sustained attention measured in the preschool years was associated with increased rumination in adolescence. Unfortunately, the analysis failed to control for concurrent CRI ability or baseline psychopathology (Hilt et al., 2012). It is arguable that rumination represents a cognitive vulnerability for depression, rather than a form of internalizing psychopathology. However, the authors focused on the brooding component of rumination, which is most strongly associated with psychopathology (Verstraeten, Bijttebier, Vasey, & Raes, 2011). Moreover, the association of EF with rumination is of interest given the proposed theoretical link between executive control and the ability to disengage with ruminative processes (Wells & Matthews, 1996) supported by the study findings (Hilt et al., 2012). The available evidence precludes

firm conclusions but suggests that further study of associations between preschool EF with the emergence of depression and related cognitive processes is warranted.

Anxiety. Seven studies examined association of EF (attention, SRI, CRI and attention shifting) with measures of anxiety. Direction of significant main effects were negative (Selcuk et al., 2018; Ezpeleta et al., 2017; Nozadi et al., 2013). Direction of interaction effects varied dependent upon the aspect of EF under study (CRI vs. attention shifting) and temperamental characteristics (Thorell et al., 2004; White et al., 2011). Two studies that used measures of SRI failed to find association with separation distress in a single sample (Eisenberg et al., 2010; Spinrad et al., 2007). The available evidence suggests that there may be an overall negative association between EF measured in preschool with subsequent anxiety that is moderated by temperamental characteristics. It should be noted that four studies (Eisenberg et al., 2010; Spinrad et al., 2007; Thorell et al., 2004; White et al., 2011) did not covary for other forms of psychopathology.

Internalizing composites. Five studies used composite measures of internalizing and three report significant main effects: two negative (Hughes & Ensor, 2011; Roman et al., 2016) and one positive (Murray & Kochanska, 2002). One study failed to find a significant association between SRI or a composite measure of EF and internalizing (Moran et al., 2013). Brooker et al. (2014) reported a significant negative association of EF with internalizing within a three-way-interaction. These studies all use valid standardized measures of internalizing symptoms. However, the use of composite measures limits inference regarding relationships between EF and distinct aspects of internalizing psychopathology (e.g., anxiety and depression).

Does age at assessment of executive function effect the findings?

There is variation in measures used across age groups. Most studies assessed EF in children between 3 and 5 years old (Table 1) and report on a range of EF components, including attention, SRI, CRI, AS, planning and composite measures. There are rapid gains in CRI performance during the third year (Carlson, 2005). CRI was measured at 4 years or older in three of four studies (Selcuck et al., 2018; Thorell et al., 2004; White et al., 2011) and at 3.6 years in one (Buffred et al., 2014). CRI ability may have been relatively established at assessment in the reported studies. Only one study reported on attention shifting (White et al., 2011) and planning (Nozadi et al., 2013), both assessed during the fourth year. The results of these studies may therefore be limited in generalizability to children of this age. Hughes and Ensor (2011) found that more rapid development in EF in children between 4 and 6 years old was associated with fewer internalizing problems. They do not report on direct association between EF measured at age four and internalizing but the effect of gains in EF was independent of concurrent abilities. They suggest that growth in performance across the transition to school is more salient for the prediction of outcomes than current performance and hypothesize that this may be mediated by an effect on self-esteem, although this is not measured.

Does EF moderate or mediate the effect of risk on internalizing psychopathology?

Several studies included in this review suggest that associations between individual differences in child temperament and environmental risk with internalizing problems are both mediated and moderated by EF (Hilt et al., 2012; Nozadi et al., 2013; Roman et al., 2016; Thorell et al., 2014; White et al., 2011). There is also preliminary evidence that EF may moderate interactions between genetic and environmental risk (Brooker et al., 2014). Sub-components of EF may play distinct roles in this

relationship; EF can be both protective and detrimental but these effects appear to be context specific and dependent upon the component of EF under study. These effects underscore the importance of hypothesis driven assessment and reporting of EF subcomponents as well as association with specific risk factors and developmental outcomes.

Findings here have theoretical significance. For some children, it appears that high levels of executive control (CRI and sustained attention) are associated with internalizing disorder. Overall, the findings may be at least partially compatible with the Self-Regulatory Executive Function (S-REF) model of psychological disorder (Wells & Matthews, 1996), which emphasizes the central role of executive control of attention via the selection of stimuli for further processing. In psychological disorder, this occurs as perseverative processing of self-relevant information (e.g., rumination) that is difficult to control (Wells, 2005; 2008). As such, greater flexibility in regulation of attention to internal events will reduce such processing (Wells, 2005). An implication is that flexibility will be protective against psychopathology because the individual will be better able to disengage from unhelpful cognitive processes. The reported negative associations between EF and internalizing disorder are consistent with this theory.

However, that higher levels of executive control are positively associated with internalizing for some children appears to contradict the model. It could be hypothesized that children who exhibit high levels of response inhibition and are temperamentally vulnerable may be more likely to excessively control thoughts and maintain attention to threat rather than to flexibly shift their attention (Fox & Pine, 2012). Continued efforts to control thoughts (e.g., through thought suppression) can have a counterproductive effect and lead to perceived loss of mental control (Wells, 2005). Derryberry and Rothbart (1997) suggested that children who are

temperamentally fearful or inhibited with high effortful control may attempt to control fear by gathering information about threatening stimuli (i.e. threat monitoring). Thus, high levels of CRI may compound risk in temperamentally vulnerable children by facilitating cognitive and behavioral features associated with anxiety and depression (Derryberry & Rothbart, 1997; Rothbart & Bates, 2006). Furthermore, greater ability to flexibly shift attention appears protective in similar contexts (White et al., 2011). Thus, both findings could be considered as consistent with the predictions of the S-REF model. However, replication and further testing of these hypotheses is required.

Strengths and limitations of reviewed studies

Findings of the reviewed studies should be considered in the context of the strengths and limitations identified during quality analysis (Table 2). Most studies were of moderately high methodological quality. All use longitudinal multi-panel designs. Several are designed such that robust tests of mediation and moderation were possible. These features support inference on the direction of effects of EF on internalizing problems. However, almost half of the studies fail to covary baseline internalizing and concurrent EF in longitudinal analysis. It is therefore not possible to assess whether baseline EF reflects concurrent symptom severity, which may confound analysis of association with internalizing. This may be a difficult limitation to overcome for studies that measure EF in infancy and very early childhood, where careful selection of age-appropriate measures would be required. Some studies failed to control for variation in language and other factors that may impact on EF performance and internalizing (e.g., gender). All studies used standardized performance measures of EF, which was therefore objective: the potential for confounding with reporting of internalizing symptoms was limited. Several authors used latent class analyses on multiple EF measures to reduce measurement effects. Most studies also used multi-informant

measures of EF and internalizing, which reduces the potential for common-rater effects to impact on findings. No studies reported independent associations between tests of working memory and EF, which leaves an important gap in the literature given that working memory represents one of the earliest emerging components of EF and is significantly correlated with performance on more complex tasks. The samples are mostly limited to White populations, which limits generalizability.

Strengths and limitations of this review

The generalizability of findings is limited to the age range of the included samples and only one study measured internalizing outcomes beyond middle childhood. Relationships between EF and internalizing problems may differ across development. This should be explored in longitudinal designs with assessment of EF at multiple time-points across childhood and adolescence. Assessments of EF and internalizing outcomes used were heterogeneous. Three studies used measures of CRI and anxiety but two reported non-significant direct effects. Given that the direction of reported associations varied by EF construct, meta-analysis of findings was considered inappropriate at this stage. Future research should report independent association of key EF constructs with outcomes to reliably characterize specific associations. A broad definition of internalizing psychopathology was adopted in the identification of relevant studies. This reflects the age of the samples under study and the inclusion of non-clinical typically developing populations, where there may be limited variance in standard measures of internalizing problems. Grey literature and studies in languages other than English were excluded from the review, which may result in publication bias (Hopewell, Clarke, & Mallett, 2006).

Clinical implications

That sub-components of EF measured early in childhood, including sustained attention, the inhibition of pre-potent responses and attention shifting were predictive of subsequent internalizing problems has important implications for clinical practice. The findings point to a role of the regulation of attention in the development of internalizing psychopathology. They are also consistent with recent studies (Murray, Scott, Connolly, & Wells, 2018; Murray, Theakston, & Wells, 2016) showing that increasing attention flexibility in 5- and 6-year-old children was associated with the ability to delay gratification during the marshmallow task (Mischel & Ebbesen, 1970), which is associated with a range of favourable long-term outcomes (Mischel, Shoda, & Peake, 1988). The S-REF model provides the basis for meta-cognitive therapy (MCT) (Wells, 2008). A recent meta-analysis showed that MCT is an effective treatment for anxiety and depression with effects that might be greater than the current gold-standard treatment – cognitive behavioral therapy (Normann, van Emmerik, & Morina, 2014). There is a recent move to consider the application of the S-REF model and MCT to childhood psychopathology (Ellis & Hudson, 2010; Simons, Schneider, & Herpertz-Dahlmann, 2006). The findings of this review provide further support for this work.

Conclusions and future directions

The reviewed evidence suggests that poorer EF abilities measured in infancy and preschool are associated with increased risk for subsequent internalizing problems. These effects appear most reliably for anxiety with fewer studies having investigated links with depression. Further, EF may moderate relationships between individual differences in child temperament and environmental risk with later internalizing problems. The direction of association between EF and internalizing varies as a function of these factors as well as the EF component under study. EF may also mediate

relationships between early risk and internalizing. The reviewed evidence suggests research aiming to explore the role of early EF in the development of psychopathology should consider selecting, assessing and reporting on EF components in a hypothesis driven manner and in relation to specific outcomes. Several of the studies included in this review report on composite measures of EF or internalizing. Given that the direction of effects could vary according to EF component and other factors, we hypothesize similar specificity in relation to outcome variables (e.g., anxiety, depression and externalizing problems). There are tantalizing implications for theory and practice here. We suggest that consideration of the S-REF model of emotional disorder may inform future research on the role of attention regulation in childhood to the development and maintenance of psychopathology.

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Paper 2

Meta-cognitive beliefs, theory of mind and psychopathology in maltreated adolescents

Catherine Kay, Jonathan Green and Adrian Wells

University of Manchester

Abstract

Meta-cognitive beliefs (MCB) - implicit and explicit beliefs about cognition - have been associated with psychopathology in adults and adolescents and are a key component of the Self-Regulatory Executive Function (S-REF) model of psychopathology (Wells & Matthews, 1996). We aimed to test the independent contribution of MCB over and above theory of mind (ToM) to psychopathology in a high-risk adolescent sample. We assessed MCB in 41 adopted adolescents participating in a longitudinal study. ToM was assessed during middle childhood and parents reported on child psychopathology during middle childhood and again in adolescence. We found no association between MCB and ToM. MCB were positively correlated with psychopathology but ToM was not. Adolescent reports of dysfunctional MCB were significantly positively associated with parent reported internalizing psychopathology independent of ToM, demographics and language. There was no linear association between MCB, ToM and extent of early maltreatment or adversity. This is consistent with previous studies of ToM and suggests that future research should focus on alternative aetiological mechanisms. Findings suggest that the S-REF model of psychopathology may provide a useful framework for understanding the mechanisms of internalizing disorder in adolescent maltreated populations. The theoretical and clinical implications are discussed.

Introduction

Whilst understanding of the cognitive mechanisms of psychopathology in adult populations has improved, there remains a dearth of similar evidence in the context of on-going development during childhood and adolescence. A recent move to consider the relevance of models of adult psychopathology to child and adolescent populations may inform more effective intervention approaches (Weisz et al., 2017). In the adult field progress has been made by basing treatments on theoretical models that capture maintenance processes. A leading example is the self-regulatory executive function model (S-REF) (Wells & Matthews, 1996) that provides the basis for meta-cognitive therapy (Wells, 2008). A recent meta-analysis showed that meta-cognitive therapy is an effective treatment for anxiety and depression and may be more effective than CBT (Normann, van Emmerik, & Morina, 2014). In this model meta-cognitive beliefs (MCB) - implicit and explicit beliefs about cognition - are considered central factors leading to psychopathology. However, in the field of developmental psychopathology meta-cognition in the form of theory of mind (ToM) is implicated (Cotter et al., 2018). These two forms of meta-cognition have not been studied together in relation to psychopathology. The aim of this paper is to explore inter-association between meta-cognitive constructs and test the independent associations of MCB and ToM with psychopathology in a high-risk adolescent sample.

Meta-cognition

The term meta-cognition refers to “any knowledge or cognitive activity that takes as its object, or regulates, any aspect of any cognitive activity.” (Flavell, 2004, p.275). This includes beliefs, processes and strategies used to interpret, monitor or control cognition (Flavell, 1971). Early study of childhood meta-cognition focused on meta-memory – knowledge and use of memory strategies, but subsequently included

cognition concerning language, attention and problem solving (Flavell, 2004). The focus of developmental research shifted to the understanding of other minds - ToM based on the false-belief paradigm (Wimmer & Perner, 1983). A substantial body of research has subsequently been concerned with normative and non-normative development, antecedents, correlates and consequences of ToM. Work with adult populations has continued to study the nature and importance of meta-cognition in relation to the self. This has informed understanding of the role of MCB in the development and maintenance of psychopathology (Wells, 1999). We first discuss the significance of MCB and ToM to child and adolescent psychopathology before considering interrelationships and factors that may influence meta-cognition, including language and the environment.

Meta-cognitive beliefs and psychopathology

MCB have been extensively studied in relation to adult psychopathology (Wells, 2008). The S-REF model (Wells & Matthews, 1996) of psychological disorder was first developed as a model of generalized anxiety disorder (GAD) but has subsequently been applied to depression (Wells, 2008), post-traumatic stress disorder (PTSD) (Wells & Sembi, 2004), psychosis (Morrison, French, & Wells, 2007), eating disorders (Cooper, Todd, & Wells, 2009) and obsessive-compulsive disorder (OCD) (Solem, Myers, Fisher, Vogel, & Wells, 2010; Wells & Matthews, 1994). According to the model, psychological disorder is associated with a style of thinking characterized by perseverative conceptual processing in the form of worry or rumination, an attentional focus on threat and maladaptive coping behaviors, such as avoidance, reassurance seeking and thought suppression (Wells, 2008). This processing is referred to as the Cognitive-Attentional Syndrome (CAS), which once engaged, leads to extended

negative emotional experience as well as difficulty with regulation of thoughts and emotions (Wells, 2008).

MCB and executive control abilities play a central role in activation and maintenance of the CAS (Wells, 2008; Wells & Matthews, 1994., 1996). Positive MCB about the advantages of using CAS strategies to deal with threat (e.g., “If I worry I’ll be able to cope”) lead to CAS activation. Negative MCB concerning the uncontrollability of cognition lead to prolonged negative thinking – processing remains uninterrupted because it is perceived as unstoppable. Furthermore, beliefs concerning the danger of thoughts (e.g., “worry could make me go crazy.”) lead to an increased sense of threat and behavioral avoidance, reassurance seeking or thought suppression - attempts not to think about a certain thought by diverting attention to something else (Wells & Davies, 1994). Thought suppression can have the unwanted effect of increasing suppressed thoughts (Clark, Winton, & Thynn, 1993; Wegner, Schneider, Carter, & White, 1987). Avoidance and reassurance seeking both prevent discovery of the benign nature of thoughts and emotions. Moreover, continued attention to threat results in an increased sense of danger, increasing the cognitive capability and opportunity for threat detection (Wells, 2008).

MCB have been measured using the meta-cognitions questionnaire (MCQ) (Cartwright-Hatton & Wells, 1997) and studied in relation to a range of psychological disorders and symptoms in both cross-sectional and prospective designs with adult populations (Myers & Wells, 2005; Roussis & Wells, 2006; Sica, Steketee, Ghisi, Chiri, & Franceschini, 2007; Spada & Wells, 2005; Yılmaz, Gençöz, & Wells, 2011). A recent meta-analysis of 41 studies reported higher prevalence of dysfunctional MCB in adults with psychiatric disorder compared to non-clinical controls (Sun, Zhu, & So, 2017). Largest effect sizes were observed for beliefs about the uncontrollability and danger of

thoughts (1.59). Dysfunctional MCB were observed trans-diagnostically but negative beliefs were particularly important, showing large effects across disorders (Sun et al., 2017). Similarly, the Thought Control Questionnaire (TCQ) was developed to measure strategies used in the control of thoughts (e.g., suppression, distraction and worry). The scales of the TCQ, particularly the use of worry and punishment, are positively correlated with measures of psychopathology (Coles & Heimberg, 2005; Morrison & Wells, 2000; Wells & Davies, 1994).

More recently, the MCQ and TCQ have been adapted and validated for use with adolescent populations. The meta-cognitions questionnaire – adolescent version (MCQ-A) (Cartwright-Hatton et al., 2004) has identified medium to large effects of MCB on psychopathology, suggesting similar relationships to those observed in adults (Myers, 2012). The use of worry and punishment as thought control strategies (TCS) identified via the thought control questionnaire for adolescents (TCQ-A) is also positively correlated with emotional symptoms (Gill, Papageorgiou, Gaskell, & Wells, 2013). Overall, there is convincing evidence that MCB, particularly beliefs concerning the uncontrollability and danger of thoughts and TCS characterized by worry and punishment are associated with a range of psychopathology in adults. Similar evidence is emerging from adolescent samples, although most studies to date have included low-risk non-clinical groups (Myers, 2012). No studies have explored the association between MCB and externalizing problems, (e.g., anti-social and aggressive behavior). It is possible to hypothesize that associations will be strongest with emotional disorder and are especially likely to involve uncontrollability and danger beliefs.

The association between theory of mind and psychopathology

ToM has been studied in relation to a range of psychopathology in both adult and child populations, including psychosis (Frith, 1992), internalizing (Banerjee &

Henderson, 2001) and externalizing disorders (Happé & Frith, 1996; Hughes & Ensor, 2008). Conceptualization of the role of ToM in psychopathology is based on deficit models: a deficit in ToM leads to impairment in mind-reading ability that is associated with social and emotional difficulties (Baron-Cohen, Leslie, & Frith, 1985; Frith, 1992; Happé & Frith, 1996). A ToM deficit has most consistently been observed in relation to autistic spectrum conditions (Baron-Cohen et al., 1985; Happé, 1994) with some arguing that ToM deficits underlie the characteristic impairments in social and communicative functioning (Hughes & Leekam, 2004).

A recent systematic review of 31 meta-analytic studies found overall significant deficits in performance on ToM tasks across a range of clinical groups, including psychiatric, neurological and developmental disorders in adult and child populations (Cotter et al., 2018). Effects were largest for neurological disorders but also large in samples with attention deficit hyperactivity disorder (-.45), autism (-.81), first episode psychosis (-1.00), schizophrenia (-.96), bipolar disorder (-.63) and depression (-.58). Only one meta-analysis examined ToM in OCD (-.30) based on two studies (Plana et al., 2014). Despite this, effect sizes fail to reach the magnitude of those reported in relation to MCB (Sun et al., 2017). No meta-analytic reviews report on ToM in GAD, panic, social phobia, PTSD or conduct disorder were included (Cotter et al., 2018). There is some evidence that adults and children with social anxiety perform poorly on ToM tests (Banerjee & Henderson, 2001; Hezel & McNally, 2014) and in the understanding of complex emotions (O'Toole, Hougaard, & Mennin, 2013).

Interrelationships between meta-cognitive constructs and the role of language

Surprisingly, the relationship between meta-cognition relating to the self and ToM has hardly been studied. It is only in recent years that researchers have begun to explore longitudinal links between meta-cognitive knowledge and ToM in childhood.

Studies consistently report a significant positive relationship between meta-cognitive knowledge, meta-cognitive vocabulary and meta-memory with ToM (Ebert, 2015; Feurer, Sassu, Cimeli, & M. Roebbers, 2015; Lockl & Schneider, 2007). However, findings concerning the sequential development of meta-cognition and ToM are somewhat contradictory. Whilst some have suggested that ToM development predicts subsequent gains in meta-cognitive knowledge and vocabulary (Ebert, 2015; Lockl & Schneider, 2006, 2007), others find the opposite effect (Feurer et al., 2015).

A more consistent finding is the significant role of language in the development of both meta-cognitive knowledge and ToM (Astington & Jenkins, 1995; Ebert, 2015; Feurer et al., 2015). One study reported that early language ability significantly predicted ToM ability and meta-memory knowledge, with ToM mediating the relationship between language and subsequent improvements in meta-memory. Language did not fully explain the association between meta-memory and ToM, suggesting that the constructs are associated directly and through other pathways as well (Ebert, 2015). The nature of the relationships between language, meta-cognition and ToM remains unclear. No studies have explored the relationship between dysfunctional MCB implicated in the S-REF model of psychopathology and ToM, which is a further aim of the present study.

The influence of environmental adversity

Environmental adversity such as maltreatment and neglect are established risk-factors for psychopathology (Cicchetti & Toth, 1995). Meta-cognition may play a mediating role in this relationship. There is a growing body of literature on the impact of environmental factors on ToM development. Genetically informed and observational studies show that ToM development is susceptible to the quality of early social environmental as well as genetic influence (Hughes et al., 2005). The quality of early

parent-child interactions is particularly important for ToM development (e.g., maternal mental state talk (Dunn, Brown, Slomkowski, Tesla, & Youngblade, 1991). ToM deficits have been reported in young maltreated children (Cicchetti, Rogosch, Maughan, Toth, & Bruce, 2003; Pears & Fisher, 2005). Regarding MCB, similar levels of positive and negative MCB are present in children and adolescents as in adult populations so the development of dysfunctional meta-cognitions may occur early in life (Myers & Wells, 2015) and there is emerging evidence of a link with experience of abuse. Myers and Wells (2015) reported that dysfunctional MCB mediated the relationship between retrospective reports of emotional abuse and negative affect in a non-clinical sample ($n = 350$). Scarpa, Wilson, Wells, Patriquin and Tanaka, (2009) also found a positive correlation between the severity of childhood sexual abuse with worry and punishment TCS measured using the TCQ. There is therefore preliminary evidence from adult samples that adverse early experience is associated with the development of dysfunctional MCB and TCS identified in the S-REF model. Previous studies have relied on retrospective self-report of a limited range of early adverse experiences and none have explored the influence of those experiences on MCB in adolescence. An aim of the present study is to explore these associations for the first time.

Clinical and theoretical significance

Important clinical and theoretical implications arise from the reviewed evidence. The meta-cognitive model of psychopathology has informed the development of Meta-Cognitive Therapy (MCT) (Wells, 2008), which focuses on modifying MCB and TCS. A recent meta-analysis of the efficacy of MCT in the treatment of adult depression found MCT to be more effective than either waitlist control or Cognitive Behavioral Therapy (Normann et al., 2014). There is also support for the effectiveness of MCT in other forms of psychopathology (Nordahl, 2009; van der Heiden, Muris, & van der

Molen, 2012; Wells & Colbear, 2012). There is an emerging impetus to consider the relevance and potential adaptation of the meta-cognitive model and clinical application of MCT in child and adolescent psychopathology (Ellis & Hudson, 2010; Esbjørn, Normann, & Reinholdt-Dunne, 2015; Simons, Schneider, & Herpertz-Dahlmann, 2006). This work is in its infancy and key questions remain on the nature and correlates of MCB in children and adolescents. The study of these processes in adolescent populations may shed light on the conditions under which MCB are established, with implications for identification and early intervention.

Aims and hypotheses

In the present study we assess MCB, ToM and psychopathology in a sample of maltreated adolescents to test association between meta-cognitive constructs and the following hypotheses: i) adolescent reports of dysfunctional MCB and TCS will be associated with increased severity of parent reported internalizing psychopathology; ii) poorer performance on a ToM task during middle childhood will be associated with increased severity of parent reported internalizing psychopathology; iii) dysfunctional MCB will make an independent contribution to internalizing psychopathology after controlling for ToM and demographics. Finally, we will explore the association between meta-cognitive constructs, language and early adverse experience to identify factors that predict dysfunctional meta-cognition.

Method

Participants

Participants were recruited as part of a longitudinal study of outcomes in children adopted from out-of-home care in the UK (Green, Leadbitter, Kay, & Sharma, 2016; Kay, Green, & Sharma, 2016). UK adopted children represent a high-risk group with early experiences of maltreatment and pre-natal adversity prior to placement in adoptive care (Selwyn, Wijedasa & Meakings, 2014). This study includes data collected at Time 1 (T1: age 6 to 11 years) and Time 3 (T3: age 11 to 17 years). At T1 children received a £10 gift voucher for taking part. At T3, children received a £5 gift voucher. The original sample includes 59 children who were between the age of 6 and 11 years old at recruitment. Children were recruited through Adoption UK, a national membership charity for adoptive families. The study was advertised on the Adoption UK website and families volunteered to take part by contacting the research team. Exclusion criteria were parent reported i) moderate to severe learning disability, ii) poor spoken English or iii) current severe mental health problem (e.g., psychosis).

Approximately 2 years following initial recruitment (T2: range, 1 year 11 months to 3 years 7 months [$M = 25$ months, $SD = 3.6$]) families were contacted again and consent was obtained to continue to participate in the study. Fifty children participated at T2. The same procedure was followed approximately 3 years later (T3: range = 2 years 10 months - 4 years 8 months [$M = 47$ months, $SD = 5.2$]) and 42 children remained in the study. The total follow-up time from T1 to T3 ranged from 58 to 80 months ($M = 73$ months, $SD = 5$). A further six adopted children aged between 11 and 17 years old were recruited at T3 via the same method and using the same inclusion and exclusion criteria to the original sample. Three of these participants were excluded

due to missing data. The total overall sample is 62 and the total sample included at T3 is 45.

Measures

Maltreatment and care history. Data on maltreatment and care history were collected from adoptive parent report at T1, including the child's age-at-entry to care, number of placements, age at adoption, detail of known physical, sexual, emotional abuse and/or neglect. Severity ratings of parents' verbatim descriptions were made based on the coding anchors of the Maltreatment Classification System (MCS) (Barnett, Manly, & Cicchetti, 1993). The severity of the reported act of the caregiver (e.g., leaving an 8-year-old child to care for preschool age siblings), and physical outcome for the child (e.g., minor burns or treatment for malnutrition) is rated. A severity rating of 0-5 was made for descriptions of emotional maltreatment, lack of supervision, failure to provide for the child, physical and sexual abuse. One rating was given for each category reflecting the most severe episode of abuse. A score of 0 was given when there was no report of incidents or evidence relating to a maltreatment category. To control for variability in the knowledge of parents, a confidence rating of 0-3 was assigned to each rating; 0 = parent acknowledged a lack of information; 1 = poor detail in descriptions; 2 = descriptions of specific events and evidence. Ratings for each form of maltreatment were summed to produce a single maltreatment severity score ranging from 0-25. A second researcher rated all cases, blind to the scores of the first researcher and agreement was excellent ($ICC = 0.89$). Evidence of pre-natal exposure to adversity (e.g., drug or alcohol misuse during pregnancy) was rated as present or absent from adoptive parents' report of pre-care experiences. In cases in which pre-natal exposure was suspected but not confirmed pre-natal adversity was coded as present.

Psychopathology. The Strengths and Difficulties Questionnaire (SDQ) was completed by parents at T1 and T3 and is used as the primary outcome measure. Twenty-five items assess emotional and behavioral problems. Each item is rated on a scale of 0 - 2 (0 = 'Not True', 1 = 'Somewhat True' or 2 = 'Certainly True' of the child). Scores are summed and used to create five subscale scores: emotional, conduct, hyperactivity, peer problems and prosocial behavior. The emotional and peer problems subscales are summed to produce an internalizing scale score ranging from 0-20. The conduct and hyperactivity subscales are summed to create an externalizing score ranging from 0-20. Internalizing and externalizing scales are summed to create a total score that ranges from 0-40. The SDQ is widely used for screening and identification of psychopathology in health and social care settings in the UK. Subscales have good sensitivity and positive predictive value for mental health problems in children in out-of-home care (Goodman et al., 2004). Raw scores were used in analysis whilst clinical cut-offs were based on established criteria (Youth in Mind, 2016).

To explore associations using a more detailed measure of psychopathology parents also completed the Child Behavior Checklist (CBCL) at T3 (Achenbach & Edelbrock, 1983). The CBCL has been widely used in studies of children in out-of-home care (Horan et al., 1993). One-hundred and eighteen problem items are rated on a 3-point scale: 0 (not true), 1 (somewhat or sometimes true) and 2 (very true or often true). Ten empirically derived subscales include broadband internalizing and externalizing problems and eight core syndrome subscales: depression/withdrawal, anxiety, somatic complaints, aggression, rule-breaking behavior, thought problems, social problems and attention problems. The withdrawal/depression, anxiety and somatic complaints scales are summed to produce the internalizing scale whilst the aggression and rule-breaking behavior scales are summed to produce the externalizing

scale. T-scores were used to establish clinical thresholds. Raw scores were used in exploratory analysis of association between meta-cognition and psychopathology. The CBCL has high reliability (0.90) as well as good convergent and discriminant validity (Achenbach, 1991).

Meta-cognitions questionnaire – adolescent version (MCQ-A). The MCQ-A (Cartwright-Hatton et al., 2004) is a 30-item-questionnaire completed by adolescents at T3. Items measure beliefs about thinking and thinking processes. The MCQ-A was developed from the MCQ-30 (Wells & Cartwright-Hatton, 2004), which has been widely used in adult populations to identify association between dysfunctional MCB and psychopathology (Sun et al., 2017). The MCQ-A has been used to identify dysfunctional MCB in adolescent samples (Myers, 2012). Factor analysis of the MCQ-A shows it consists five sub-scales, with good internal reliability (subscale alphas range from .66 to .88) and acceptable test–retest reliability (Cartwright-Hatton et al., 2004). The positive beliefs scale assesses beliefs that worry is a useful strategy to solve problems (e.g., *“I need to worry to work well.”*). Uncontrollability and danger items measure beliefs about the danger of thoughts; *“My worrying could make me go mad.”* and ability to control worry; *“When I start worrying, I cannot stop”*. Cognitive confidence includes items such as *“I have a poor memory”*. Superstition, responsibility and punishment items include *“If I did not control a worrying thought, and then it happened, it would be my fault”*. The cognitive self-consciousness items concern attention to internal events (e.g., *“I monitor my thoughts.”*). Items are rated on a Likert scale from 1 (*‘do not agree’*) to 4 (*‘agree very much’*). Item scores are summed to produce subscale and total scores. Subscale alphas in our sample ranged from .62 (superstition) to .84 (danger and uncontrollability).

Thought control questionnaire – adolescent version (TCQ-A). The TCQ-A (Gill et al., 2013) is a thirty item self-report questionnaire adapted from the TCQ-30 (Wells & Davies, 1994) to measure individual differences in thought suppression techniques in adolescents. Five factors include items assessing the frequency of use of distraction (“*I occupy myself with jobs or work instead.*”), social control (“*I find out how my friends deal with these thoughts.*”), worry (“*I keep thinking about other worries.*”), punishment (“*I get angry at myself for having the thought.*”) and reappraisal (“*I examine the thought logically.*”). Items are rated on a four-point scale from 1 ‘never’ to 4 ‘almost always’ and are summed to create subscale and total scores. The factor structure of the TCQ-A mirrors that of the TCQ-30; it has good internal consistency (subscale alphas range from .72 to .82) and reliability, and is associated with emotional symptoms (Gill et al., 2013). Subscale alphas in this study ranged from .53 (worry) to .79 (distraction).

Theory of mind (ToM). ToM was assessed using the Strange Stories (SS) task at T1 (Happé, 1994). Six vignettes describe events that concern motivations that may lie behind everyday utterances that are not literally true (Happé, 1994, p131). Questions about the content of the story require inference concerning a character’s thoughts, desires, motivation or intentions to supply a justification for their actions (e.g., “*Why did Brian say that?*”). Six control vignettes closely matched for difficulty to the ToM stories describe events in nature, for example, weather (White, Happé, Hill, & Frith, 2009). The content of each response is rated on a standard three-point scale: higher scores are awarded for more accurate and complete responses. The test was developed to be a more contextually embedded and ecologically valid measure of ToM than traditional false belief paradigms (see Baron Cohen et al., 1985). Performance discriminates groups of children, adolescents and adults with autism spectrum

conditions (Jolliffe & Baron-Cohen, 1999; Kaland et al., 2005). Ten sets of responses (17%) for the mental state stories were scored by a second researcher and agreement was excellent ($ICC = .93, p = .000, 95\% CI [.72, .98]$).

Language. To control for language skills, children completed the recalling sentences subtest of the Clinical Evaluation of Language Fundamentals-4 (CELF-4) at T1 (Paslawski, 2005). The task assesses recall and reproduction of sentence surface structure of increasing syntactic complexity. This subtest has been widely used and correlates highly with language scores derived from multiple subtests of the CELF-4 (Conti-Ramsden & Botting, 2008). Parents reported on whether their child had a diagnosed intellectual disability.

Procedure

ToM and language were assessed during a visit to participants' homes at T1 and parents completed the SDQ online as part of a wider assessment of psychopathology. At T3 all questionnaires were either posted to participants' homes for return to the researcher, or completed on the web-based Select Survey platform. Questionnaires were completed in a telephone call with the lead author for three participants.

Ethical approval

The study was approved by the University of Manchester Research Ethics Committee (reference: 2017-0525-4256) (Appendix 4). Informed consent was obtained from all parents and adolescents prior to participation (Appendix 5-6).

Analysis

- i) Descriptive statistics were used to explore rates of adverse experience and psychopathology.
- ii) Association between MCB, TCS and ToM were explored using bivariate correlation analysis. Significant associations were tested using

hierarchical linear regression adjusted for demographics. To maximize sample size, missing T1 ToM data were replaced with scores obtained at T2 (n = 4). Data on ToM and MCB were available for 38 participants.

- iii)** The first two hypotheses that meta-cognitive variables will be associated with psychopathology were tested using bivariate correlation analysis.
- iv)** The hypothesis that MCB and TCS would make an independent contribution to psychopathology was tested using four hierarchical linear regression models. SDQ internalizing and externalizing psychopathology were entered as dependent variables. Age, gender and language were entered in step one, ToM was entered in step two and MCQ-A or TCQ-A total scores were entered in the final step. Change in R^2 associated with MCB and TCS was examined. Given the theoretical significance of danger and uncontrollability MCB, two regression models included MCQ-A danger and uncontrollability beliefs entered in the final step predicting internalizing and externalizing SDQ scores.
- v)** Relationships between meta-cognition, demographic, language and care history variables were explored using bivariate correlation analysis and t-tests for binary variables. Significant associations were tested in multivariate hierarchical regression models.

Results

Sample characteristics

Demographics. Sample characteristics are presented in Table 1. Six children (10%) were reported by parents to have an intellectual disability at T1. Five of these children (11%) participated at T3. There were no significant differences in the sample demographics between those included and not included at T3 (Table 1).

Maltreatment and care history. Seventy-four percent of the total sample (46/62) had been exposed to maltreatment and 53% (33/62) had experienced \geq two forms of maltreatment. Fifty-eight percent had experienced pre-natal adversity; 18/62 (29%) with suspected exposure, 7/62 (11%) with documented exposure and 11/62 (18%) with physical symptoms at birth. Five (8%) had no known experience of either pre- or post-natal exposure to adversity; 25/62 (40%) had both pre- and post-natal exposure; 21/62 (34%) experienced just post-natal and 11/62 (18%) had just pre-natal exposure. Mean age at entry to out-of-home care was 12.5 months ($SD = 15.5$; range = 0-60). All children entered care due to child protection concerns about actual or potential harm. Twenty-one children (34%) entered care at birth. Mean number of care placements was 2.5 ($SD = 1.8$; range = 1-10) and mean length of time spent in out-of-home care prior to adoption was 24.3 months ($SD = 22.2$). Mean age at adoption was 35.5 months ($SD = 27$). All children were adopted from foster care. Three children were adopted before 6 months and seven by 12 months.

There was a significant negative correlation between maltreatment severity scores and confidence ratings ($r = -.41, p < .01$); lower confidence ratings were associated with higher severity scores, reflecting the high rates of confidence in maltreatment information on children who were admitted to out-of-home care at birth. When age at first admission to out-of-home care is controlled, the correlation falls to $r =$

-.16 and is no longer significant. MCS severity, age at entry to care and age at adoption were all significantly positively correlated ($r = .38-.61$). There were no significant differences in MCS severity, age-at-entry to care or age at adoption between those included at T3 and those lost to follow-up (Table 1). Significantly more children in T3 had experienced pre-natal adversity ($\chi^2 = .5.68, df = 1, p = .016$).

Psychopathology. Descriptives for SDQ and CBCL subscales are presented in Table 1. All scales were normally distributed. Established clinical cut-offs for the SDQ and CBCL subscales were used to explore the nature and severity of psychopathology in the sample at T1 and T3 (Table 2). A small number of scores (range 1-6) fell within the borderline clinical range on SDQ subscales. The borderline and clinical categories were therefore collapsed. Sixty-two percent of adolescents scored at or above the borderline threshold for SDQ total problems at T3. Two-thirds of the sample (67%) scored above the borderline threshold for conduct problems, with fifteen adolescents scoring at or above the clinical threshold. Almost two-thirds of the sample (64%) were reported to have clinical levels of peer relationship problems. Similar numbers of problems were reported at T1. Continuous SDQ total and subscale scores were all significantly positively correlated between T1 and T3. A paired samples t-test showed that the peer problems scores were significantly higher at T3 ($t = -2.04, df = 39, p = .049$). McNemar tests showed that there was no difference in the number of adolescents scoring above clinical thresholds between T1 and T3. At T1, 51% ($n = 23$) of children scored above the borderline threshold on both emotional and behavioral subscales. At T3, this number was 67% ($n = 30$). The CBCL was administered at T3 and showed similar high levels of a range of psychopathology, with 58 and 63 percent of the sample scoring above the borderline clinical threshold for internalizing and externalizing problems, respectively

(Table 2). Forty-nine percent ($n = 22$) scored above the borderline threshold on both the internalizing and externalizing scale.

Table 1: Sample characteristics and descriptive statistics.

Variables	Time point		Statistics
	T1	T3	T1 < T3 ¹
Demographics	($n = 59$)	($n = 45$)	
	<i>M (SD)</i>	<i>M (SD)</i>	
Age (months)	102.40 (20.12)	175.71 (20.93)	$U = 372, ns$
	% (n)	% (n)	
Gender (male)	45.8% (27)	42% (19)	$\chi^2 = .117, df = 1, ns$
Ethnicity (White British)	83% (49)	84% (38)	$\chi^2 = .538, df = 1, ns$
SES (Higher Education)	93% (55)	93% (42)	$\chi^2 = .013, df = 1, ns$
Maltreatment and care history	($n = 62$)	($n = 45$)	
	<i>MED</i>	<i>MED</i>	
Maltreatment severity	5	5	$U = 406, ns$
Age entered care	5	5	$U = 381, ns$
Age adopted	24	24	$U = 294, ns$
	% (n)	% (n)	
Pre-natal exposure (positive)	55% (33)	58% (22)	$\chi^2 = .568, df = 1, p = .016$
MCQ-A		($n = 41$)	
		<i>M (SD)</i>	
MCQ-A Total	–	60.00 (15.38)	
Cognitive self-consciousness	–	13.90 (4.52)	
Uncontrollability and danger	–	13.24 (5.47)	
Positive beliefs	–	10.09 (3.13)	
Cognitive confidence	–	11.19 (4.27)	

Superstition, punishment and responsibility	–	11.56 (3.75)	
TCQ-A		(<i>n</i> = 40)	
TCQ-A Total	–	58.95 (10.58)	
Worry	–	10.90 (2.92)	
Social control	–	12.12 (3.74)	
Distraction	–	14.23 (3.98)	
Reappraisal	–	9.50 (10.01)	
Punishment	–	7.90 (3.41)	
ToM	(<i>n</i> = 58)		
	M (SD)		
SS Mental	3.35 (2.27)	–	
SS Physical	3.06 (1.92)	–	
SS Unlinked	3.36 (1.80)	–	
Language	(<i>n</i> = 54)		
CELF-RS	50.75 (16.78)	–	
SDQ	(<i>n</i> = 55)	(<i>n</i> = 45)	
SDQ Total	10.89 (5.67)	18.52 (9.62)	<i>U</i> = 208, <i>ns</i>
Internalizing	7.63 (5.09)	8.21 (5.33)	
Externalizing	10.89 (5.67)	9.78 (5.26)	
CBCL		(<i>n</i> = 41)	
Total	–	69.74 (43.22)	
Internalizing	–	17.86 (13.40)	
Externalizing	–	21.86 (15.02)	

¹Comparison between those included at T3 (n = 45) and those only included at T1 (n = 17). MCQ-A = Meta-cognitions Questionnaire-Adolescent, TCQ-A = Thought Control Questionnaire-Adolescent, SS = Strange Stories, CELF-RS = Clinical Evaluation of Language Fundamentals-Recalling Sentences, SDQ = Strengths and Difficulties Questionnaire, CBCL = Child Behavior Checklist.

Table 2: Number and percentages of adolescents scoring at or above the clinical threshold on psychopathology measures.

Scale	Borderline/clinical	
	T3 (n = 45)	T1 (n = 40)
	n (%)	n (%)
SDQ Total	28 (62)	25 (63)
SDQ emotional problems	24 (53)	20 (50)
SDQ conduct problems	30 (67)	27 (68)
SDQ hyperactivity	24 (53)	24 (60)
SDQ peer problems	29 (64)	22 (55)
SDQ prosocial	12 (27)	11 (28)
CBCL Total	29 (71)	
CBCL Internalizing	26 (58)	
CBCL Externalizing	26 (63)	
CBCL Withdrawn	13 (32)	
CBCL Anxious	22 (54)	
CBCL Social	26 (58)	
CBCL Attention	18 (40)	
CBCL Aggressive	21 (47)	

SDQ = Strengths and Difficulties Questionnaire; CBCL = Child Behavior Checklist

Is there a relationship between MCB, thought control strategies and ToM?

Descriptive statistics for the MCQ-A, TCQ-A and ToM are presented in Table 1. All continuous variables were normally distributed except for TCQ-A punishment beliefs, which were positively skewed with 11 children scoring the lowest possible score (*Skewness* = 1.69, *SE* = .374). A logarithmic transformation did not correct the skew, so the original variable was maintained in analysis. There was a significant positive correlation between ToM and the TCQ-A reappraisal subscale ($r = .40, p = .016$). This did not remain significant after controlling for age and gender. There were no further associations between meta-cognitive variables.

Is there an association between meta-cognition and psychopathology?

Relationships between ToM and psychopathology were non-significant (see Table 3). However, there were significant positive correlations between MCQ-A and psychopathology measured with the SDQ (Table 3). SDQ internalizing scores positively correlated with MCQ-A total scores ($r = .53, p < .01$), cognitive self-consciousness ($r = .67, p < .01$), uncontrollability and danger ($r = .33, p < .05$), positive beliefs ($r = .44, p < .01$) and cognitive confidence ($r = .51, p < .01$). SDQ externalizing problems positively correlated with MCQ-A total score ($r = .39, p < .05$), superstition, responsibility and punishment ($r = .37, p < .05$) and cognitive confidence ($r = .36, p < .05$). There were also significant positive associations between TCQ-A and measures of psychopathology (Table 3). The punishment subscale was positively correlated with SDQ total scores ($r = .33, p < .05$) and SDQ externalizing scores ($r = .32, p < .05$).

To further explore associations between meta-cognition and types of internalizing and externalizing psychopathology, bivariate correlations were run with CBCL internalizing, externalizing, depression, anxiety, somatic problems, attention, rule breaking and aggression subscales (Table 3). MCQ-A subscales, particularly

MCQ-A total scores, uncontrollability beliefs and cognitive confidence were significantly positively correlated with CBCL internalizing, depressed, anxious subscale and attention subscales (Table 3). The TCQ-A distraction subscale was negatively correlated with CBCL internalizing ($r = -.33, p < .05$) and depression subscale scores ($r = -.37, p < .05$). There was no correlation between ToM and any CBCL subscale.

Do dysfunctional meta-cognitive beliefs and thought control strategies make an independent contribution to psychopathology?

Hierarchical regression models were used to test whether MCB and ToM were independent predictors of T3 internalizing (Table 4) or externalizing (Table 5) SDQ scores. Age and CELF recalling sentences (CELF-RS) scores were entered at step 1, ToM scores were entered at step 2, and MCQ or TCQ variables were entered in the final step. CELF-RS scores were included in the models due to the significant bivariate association with MCQ-A scores (see '*what affects meta-cognition*' below).

In the first model, T3 SDQ internalizing scores were entered as the dependent variable with MCQ-A total scores entered in the final step (Table 4). The final model explained 25.8% of the variance in SDQ internalizing scores ($R^2 = .258, F = 2.226$). The addition of ToM to the model did not result in a significant change in R^2 ($R^2 = .108, R^2$ change = .034, $p = .270$) and ToM was not an independent predictor of internalizing scores. The addition of MCQ-A total score resulted in a significant increase in R^2 (R^2 change = .150, $p = .016$). MCQ-A explained an additional 15% of the variance in SDQ internalizing scores (Table 4). When SDQ externalizing scores were entered as the dependent variable, the addition of neither ToM nor MCQ-A scores resulted in significant change in R^2 ($F = 2.800, R^2 = .304, R^2$ change = .036, $p = .206$). Only gender was a significant predictor of externalizing scores because females scored lower than males (Table 4).

Table 3: Correlations between psychopathology, MCQ-A and TCQ-A scores.

	MCQ-A						TCQ-A						ToM		
	Total	CSC	SRP	UD	PB	CC	Total	Dis	SC	W	P	RA	SSM	SSP	SSUL
SDQ T3 Total	.508**	.187	.386*	.401**	.403**	.484**	.126	-.163	.203	.091	.325*	-.012	-.147	-.173	-.301
SDQ T3 Internalizing	.525**	.672**	.209	.331*	.436**	.513**	.075	-.182	.203	.060	.264	-.059	-.124	-.213	-.262
SDQ T3 Externalizing	.392*	.128	.369*	.288	.306	.360*	.155	-.110	.162	.105	.323*	.040	-.124	-.213	-.284
CBCL Internalizing	.670**	.287	.533**	.633**	.394*	.621**	.048	-.330*	.049	.044	.409*	.036	-.118	-.146	-.113
CBCL Externalizing	.384*	.200	.389*	.348*	.217	.267	.064	-.248	.069	.033	.186	.237	-.052	-.174	-.197
CBCL Depressed	.486**	.168	.395*	.419**	.280	.539**	-.068	-.373*	-.005	-.120	.289	.058	-.069	-.077	-.176
CBCL Anxious	.639**	.215	.487**	.624**	.454**	.588**	.103	-.244	.039	.101	.462*	.001	-.159	-.193	-.166
CBCL Somatic	.539**	.351*	.381*	.558**	.172	.456**	.069	-.333*	.133	.111	.311	.080	-.019	-.202	-.030
CBCL Attention	.473**	.149	.438**	.434**	.327*	.419**	.114	-.198	.133	.005	.315	.064	-.106	-.302	-.191
CBCL Rule breaking	.323*	.198	.330*	.320	.052	.252	.100	-.249	.216	.158	.022	.283	-.007	-.163	-.128
CBCL Aggression	.391*	.184	.400*	.333*	.298	.257	.070	-.172	-.034	-.058	.303	.210	-.085	-.147	-.205

*p<.05, **p<.01

MCQ-A = Meta-cognitions Questionnaire-Adolescent, CSC = cognitive self-consciousness, SRP = superstition, responsibility and punishment, UD = uncontrollability and danger, PB = positive beliefs, CC = cognitive confidence, TCQ-A = Thought Control Questionnaire-Adolescent, Dis = distraction, SC = social control, W = worry, P = punishment, RA = re-appraisal. ToM = Theory of Mind, SSM = strange stories mental, SSP = strange stories physical, SSUL = strange stories unlinked.

This procedure was repeated with MCQ-A uncontrollability and danger beliefs entered at the final step of the model. A similar pattern of results was found. The inclusion of ToM did not result in a significant change in R² in either model. When SDQ internalizing scores were the dependent variable, the addition of MCQ-A

uncontrollability and danger beliefs resulted in a significant increase in R^2 ($F = 1.899$, $R^2 = .229$, R^2 change = .121, $p = .032$). Uncontrollability and danger beliefs made a significant independent contribution to internalizing scores (Table 4). The addition of MCQ-A uncontrollability and danger beliefs did not result in a significant change in R^2 when SDQ externalizing scores were the dependent variable ($F = 2.601$, $R^2 = .289$, R^2 change = .021, $p = .340$). Again, gender was the only significant predictor of externalizing scores (Table 5).

TCQ-A total scores did not independently predict SDQ internalizing ($F = .814$, $R^2 = .116$, R^2 change = .001, $p = .843$) or externalizing scores ($F = 2.417$, $R^2 = .280$, R^2 change = .011, $p = .494$).

What affects meta-cognition?

Demographics. In bivariate correlation, age at T3 was significantly positively correlated with T1 SS ToM ($r = .51$, $p = .001$) and SS nature scores ($r = .35$, $p = .023$). There was no difference in ToM scores by gender, ethnicity or SES. There was no correlation between MCQ-A or TCQ-A subscale scores and age. MCQ-A and TCQ-A scores did not differ by gender, ethnicity or SES.

Language. CELF-RS scores were negatively correlated with MCQ-A total ($r = -.41$, $p = .010$), cognitive self-consciousness ($r = -.38$, $p = .020$) and positive beliefs scores ($r = -.45$, $p = .009$). CELF-RS scores remained a significant predictor of MCQ-A total scores after controlling for age and gender in hierarchical regression analysis

Table 4: Regression coefficients from analysis of association between meta-cognitive variables and SDQ internalizing scores.

Variable	Model 1					Model 2					Model 3						
	R ²	F change	B	95% CI		R ²	F change	B	95% CI		R ²	F change	B	95% CI			
				Lower	Upper				Lower	Upper				Lower	Upper		
Age	.074	.905	-.011	-.11	.09	.108	1.256	.023	.06	.14	.258	6.474*	.03	.05	-.08	.14	
Gender		-.830	1.90	-4.69	3.03			-.942	(1.89)	-4.79	2.91			-.74	(1.76)	-4.32	2.83
CELF-RS		-.102	.07	-.25	.04			-.086	(.07)	-.23	.06			-.02	(.07)	-.17	.13
SS ToM								-.573	(.51)	-1.61	.47			-.38	(.48)	-1.35	.60
MCQ-A Total														.17*	(.07)	.033	.29
Age	.074	.905	-.01	-.11	.09	.108	1.256	.023	.06	.14	.229	5.015*	.04	.05	-.071	.15	
Gender			-.83	-4.69	3.03			-.942	(1.89)	-4.79	2.91			-1.33	(1.79)	-4.99	2.34
CELF-RS			-.10	-.25	.04			-.086	(.07)	.23	.06			-.06	(.07)	-.20	.08
SS ToM								-.572	(.51)	-1.61	.47			-.49	(.48)	-1.47	.49
MCQ-A UD														.39*	(.17)	.04	.74
Age	.069	.812	-.01	-.11	.08	.116	1.709	.025	.06	.14	.116	.006	.02	.06	-.09	.14	
Gender			-.54	4.42	3.33			-.630	(1.89)	-4.75	3.21			-.61	(1.93)	-4.56	3.33
CELF-RS			-.09	-.24	.05			-.080	(.07)	-.23	.07			-.08	(.08)	-.23	.07
SS ToM								-.667	(.51)	-1.71	.37			-.66	(.53)	-1.74	.42
TCQ-A Total														-.01	(.09)	-.21	.19

CELF-RS = CELF recalling sentences; SS ToM = strange stores theory of mind; MCQ-A = meta-cognitions questionnaire-adolescent; MCQ-A UD = uncontrollability and danger; TCQ-A = thought control questionnaire-adolescent.

Table 5: Regression coefficients from analysis of association between meta-cognitive variables and SDQ externalizing scores.

Variable	Model 1					Model 2					Model 3					
	R ²	F	B	95% CI		R ²	F	B	95% CI		R ²	F	B	95% CI		
				Lower	Upper				Lower	Upper				Lower	Upper	
Age	.247	3.708*	-.06	(.04)	-.14	.268	.976	-.04	(.05)	-.13	.304	1.663	-.03	(.05)	-.13	.07
Gender			-4.44**	(1.59)	-7.67			-4.52**	(1.59)	-7.76			-4.43**	(1.76)	-7.65	-1.21
CELF-RS			-.058	(.06)	-.18			-.05	(.06)	-.17			-.02	(.07)	-.14	.11
SS ToM								-.43	(.43)	-1.30			-.34	(.48)	-1.21	.54
MCQ-A													.07	(.07)	-.04	.19
Total																
Age	.247	3.708*	-.06	(.04)	-.43	.268	.976	-.04	(.05)	-.13	.289	.936	-.03	(.05)	-.13	.07
Gender			-4.44**	(1.59)	-7.67			-4.52**	(1.59)	-7.76			-4.67**	(1.60)	-7.93	-1.40
CELF-RS			-.06	(.06)	-.18			-.05	(.06)	-.17			-.04	(.06)	-.16	.09
SS ToM								-.43	(.43)	-1.30			-.39	(.43)	-1.27	.49
MCQ-A													.15	(.15)	-.17	.46
UD																
Age	.238	3.433*	-.07	(.04)	-.146	.273	1.541	-.03	(.05)	-.129	.280	.329	-.03	(.05)	-.13	.06
Gender			-4.12*	(1.57)	-7.324			-4.19*	(1.56)	-7.37			-4.31*	(1.59)	-7.56	-1.06
CELF-RS			-.06	(.06)	-.173			-.04	(.05)	-.16			-.03	(.06)	-.16	.09
SS ToM								-.52	(.42)	-1.46			-.57	(.43)	-1.46	.32
TCQ-A													.05	(.08)	-.12	.21
Total																

CELF-RS = CELF recalling sentences; SS ToM = strange stores theory of mind; MCQ-A = meta-cognitions questionnaire-adolescent; MCQ-A UD = uncontrollability and danger; TCQ-A = thought control questionnaire-adolescent.

when age and gender were entered at step one and language was entered at step two ($\beta = -.43$, $SE = 4.69$, $p = .019$, 95% CI[-.79, -.08]). The addition of CELF-RS scores to the model resulted in a significant increase in R^2 ($R^2 = .195$, R^2 change = .145, $F(34) = 6.115$, $p = .019$). Similarly, CELF-RS scores significantly predicted MCQ-A positive belief scores ($\beta = -.08$, $SE = .04$, $p = .043$, 95% CI[-.16, -.01]), resulting in a significant change in R^2 ($R^2 = .151$, R^2 change = .110, $p = .043$) as well as MCQ-A cognitive self-consciousness scores ($\beta = -.12$, $SE = .06$, $p = .030$, 95% CI[-.24, -.01]) with a significant change in R^2 ($R^2 = .154$, R^2 change = .127, $F(34) = 5.104$, $p = .030$). There was no correlation between language and ToM or TCQ-A scores.

Maltreatment and care history. There was no significant correlation between MCQ-A, TCQ-A or ToM with maltreatment severity, age-at-entry to care or age at adoption and no difference in meta-cognition variables between children with and without pre-natal exposure. This remained true after controlling for age, gender and language in hierarchical regression analysis.

Discussion

We aimed to explore the inter-relationship between meta-cognitive constructs and the independent association of meta-cognitive beliefs (MCB), thought control strategies (TCS) and theory of mind (ToM) with psychopathology in a high-risk adolescent sample. The association between MCB and TCS with ToM has never been tested before: we found no evidence of an association. Dysfunctional MCBs but not ToM were significantly positively correlated with internalizing and externalizing psychopathology. Furthermore, MCBs continued to predict internalizing psychopathology independent of age, gender, language and ToM. Finally, we explored association between meta-cognitive constructs, language and indices of early adverse experience. There was a significant negative relationship between language measured during middle childhood and adolescent MCBs. We found no evidence of an association between extent or duration of early exposure to adversity with meta-cognition in adolescence. We discuss the theoretical and clinical implications of these findings below.

Are meta-cognitive beliefs, thought control strategies and theory of mind related?

We found no evidence of a relationship between the meta-cognitive constructs of MCB and ToM. There was a significant positive correlation between ToM and reports of cognitive reappraisal strategies (e.g., thought challenging and logical enquiry), but this was not significant after controlling for language and demographic factors. ToM measured in middle childhood had no impact on reporting of MCB and TCS in adolescence – children with poorer ToM abilities on the strange stories task reported similar MCB's and TCS's in adolescence as those with more advanced ToM skills. This is contrary to previous research that reports positive associations between

meta-cognitive knowledge, meta-cognitive vocabulary and meta-memory with ToM (Ebert, 2015; Feurer et al., 2015; Locki & Schneider, 2006, 2007).

Our assessment of ToM may have been confounded by language. Interestingly, unlike in previous studies (e.g., Kay & Green, 2016), there was no concurrent association between language and ToM. Alternatively, interrelationships between meta-cognitive constructs may become less apparent over time. We did not measure MCB in middle childhood, so it was not possible to test this. Nor was it possible to test the prediction of change in MCB from middle childhood to adolescence. A further hypothesis is that associations are limited to measures of declarative and procedural meta-cognitive knowledge as previously identified. A reciprocal relationship between ToM and meta-cognitive knowledge may exist in early childhood that lays the foundation for later development of MCB through acquired knowledge of one's own and other minds. It is possible that early deficits or later acquisition of ToM may delay or influence the rate at which more sophisticated aspects of meta-cognition develop, including MCB and TCS. These children may struggle to report on MCB. Indeed, at least three of the children in our sample struggled with aspects of the MCQ-A and two children were unable to complete it. There were insufficient numbers to test the hypothesis that these children had particularly poor language or ToM abilities but this is a potential avenue for future research. Future longitudinal research that assesses different aspects of meta-cognition, including ToM, meta-cognitive knowledge and MCB is required to untangle the developmental associations between these constructs and their temporal roles in the development of psychopathology.

Is meta-cognition associated with psychopathology in maltreated adolescents?

Over 60% of the adopted adolescents in this study had clinical levels of parent reported psychopathology with significant rates of co-occurring internalizing and externalizing problems that were stable from middle childhood to adolescence. We hypothesized that meta-cognition in relation to the self and other minds would be associated with psychopathology. MCB - implicit and explicit beliefs about cognition – are a key component in the Self-Regulatory Executive Function (S-REF) model of adult psychopathology (Wells, 2008) and have been consistently associated with a range of psychopathology in adults and adolescents (Wells, 2012; Myers, 2012; Sun et al, 2017). The ability to form a cognitive representation of other minds – theory of mind – has been extensively studied in relation to childhood psychopathology and neurodevelopmental disorder (Cotter et al., 2018). Despite this, there remains a lack of clarity as to how proposed deficits in ToM are related to the symptoms of psychopathology, particularly externalizing and anxiety disorders.

We hypothesized that i) dysfunctional MCB and TCS would be positively associated with internalizing psychopathology; ii) poorer ToM would be associated with internalizing psychopathology; iii) dysfunctional MCB and TCS would continue to make an independent contribution after controlling for ToM. Findings partially support the first and third hypotheses – subscales of the MCQ-A, including positive beliefs about worry, cognitive self-consciousness, beliefs about the danger and uncontrollability of thoughts and cognitive confidence were all significantly positively correlated with internalizing psychopathology. MCQ-A total scores and negative beliefs significantly predicted concurrent internalizing problems after controlling for language and demographics. When entered in hierarchical regression analysis, MCQ-A total scores contributed an additional 15% of variance in internalizing scores.

Uncontrollability and danger beliefs predicted 13.7% of the variance in internalizing scores.

We also tested whether TCS measured using the TCQ-A were associated with psychopathology. Only punishment strategies were positively correlated with total problems and externalizing scores on the SDQ. However, there were some positive correlations with internalizing subscales of the CBCL. There was no relationship between overall TCQ-A scores and internalizing problems after controlling for language and demographics. Distraction was negatively correlated with both internalizing and externalizing problems, although this was only significant in relation to CBCL internalizing scores. It has been suggested that distraction may be an adaptive strategy in some circumstances (Gill et al., 2013). The implication is that analysis using TCQ-A total scores may obscure differential relationships between specific TCS and psychopathology. It is worth noting that the mean scores in this sample are also comparable to those reported in a non-clinical sample (Gill et al., 2013).

Large effects have been observed in studies of dysfunctional MCB and internalizing forms of psychopathology (Sun et al., 2017). Few studies have tested the role of MCB or TCS in externalizing disorder. After controlling for demographics and language, we found no association between either dysfunctional MCB or TCS and externalizing psychopathology scores on the SDQ. MCB may therefore be particularly relevant to conditions in which symptoms of emotional disorder are a core component. Overall, we find little support for a relationship between TCS and psychopathology in this sample.

Contrary to our hypothesis, ToM was not associated with internalizing problems. Meta-analytic reviews find poorer performance on ToM measures in depressed samples with a moderate effect size ($-.58$; Cotter et al., 2018). Larger effects

are reported in samples with neurological and neurodevelopmental disorders, such as autism (-.81). Fewer studies have examined association between ToM and anxiety or externalizing disorders, producing mixed findings (e.g., Happé & Frith, 1996). The hypothesized role of ToM in psychopathology and developmental disorder is based on a model whereby a deficit in ToM underlies social and communication difficulties and inaccurate processing of social cues (Jones et al., 2018). We did not explore group differences in ToM or test for deficits in this study. Nor did we perform robust tests of association with specific forms of psychopathology since the sample had high levels of co-morbidity. It is not possible to rule out that the small sample size limited our ability to detect smaller effects. However, the findings are consistent with a previous study that failed to find a significant association between ToM and externalizing psychopathology in a larger sample ($n = 63$) of maltreated adolescents (Kay & Green, 2015). We extend this to show that there is no association with internalizing disorder in a similar sample. ToM deficits may be more common in forms of psychopathology, developmental and neurological disorders that are characterized by neurocognitive deficits and social communication difficulties.

What affects meta-cognition?

Finally, we explored the effects of language and early adverse experiences on meta-cognition. Unlike ToM, there was a significant negative association between MCB and language – with lower overall endorsement of positive and negative MCB being associated with better language skills. However, MCB continued to predict psychopathology even after controlling for language. Language did not predict psychopathology in any of the multivariate models before or after entering meta-cognitive variables. This is the first time that longitudinal associations between language and MCB have been explored whilst the role of language in the development

of other forms of meta-cognition, for example meta-memory, has been demonstrated (Ebert, 2015; Feurer et al., 2015). Regardless, it is striking that language abilities measured during middle childhood continue to predict lower reported rates of dysfunctional MCB several years later. Although not directly related to psychopathology, superior language abilities may act as a buffer against psychopathology via its relationship with MCB. It is also possible that superior language ability is an indicator of cognitive function or an aspect of environmental experience that is similarly associated with fewer dysfunctional MCB.

We found no linear relationships between meta-cognition or psychopathology with maltreatment or any aspect of early care history in this sample. Furthermore, mean scores on the MCQ-A scales in this study are remarkably similar to those reported in a non-clinical sample (Cartwright-Hatton et al., 2004). This suggests that positive and negative MCB are not more prevalent in a high-risk sample, although this has not been formally tested here. Previous studies that have identified links between ToM and maltreatment have done so largely through comparison of maltreated and non-maltreated groups (Cicchetti et al., 2003; Pears & Fisher, 2005). Our previous study of maltreated adolescents in UK out-of-home care similarly failed to find direct association between indices of adversity with ToM (Kay & Green, 2015). A systematic review concluded that there is limited evidence for ToM deficits in maltreated children and adolescents, whilst noting that studies frequently inadequately control for the presence of psychopathology or cognitive confounds (Benarous, Guilé, Consoli, & Cohen, 2015).

Unmeasured aspects of the early environment such as the quality of parent-child communication may be more relevant to the development of meta-cognition than extent of exposure to maltreatment. For example, ToM acquisition is affected by the frequency and quality of mental-state talk (Dunn et al., 1991; Ensor & Hughes, 2008).

Various aspects of parental socialization to emotion including reaction to child emotions, parental expression and discussion of emotion are related to child negative emotionality and poorer social competence (Eisenberg, Cumberland, & Spinrad, 1998). Parental beliefs and attributions concerning emotion and mental states may also influence child MCB and TCS. Discussion of cognitive abilities such as memory could influence beliefs concerning those functions, i.e., cognitive confidence. Implicit and explicit expectations regarding the expression and control of cognition and emotion, and narratives concerning mental health may lead to beliefs regarding the danger and uncontrollability of thoughts (e.g., “those who fail to control their emotions are weak or psychologically unstable”). Narratives concerning the impact of mental health within families may be particularly pertinent to children who are adopted or placed in out-of-home care (Watson, Latter, & Bellew, 2015). Narratives may be incomplete and overwhelmingly influenced by the act of removal from the birth family; the inability to overcome emotional, cognitive or problems of addiction leads to devastating consequences. Life story work that aims to inform children of facts relating to their past and facilitate a sense of personal identity (Aldgate & Simmonds, 1988) is common in UK social work practice but there is no evidence concerning its effectiveness. Moreover, poorly conducted life story work has been linked to negative outcomes in adoption (Selwyn et al., 2015).

Our study is the first to explore associations between early environmental adversity, MCB and TCS in a high-risk adolescent sample. That we identify significant association between dysfunctional MCB and psychopathology suggests that further study of factors that influence the acquisition of these beliefs is warranted in this group. Our findings suggest that a simple linear association between severity of maltreatment or exposure to pre-natal adversity is unlikely. Further understanding of the way in

which narratives and parental emotion socialization influence MCB could inform guidance on the implementation of life story work for adopted children as well as provide early indicators of risk and targets for prevention of psychopathology.

Strengths and limitations

There are several methodological strengths to this study. We used well validated standardized multi-informant measures of psychopathology and meta-cognition, which limits the potential for common respondent biases to confound results. We did not obtain a measure of MCB at T1 or a measure of language and ToM at T3. Aspects of meta-cognition may develop at different rates, which may have impacted on analysis of association between ToM, language and MCB. Our sample is well characterized but relatively small. The small sample size limited our ability to perform robust tests of multiple components of meta-cognition with psychopathology. Retention of participants over the course of the follow-up was challenging. Several years elapsed between T1 and T3 and some families were no longer contactable due to relocation. Furthermore, at least seven adolescents were no longer living with their adoptive parents at T3. It was possible to obtain information for only one of these adolescents. Two adolescents were experiencing significant mental health difficulties so did not participate at T3. Finally, at least three adolescents chose not to participate for other reasons. Comparison of the baseline characteristics of those who continued to participate with those who did not revealed little difference. However, it is possible that adolescents with more significant difficulties were lost to follow-up, which may have affected the findings concerning the overall level of psychopathology in the sample but is unlikely to have impacted significantly on tests of association between psychopathology and meta-cognition. Our sample of adopted children had a range of pre-adoption experiences, broadly comparable to those of nationally representative

adoption cohorts (Selwyn et al., 2015). However, recruitment of the sample was through self-referral, so selection bias cannot be ruled out. Data on care and maltreatment history were based on adoptive parent report. Details of timings into care and at adoption will be accurate but data on pre-adoption experience is dependent on the extent of adoptive parent knowledge: extent of maltreatment may be over or under-estimated. It may be useful for future research to incorporate direct examination of social services case files to capture more detailed information on the nature, timing and chronicity of maltreatment for more robust analysis of association with different aspects of meta-cognition and psychopathology. We did not measure IQ but did include a standard measure of language.

Clinical implications

We find that dysfunctional MCB are associated with internalizing psychopathology in maltreated adolescents. This effect is independent of language and ToM. The S-REF model (Wells and Matthews, 1996), which describes key maintenance processes implicated in psychopathology during adulthood, may be relevant to high-risk adolescent populations. This has significant implications for clinical practice. The S-REF model provides the basis for meta-cognitive therapy (MCT; Wells, 2008), which focuses on modifying dysfunctional MCB. A recent meta-analysis showed that MCT is an effective treatment for anxiety and depression with larger effects than the current gold-standard treatment – cognitive behavioral therapy (Normann et al., 2014). Our findings are consistent with previous studies that identify dysfunctional MCB in adolescent samples and extend them to include a high-risk population with co-morbid internalizing and externalizing problems. Recent evidence shows that MCT techniques can be successfully applied to young children. Brief exposure to a core component of MCT – the Attention Training Technique, which trains individuals in externally focused

auditory attention to aid disengagement from perseverative cognitive processing (Wells, 2008), leads to improvement on indicators of long-term adaptive functioning (the ability to delay gratification) in five and six-year-old children (Murray, Scott, Connolly, & Wells, 2018; Murray, Theakston, & Wells, 2016).

UK adopted adolescents are a high-risk group who show multiple forms of psychopathology. When accessing mental health services, children with disrupted care experiences are often classified as primarily presenting with disorders of attachment (Woolgar & Baldock, 2015). Interventions therefore focus on parent training with an emphasis on fostering therapeutic attachment relationships but there is little evidence to support their use (National Institute for Health and Care Excellence, 2016) and they may fail to address core mechanisms of emotional disorder. By establishing the presence and significance of dysfunctional MCB in this group, we pave the way for evaluation of the feasibility and effectiveness of MCT for emotional disorder in maltreated adolescents.

Conclusions and future directions

We find evidence of a significant association between dysfunctional MCB and internalizing psychopathology in a sample of maltreated adolescents. This is consistent with findings from non-clinical samples and a large body of evidence on the role of MCB in adult psychopathology (Myers et al., 2012; Sun et al., 2017). The S-REF model of psychopathology may provide a useful framework for understanding the mechanisms of internalizing disorder in adolescent maltreated populations, which has important theoretical and clinical implications. We find no evidence for a role of ToM, so intervention approaches based on training in ToM skills may have limited clinical utility in relation to psychopathology. We also found no evidence for an association between ToM and MCB: these components of meta-cognition appear relatively

independent in adolescence. However, replication in longitudinal designs using larger samples will be necessary to fully understand the developmental associations between meta-cognitive constructs and their relative contribution to social and emotional functioning. Given the significant role of language in predicting MCB, future studies should incorporate measures of language to better understand this association and consider factors that may confound associations with psychopathology and other outcomes. Finally, we find no evidence for a linear association of meta-cognition with psychopathology. Future research should consider alternative mechanisms including emotion socialization.

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Paper 3

Critical appraisal

Overview

This paper will provide an overview of the theoretical perspective and findings of the thesis, followed by discussion of the methodological strengths and limitations of papers one and two along with implications for the interpretation of findings. Strengths and limitations of the thesis in its entirety will be discussed before considering the theoretical and clinical implications of the work. Finally, suggestions will be made for future research in this area.

Theoretical perspective

The thesis adopts a perspective consistent with the tradition of developmental psychopathology. That is, study of the origins and course of patterns of behavioural maladaptation with the aim of understanding the underlying processes of continuity and change in maladaptive patterns (Rutter & Sroufe, 2000). The approach assumes that development is an active and dynamic process in which individuals add meaning to their experience via cognitive and affective processing, which both shapes and is shaped by biological factors. Thus, there is dynamic interplay between the environment, the individual and their biological makeup (Rutter & Sroufe, 2000). Key principles of the developmental psychopathology perspective are: i) a focus on the continuity and interplay between typical and atypical development; ii) a multi-domain approach with analysis at multiple levels (e.g., neurobiological, cognitive and behavioural); iii) utilisation of a developmental framework to understand adaptation and pathology across the life course (Cicchetti, 1993).

Paper one is consistent with the developmental psychopathology approach in its focus on the role of cognitive processes in the emergence of adaptive and maladaptive emotional and behavioural functioning in typically developing children. Specifically, the longitudinal relationships of individual differences in executive function with

internalising forms of psychopathology. Paper two investigates the relative contribution of two forms of metacognition – beliefs, processes and strategies used to interpret, monitor or control cognition (Flavell, 1971) – to psychopathology in a sample of adolescents who had been exposed to significant pre-natal and post-natal adversity. Both papers aim to advance basic understanding of the developmental mechanisms of childhood psychopathology within typical and atypical biological (i.e. pre-natal substance exposure) and environmental contexts.

Both papers utilise existing developmental and cognitive psychology frameworks to further understanding of atypical development (e.g., executive function and a theory of metacognition) in psychopathology. Research on the mechanisms of psychopathology has tended to focus on adulthood. There has been a call to bridge developmental and clinical psychology via the merger of theoretical constructs, aims, populations and methods in order to understand the developmental mechanisms of psychopathology (Frick, 2004; Rutter & Sroufe, 2000). The thesis explores the predictions of an established meta-cognitive model of adult psychopathology – the self-regulatory executive function (S-REF) model (Wells & Matthews, 1996) within a developmental psychopathology framework. The S-REF model places the executive control of attention as central to psychological disorder. Paper one tests prospective relationships between the higher order cognitive processes implicated in the regulation of attention with internalising psychopathology. Paper two investigates association between other key components of the model – meta-cognitive beliefs and thought control strategies - with psychopathology in a high-risk adolescent sample. The relevance of the S-REF model to child and adolescent psychopathology is therefore a crosscutting theme of the thesis that will be discussed further when considering the theoretical implications of the work.

Overview of findings

Paper one. Paper one systematically reviewed the evidence that executive function (EF) - cognitive processes that enable adaptive goal-directed behaviour (Garon, Bryson, & Smith, 2008; Hughes & Ensor, 2011) assessed before the age of 6 years are associated with subsequently measured symptoms of internalising psychopathology, including depression and anxiety. One of the challenges in this area is determining the dimension(s) of EF that might give rise to vulnerability to psychological problems. Theories have implicated the role of flexible modulation of attention (attention shifting) and inhibition of pre-potent responses (response inhibition) for the regulation emotion and behaviour (Rothbart & Bates, 2006). This is consistent with the S-REF model. Specifically, the selection of stimuli for further processing is viewed as a central concept in psychological disorder, which is characterised by perseverative processing of self-relevant information (e.g., rumination) that is difficult to control (Wells, 2008). Such sustained processing will interfere with the processing resources required to disengage attention and thus the model predicts that EF tasks involving selective attention and poor disengagement of over-learned responses are likely to be important markers of psychological vulnerability.

The findings of the review are consistent with these predictions. There was evidence that poorer EF abilities were associated with increased risk for subsequent internalising problems, particularly anxiety. EF mediated relationships between early risk and internalising (Nozadi, Spinrad, Eisenberg, & Eggum-Wilkens, 2015; Roman, Ensor, & Claire, 2016) and moderated relationships between individual differences in child temperament and environmental risk with later internalising problems (Hilt, Armstrong, & Essex, 2012; Thorell, Bohlin, & Rydell Lisa B, 2004; White et al., 2011). The direction of effects varied as a function of risk factors and the EF component under

study. Superior ability to inhibit prepotent responses and to sustain attention before age six increased risk for internalising symptoms in the presence of an inhibited temperamental style and over-controlling parenting (Hilt et al., 2012; Thorell et al., 2004; White et al., 2011). A superior ability to shift attention buffered against internalising problems in similar contexts (White et al., 2011). The theoretical and clinical implications of these findings will be discussed further below.

Paper two. The primary aim of paper two was to investigate the independent contribution of meta-cognitive beliefs and thought control strategies - key components of the S-REF model – over and above theory of mind to psychopathology in a high-risk adolescent sample. Theory of mind (ToM) is a form of meta-cognition that facilitates recognition and interpretation of the thoughts, desires and intentions of others. ToM is extensively studied in the field of developmental psychopathology and a substantial body of literature exists on the aetiology, correlates and consequences of ToM in relation to psychopathology, neurological and neuro-developmental disorders (Cotter et al., 2018). ToM development is vulnerable to environmental risk (Cicchetti, Rogosch, Maughan, Toth, & Bruce, 2003; Dunn & Cutting, 1999; Hughes et al., 2005; Pears & Fisher, 2005) so represents a key candidate mechanism of risk for psychopathology.

Empirical study of the S-REF model shows meta-cognitive beliefs, particularly those concerning the danger and uncontrollability of thoughts, are trans-diagnostically significant (Sun, Zhu, & So, 2017). Such beliefs lead to an increased sense of threat and behavioural avoidance, reassurance seeking or thought suppression - attempts not to think about a certain thought by diverting attention to something else (Wells & Daveis, 1994). These strategies have the counterproductive effect of maintaining a sense of threat, perseverative processing, extended negative emotional experience, difficulty with the regulation of thoughts and emotions and the modification of dysfunctional

beliefs (Clark, Winton, & Thynn, 1993; Wegner, Schneider, Carter, & White, 1987; Wells, 2008).

We therefore hypothesised that dysfunctional meta-cognitive beliefs and thought control strategies in relation to the self would predict variance in psychopathology independent of ToM ability. Our hypothesis was supported: adolescent reports of dysfunctional meta-cognitive beliefs were significantly positively associated with parent reported internalising psychopathology and this was independent of ToM, key demographic factors and language. ToM on the other hand, was not associated with psychopathology. Finally, we explored the relationship between meta-cognitive constructs and their associations with adverse early experience for the first time. There were no linear relationships between ToM and meta-cognitive beliefs or thought control strategies. Nor was there an association between indicators of adversity and meta-cognition. However, language ability measured during middle childhood significantly predicted reports of fewer dysfunctional meta-cognitions up to 7 years later during adolescence. The implications of these findings for theory and practice will be discussed further below.

Methodological strengths and weaknesses

The main methodological strengths and limitations are reviewed in the respective papers. Issues already discussed will not be mentioned here unless further consideration of their implications is warranted.

Paper one. A primary strength of paper one is the use of systematic review methodology. The systematic review is the gold standard method of identifying, appraising and synthesising evidence in relation to a specific question. The aim is to provide an un-biased synthesis of all available evidence to inform decision-making regarding theory, practice and policy (Boland, Cherry, & Dickson, 2013). Systematic

reviews also highlight areas that require further research (Brown et al., 2006) and where evidence is currently limited (Petticrew & Roberts, 2006). Unlike a narrative review, it uses explicit search criteria and strategies that are systematically applied and replicable by others (Centre for Reviews and Dissemination, 2009). Systematic review methodology was therefore deemed the most appropriate for paper one. To ensure rigour in the review process and transparent reporting, the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) statement was followed (Moher, Liberati, Tetzlaff, Altman, & PRISMA Group, 2009).

The available evidence in relation to the research question was not of a quantity or nature to support meta-analytic review. A benefit of meta-analysis is that effect sizes from multiple studies can be combined, which leads to greater accuracy in estimates of population effects (Glass, 1976). To perform a meta-analysis, the available data needs to be of sufficient quantity and outcomes must be reasonably homogenous to justify quantitative synthesis. The population under study in paper one was homogenous, but the reporting of EF and outcome measures were inconsistent – studies assessed and reported on different aspects of EF in relation to different measures of internalising psychopathology. The criterion of homogeneity was therefore unmet. Furthermore, although sufficient for narrative synthesis, the quantity of papers identified was quite small ($n = 14$). The review is therefore timely; it highlights the potential contribution of the research area and provides guidance on the form that future research should take in order that quantitative synthesis may be possible, for example assessing and reporting on the individual components of EF in relation to internalising outcomes in a hypothesis driven manner.

A further methodological strength was the use of a standard quality assessment tool (Sirriyeh, Lawton, Gardner, & Armitage, 2012), which facilitated discussion of the quality of the reviewed studies in relation to the findings. The tool was selected due to its ease of use in studies with diverse designs, as opposed to treatment trials or

qualitative designs. Studies included in the review were all longitudinal multi-panel designs but, to the best of our knowledge, there is no tool designed for this purpose. The chosen tool was therefore necessarily broad in defining each scoring anchor. This means that the ratings were somewhat subjective. To counteract this, the reviewer considered aspects of design most relevant to the review in consultation with the supervisor (e.g., analytic methods and use of multiple informants) to inform quality analysis scores and descriptions. An example of a completed quality assessment tool is provided in Appendix 2.

Finally, the review protocol initially stated that studies using either objective behavioural and/or informant measures of EF would be included in the review. The search strategy was therefore designed to meet this aim. The assessment of EF in pre-school age children using objective measures such as the day/night task is possible because of the recent development, adaptation and validation of such measures (Carlson, 2005). Initial scoping exercises identified several suitable studies that used performance measures. However, it was anticipated that the quantity of studies may be insufficient for a systematic review. On performing the searches this was proven wrong and fourteen studies were identified. A further eighteen suitable studies included an informant measure of EF only. We chose to focus on studies using behavioural measures due to questions regarding the validity of informant measures, potential common-respondent and co-measurement effects and to facilitate comparison across the life-span. In light of this, the review protocol was revised, and the PROSPERO registration was amended prior to data extraction (Appendix 3).

Paper 2. The main strength of paper two is the inclusion of a well-characterised sample of maltreated adolescents who have been adopted from local authority care. The sample had early experience of multiple forms of maltreatment and pre-natal exposure

to adversity. Adoption is a radical intervention that aims to prevent further exposure to maltreatment, which is a risk factor for poor long-term outcomes (Cicchetti & Toth, 1995). Adopted samples therefore provide a unique opportunity to study the effects of exposure to adversity during defined periods of development, which is in keeping with the developmental psychopathology approach. This enabled testing of hypotheses concerning the effects of early maltreatment and adversity on meta-cognition and psychopathology. Furthermore, the sample had high levels of psychopathology, enabling robust testing of relationships with meta-cognition.

The trainee recruited the sample during the first phase of a longitudinal study of outcomes in UK adopted children, which was co-led by the second supervisor (Green, Leadbitter, Kay, & Sharma, 2016a; Kay, Green, & Sharma, 2016). The sample consented to be contacted for future research and was followed-up in a second phase of the research approximately 2 years later, which was also conducted by the Trainee and second supervisor. The Trainee re-contacted the sample for the phase of the study reported in this thesis under the supervision of the main and second supervisor. The benefit of the longitudinal design is that data on psychopathology was collected at multiple time-points, providing evidence of stability of problems and reduction in measurement error.

An associated limitation of the longitudinal design is that a degree of attrition has occurred over the course of the study. Retention of participants was challenging for several reasons. First, the sample is geographically located across the UK. In the first and second phase of the study, which achieved a follow-up rate of 80%, participants were visited in their homes for data collection. It was not possible to conduct home visits in this most recent follow-up, which may have impacted on participant retention. Second, several years have elapsed since initial recruitment and some families were no

longer contactable due to relocation. Third, at least seven adolescents were no longer living with their adoptive parents at this most recent follow-up. It was possible to obtain information for only one of these adolescents. Two adolescents were experiencing significant mental health difficulties, so it was deemed an inappropriate time to participate in the study. Finally, at least three adolescents chose not to participate for other reasons. Comparison of the baseline characteristics of those who continued to participate in the study with those who did not revealed little difference. However, it is possible that adolescents with more significant difficulties were lost to follow-up, which may have affected the findings concerning the overall level of psychopathology in the sample but is unlikely to have impacted significantly on tests of association between psychopathology and meta-cognition.

A degree of attrition in the existing sample was anticipated based on the rate of attrition between T1 and T2. An a-priori statistical power calculation (see Appendix 7) showed that 42 participants would be required for bivariate correlation analysis, whilst 50 would allow five simultaneous predictors of psychopathology to be entered in multiple regression analysis - meta-cognitive beliefs, ToM, age, gender and language. A longitudinal design was originally specified – with data on meta-cognition and psychopathology collected at two time-points in order to test mediation hypotheses (Appendix 7). The original specified total sample size was 60 to allow for attrition during follow-up. To achieve this, we aimed to recruit an additional 20 adopted adolescents via the same methods as those used to recruit the original sample. Unfortunately, only six additional participants were recruited and it was not possible to obtain meta-cognition data for three of these.

Discussion with Adoption UK, a national membership charity for adoptive families, suggested that adoptive parents often reduce contact with services following

adoption before making contact again if problems arise during adolescence. The implication is that families who are most likely to receive information about the study via Adoption UK may also be experiencing difficulties. This is a factor that may have introduced bias to the sample as a whole, for example incidence of psychopathology may be higher than that seen in the wider adoptive population but is unlikely to have significantly affected the main findings of this study since we were testing hypotheses concerning relationships between psychopathology and meta-cognition. However, it may have impacted on willingness and ability to engage in research, which is consistent with the reasons given for incomplete data. Feedback from adoptive parents also highlighted concerns about completion of the ToM task over the phone. Adolescents were reportedly anxious about this aspect of the study, despite having received information about the task. As a result, the phone call was made optional so that key relationships with meta-cognitive beliefs could be explored in a larger sample if necessary. This had a limited impact on recruitment of new participants but maximised retention of the existing sample. It will be crucial for future research to seek the input of adolescents and adoptive families from the outset to establish the factors that motivate them to engage with research. Adopter feedback has guided the direction of the study thus far, for example we investigated service use, parental efficacy and stress at T2.

The final sample with data on both meta-cognitive beliefs and ToM for multivariate analysis was 38. This is lower than indicated by the statistical power calculation as required to identify a medium sized effect and may have increased the chance of Type II error. However, meta-cognitive beliefs were still found to be significantly associated with psychopathology as hypothesised. That ToM was not associated with psychopathology may be a result of poor statistical power. However,

replication of analysis with the whole sample at T1 ($n = 53$) similarly failed to find any association between ToM and psychopathology. Testing in a larger sample could identify smaller effects that may be of theoretical importance, but clinical value would be questionable given the size of effects and identified role of meta-cognitive beliefs.

As a result of the difficulties with recruitment it was not possible to assess meta-cognition at two time-points as planned. This would have enabled tests of mediation of psychopathology by meta-cognition. However, we found limited evidence of variance in psychopathology from middle childhood to adolescence. It is unlikely that robust tests of predictors of change would have been possible in this sample over a short follow-up. Mediation hypotheses may most fruitfully be tested in large community samples of adolescents using longitudinal designs with latent variables and structural equation modelling to reduce measurement error.

Implications for theory

The interpretation of the findings of both paper one and two appear to fit meaningfully within the S-REF model of psychopathology (Wells & Matthews, 1996). The model suggests that a thinking style characterised by perseverative worry/rumination, inflexible attention to the self and threat as well as dysfunctional coping behaviours represents a form of maladaptive cognitive processing referred to as the Cognitive Attentional Syndrome (CAS) that is trans-diagnostically significant (Wells, 2005; 2008). It is hypothesised that greater flexibility in the regulation of attention to internal events will reduce CAS activation (Wells, 2005). An implication is that greater attention regulation and flexibility will be protective against psychopathology because the individual will be better able to disengage from unhelpful cognitive processes. The findings of paper one support this hypothesis by showing that in general, greater ability to regulate cognition via sustained attention, the inhibition of

pre-potent responses and planning before the age of six was associated with lower levels of subsequently measured internalising symptoms.

However, moderation effects suggest that the direction of association is influenced by factors such as the EF component under study, child temperament and parenting. For example, a greater tendency to inhibit pre-potent responses was associated with increased risk for psychopathology in children who were behaviourally inhibited or exposed to an over-controlling parenting style (Thorell et al., 2004; White et al., 2011.), whilst greater ability to flexibly shift attention was protective in similar contexts (White et al., 2011). This suggests that the ability to inhibit a pre-potent response may not always be beneficial: over-control of cognition and behaviour is also maladaptive. Within the S-REF model, these children may be more likely to maintain CAS activity due to attempts to excessively control thoughts rather than flexibly shifting their attention. Continued efforts to control thoughts (e.g., through thought suppression) can have a counterproductive effect and lead to perceived loss of mental control (Wells, 2006). Alternatively, the finding could reflect the impact of CAS activity during inhibitory control tasks (e.g., performance monitoring and excessive self-evaluation) meaning that children who are behaviourally inhibited were particularly cautious in their approach to the task (White et al., 2011).

A large body of evidence links behavioural inhibition to subsequent internalising problems, particularly anxiety (Svihra & Katzman, 2004). Behaviourally inhibited children show greater physiological arousal in novel situations including increases in salivary cortisol, heart rate and muscle tension that may indicate lower thresholds for limbic and hypothalamic activation (Kagan, Reznick, & Snidman, 1987). Several models that describe the structure of temperament exist but three domains appear to be common across frameworks and can be summarised using the Emotionality – Activity –

Sociability (EAS) model (Rowe & Plomin, 1977); emotionality refers to proneness to experience negative affect; activity concerns tempo, vigor and endurance, whilst sociability refers to the tendency towards affiliative behaviour. These characteristics are thought to be on a continuum with personality development, for example neuroticism vs. extroversion (Matthews, Deary, & Whiteman, 2003), and they are associated with activity in distinct ‘brain systems’ including a behavioural approach, behavioural inhibition and fight/flight system (Gray, 1990).

Despite evidence linking dimensions of temperament to psychopathology the mechanism of association is poorly understood, which limits the clinical utility of the construct. Rothbart and Bates (1998, 2006) proposed that a second aspect of temperament is a regulatory system referred to as effortful control, which consists both the ability to inhibit a pre-potent response (response inhibition) and to focus and shift attention – both components of executive function. These functions are thought to enable children to regulate emotions and behaviour adaptively so it is hypothesised that children who are high in negative emotionality and low in effortful control are more vulnerable to psychopathology. Much of the research in this area has used parent report measures of effortful control and focused on relationships with externalising psychopathology. Our review therefore adds to the literature here in synthesising findings on relationships between aspects of effortful control and internalising problems. Although we find support for the overall negative relationship between response inhibition and internalising problems, we also found that this does not hold true for children with temperamental vulnerability, which is contrary to the hypothesised role of effortful control. Attention shifting on the other hand did appear to buffer against anxiety in one study (White et al., 2011). Components of the effortful control construct may play distinct roles in the regulation of emotion and behaviour and

should be measured separately. The findings of the review also suggest that the S-REF model could be useful for understanding the role of temperament in psychopathology – it is possible to hypothesise that children who are high in negative affect but able to flexibly shift attention may be less vulnerable to psychopathology due to reduced CAS activity, whilst those who show a tendency to over-control of cognition may be at increased risk of sustained CAS activity. This hypothesis remains to be tested in future research.

Paper two provides further support for the S-REF model of psychopathology in a sample of maltreated adolescents. As hypothesised, key components of the model – dysfunctional meta-cognitive beliefs - were associated with symptoms of internalising psychopathology. This suggests that a well-characterised model of adult psychopathology can be relevant to our understanding of adolescent psychopathology, which would have significant implications for theory and practice. Dysfunctional meta-cognitive beliefs as assessed using the meta-cognitions questionnaire (MCQ) are present at higher rates in adults with a range of psychopathology (Sun et al., 2017).

Development of the adolescent version of the meta-cognitions questionnaire (Cartwright-Hatton et al., 2004) has facilitated study of the role of meta-cognitive beliefs in adolescent psychopathology. Most studies have demonstrated associations in low-risk non-clinical samples (Myers, 2012). Ours is the first study to demonstrate a similar role for meta-cognitive beliefs in a sample of adolescents with clinical levels of both internalising and externalising forms of psychopathology as well as significant early experience of adversity.

The S-REF model suggests that dysfunctional meta-cognitive beliefs play a central role in activation and maintenance of the CAS (Wells & Matthews, 1994, 1996). Negative MCB concerning the uncontrollability of cognition are said to prolong CAS

activation – processing remains uninterrupted because it is perceived as unstoppable. Beliefs concerning the danger of thoughts lead to a sense of threat, behavioural avoidance, reassurance seeking or thought suppression, which have counterproductive effects that maintain CAS activation and prevents disconfirmation of beliefs (Wells & Davies, 1994). We demonstrate that these types of MCB are significantly positively associated with internalising psychopathology in our adolescent sample. This effect is over and above that of ToM – which showed no association with either internalising or externalising psychopathology. This suggests that MCB are a stronger predictor of psychopathology than the ability to accurately infer the thoughts and intentions of others in the present sample.

A limited amount of research has demonstrated an association between ToM and aspects of self-meta-cognition such as meta-memory, with mixed findings on the direction of effects. No research has previously studied the association between ToM and meta-cognitive beliefs. We find no evidence of an association. It is possible that the sample was too small to detect smaller effect sizes or that associations wash out over time. However, it may also suggest that ToM and meta-cognitive beliefs are dissociable aspects of meta-cognition with distinct implications for development and adaptive functioning. For example, a deficit in ToM is proposed to underlie the social and communication difficulties that are characteristic of autism spectrum conditions (Baron-Cohen, Leslie, & Frith, 1985; Jones et al., 2018). Large effects of ToM have also been observed in samples with neurological conditions and schizophrenia (Cotter et al., 2018). ToM deficits may be more common in developmental and neurological disorders characterised more generally by neurocognitive deficits, whilst meta-cognitive beliefs are particularly relevant to conditions in which emotional disorder is a core component. It will be necessary to test this hypothesis in larger samples.

Finally, we found no linear relationships between meta-cognition or psychopathology with maltreatment or any aspect of early care history. We discuss the implications of this finding in the discussion section of paper 2 so this will not be repeated here. We conclude that the presence of dysfunctional MCB and their association with psychopathology in a sample of maltreated adolescents indicates that further study of factors that influence the acquisition of these beliefs is needed. We propose that aspects of emotion socialisation may be usefully considered. Work may begin with a review of the existing developmental literature.

Implications for practice

The S-REF model (Wells and Matthews, 1996) describes key maintenance processes of adult psychopathology and is also relevant to a high-risk adolescent population. This has significant implications for clinical practice. The S-REF model provides the basis for meta-cognitive therapy (MCT) (Wells, 2008) and a recent meta-analysis showed that MCT is an effective treatment for anxiety and depression with effects that might be greater than the current gold-standard treatment – cognitive behavioural therapy (Normann et al. 2014). MCT focuses on modifying dysfunctional meta-cognitive beliefs and strategies (e.g., uncontrollability and danger beliefs, thought suppression, reassurance seeking and avoidance). The implication of paper two is that MCT may be usefully applied to adolescents. Furthermore, paper one suggests that the ability to sustain and flexibly shift attention early in development is negatively associated with subsequent psychopathology. This is consistent with recent studies that have used the attention training technique (ATT) to increase 5- and 6-year-old children's ability to delay gratification during the marshmallow task (Mischel & Ebbsen, 1970), which is associated with a range of favourable long-term outcomes (Mischel, Shoda, & Peake, 1988).

The ATT is a meta-cognitive therapy intervention that trains individuals in externally focused auditory attention exercises to enhance executive control and increase the ability to disengage from CAS activity (Wells, 2008). Murray, Theakston, and Wells (2016) found that a brief classroom-based version of the ATT improved children's ability to delay gratification. This finding was subsequently replicated and the ATT was more effective than progressive muscle relaxation, which was used as an active control condition (Murray, Scott, Connolly, & Wells, 2018). Furthermore, the ATT was associated with significantly improved performance on the day/night task – an assessment of complex response inhibition. Although performance of children in the active control condition also improved, this was not significantly different to the inactive control group. There is promising evidence that the ATT can lead to improvement on indicators of long-term adaptive functioning as well as preliminary evidence that it can impact on a component of EF that is negatively associated with internalising psychopathology (Murray et al., 2018).

Adopted adolescents are a high-risk group who show multiple forms of psychopathology and present with significant complexity to service providers (National Institute for Health and Care Excellence, 2016). When accessing mental health services, children with disrupted care experiences are likely to be classified as primarily presenting with disorders of attachment (Woolgar & Baldock, 2015). Interventions often focus on parent training with an emphasis on fostering therapeutic attachment relationships but there is little evidence to support their use (National Institute for Health and Care Excellence, 2016). The mechanisms of poor outcome in maltreated children remains poorly understood and there is little evidence to guide the application of existing interventions or the design of new approaches. By establishing the presence and significance of dysfunctional MCB in this group, we pave the way for evaluation of

the feasibility and effectiveness of MCT for emotional disorder in maltreated adolescents. Given the challenges in recruiting adolescents to this study it may be necessary to carefully consider issues of engagement and outreach, which could be achieved via active user involvement.

Reflections on the research process

The work conducted for this thesis builds on the trainees prior doctoral and post-doctoral research. The doctoral thesis, which was supervised by the second supervisor of the present thesis, tested association between social cognition, psychopathology and features of Reactive Attachment Disorder in a sample of very high-risk maltreated adolescents residing in UK care (Kay & Green, 2013; Kay & Green, 2016). The focus of this and subsequent work has been on characterising the nature of social outcomes in children who experience early adversity and disrupted care – influenced by the study of children raised in severely depriving Romanian institutions (e.g., Colvert, Rutter, Beckett, et al., 2008; Colvert, Rutter, Kreppner, et al., 2008; Kennedy et al., 2016; Rutter et al., 1999). A further aim has been to test potential developmental mechanisms of outcome, with a focus on social cognition. The work is similarly conducted within the developmental psychopathology framework but is also consistent with psychiatric approaches to the classification of psychological disorder, i.e., testing for the reliability, validity and specificity of behavioural phenotypes (e.g., Green et al., 2016; Kay et al., 2016).

The study for the Doctorate in Clinical Psychology has built on previous research experience and provides a richer clinical framework that is reflected in the focus of the current work. The aim of this thesis was to bridge developmental, psychiatric and clinical research traditions by considering the relevance of a trans-diagnostic model of the development and maintenance of adult psychopathology to the

understanding of psychopathology in children and adolescents. Thus, the thesis can contribute to understanding of the nature of psychopathology in these populations as well as the processes that influence and maintain it, which has direct implications for clinical practice.

The trainee aims to translate the insights made in conducting this thesis to clinical practice. For example, in considering the potential role of meta-cognitive beliefs and attention regulation to psychopathology in the clinic setting. This may point to specific intervention strategies, including meta-cognitive therapy techniques (Wells, 2008), but may also suggest that other approaches are contra-indicated, for example those that may compound or reinforce dysfunctional meta-cognitive beliefs. Such beliefs may be present in family narratives as well as individuals. Clinical practice with these issues in mind will reciprocally guide the aims and objectives of the trainee's future research.

Suggestions for future research

The findings of the thesis suggest that the S-REF model of psychopathology may provide a useful framework for understanding the mechanisms of internalising disorder in children and adolescents. Several questions emerge from the work; i) what factors influence the development of dysfunctional meta-cognitive beliefs? ii) how are meta-cognitive constructs, such as executive function, theory of mind and meta-cognitive beliefs related to one-another both concurrently and prospectively? iii) what is the relative contribution of meta-cognitive constructs to the emergence and maintenance of psychopathology across development?

One could hypothesise a temporal sequence in which early emerging aspects of self- and other- meta-cognition are regulated by executive function, which in combination with temperamental vulnerability and environmental risk, lead to the

emergence of dysfunctional meta-cognitive beliefs. For example, the ability to regulate attention to threat and use strategies, such as distraction, may increase the experience of negative arousal. For children who perceive or experience threat within the environment, this could lead to the formation of positive beliefs about worry and attention to threat as a coping strategy, leading to perseverative processing of threat related material – a core feature of psychological disorder (Wells, 2008). This hypothesis is supported by evidence of biases to threat related material in maltreated children (Crick, bulletin, & 1994, n.d.; Dodge & Crick, 1990; Pollak & Tolley-Schell, 2003; Shackman & Pollak, 2014; Weiss, Dodge, Bates, & Pettit, 1992). Finally, beliefs about the danger and uncontrollability of thought may develop via cognitive and emotional socialisation processes within and outside of the family (e.g., cultural beliefs and social media). These are intriguing possibilities that have important implications for early identification of risk and prevention. Experimental paradigms may be used to manipulate exposure to socialisation material implicated here and test influence on reporting of meta-cognitive beliefs and affect (Kaltsi, Bucci, & Morrison, 2018). To thoroughly test these hypotheses, it will be necessary to perform longitudinal study of both typically developing and atypical populations.

Plans for dissemination

Paper one and two have been prepared for submission for publication in the academic journal, *Development and Psychopathology* (see Appendix 8). The trainee will present the findings of both papers to local clinicians, academics and service providers, including a regional Adoption Psychology service. A feedback report regarding paper two will be prepared for parents and shared via social media platforms. The findings will also be disseminated directly to relevant third sector organisations that have assisted with the research, for example Adoption UK and CoramBAAF.

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Appendix 1: Search terms

Search Terms¹

PsycINFO	Medline	Embase
	Executive function	
<i>Executive function</i>	<i>Executive function</i>	<i>Executive function</i>
Working memory	Working memory	<i>Working memory</i>
<i>Short term memory</i>	<i>Memory, short term</i>	<i>short term memory</i>
Planning	Planning	<i>Planning</i>
<i>Response inhibition</i>	Response inhibition	Response inhibition
Inhibitory control	Inhibitory control	Inhibitory control
<i>Set shifting</i>	Set shifting	Set shifting
Set shift*	Set shift*	Set shift*
<i>Task switching</i>	Task switching	Task switching
Task switch*	Task switch*	Task switch*
Neuropsychologic*	Neuropsychologic*	Neuropsychologic*
<i>Attention</i>	<i>Attention</i>	<i>Attention</i>
<i>Cognitive control</i>	Cognitive control	Cognitive control
Executive dysfunction	Executive dysfunction	Executive dysfunction
<i>Self-control</i>	<i>Self-control</i>	<i>Self-control</i>
<i>Delay of gratification</i>	Delay of gratification	Delay of gratification
Effortful control	Effortful control	Effortful control
<i>Self regulation</i>	Self regulation	Self regulation
Cognitive flexibility	Cognitive flexibility	Cognitive flexibility
Attention control	Attention control	Attention control
Temperament	<i>Temperament</i>	<i>Temperament</i>
BRIEF-P	BRIEF-P	BRIEF-P
Inhibition	<i>Inhibition (psychology)</i>	<i>Inhibition (psychology)</i>
	Outcomes	
PsycINFO	Medline	Embase
<i>Psychosocial development</i>	Psychosocial development	<i>Psychosocial development</i>
<i>Child psychiatry</i>	<i>Child psychiatry</i>	<i>Child psychiatry</i>
<i>Psychiatric symptoms</i>	Psychiatric symptoms	Psychiatric symptoms
<i>Adjustment disorders</i>	<i>Adjustment disorders</i>	<i>Adjustment disorder</i>
<i>Mental health</i>	<i>Mental health</i>	<i>Mental health</i>
Psychopathology	<i>Psychopathology</i>	Psychopathology
<i>Child psychopathology</i>	Child psychopathology	Child psychopathology
Emotional disorder	Emotional disorder	<i>Emotional disorder</i>
<i>Emotional disturbances</i>	Emotional disturbances	Emotional disturbances
<i>Mental disorders</i>	<i>Mental disorders</i>	<i>Mental disorders</i>
<i>Affective disorders</i>	Affective disorders	Affective disorder
Affective symptoms	<i>Affective symptoms</i>	Affective symptoms
<i>Internalization</i>	Internalization	<i>Internalization</i>
Internalizing	Internalizing	Internalizing

Internalisation	Internalising	Internalising
internalising	internalising	Internalisation mp
<i>Rumination</i> (cognitive process)	Rumination	Rumination
Worry	Worry	Worry
Mood	Mood	<i>Mood</i>
<i>Major depression</i>	<i>Depressive disorder, major or depressive disorder</i>	<i>Major depression</i>
<i>Depression (emotion)</i>	<i>Depression</i>	<i>Depression</i>
Mood disorder	Mood disorder	<i>Mood disorder</i>
Dysthymia	Dysthymia	<i>Dysthymia</i>
<i>Dysthymic disorder</i>	<i>Dysthymic disorder</i>	Dysthymic disorder
Unipolar depression	Unipolar depression	Unipolar depression
Depressive	Depressive	Depressive
<i>Anxiety</i>	<i>Anxiety</i>	<i>Anxiety</i>
<i>Separation anxiety disorder</i>	<i>Anxiety, separation</i>	<i>Separation anxiety</i>
<i>Anxiety disorders</i>	<i>Anxiety disorders</i>	<i>Anxiety disorder</i>
<i>Social anxiety</i>	Social anxiety	<i>Social anxiety</i>
<i>Social phobia</i>	<i>Social phobia</i>	<i>Social phobia</i>
<i>Generalized anxiety disorder</i>	Generalised anxiety disorder	<i>Generalized anxiety disorder</i>
Generalised anxiety	Generalized anxiety	Generalized anxiety
	Generalised anxiety	Generalised anxiety

¹Italics indicate MeSH terms.

Appendix 2: Completed quality assessment tool

Criteria	Paper: Bufferd et al (2014) www.ncbi.nlm.nih.gov/pmc/articles/PMC4111111/	Score
Explicit theoretical framework	Very general and brief description of the theory regarding predictors of depression. Limited explanation for choice of predictors in study.	2
Statement of aims/objectives in main body of report	<u>Yes</u> but not all explained	2
Clear description of research setting	Yes, some description	2
Evidence of sample size considered in terms of analysis	Brief mention in limitations section but no power calculation presented.	1
Representative sample of target group of a reasonable size	Yes	3
Description of procedure for data collection	Some description within measures section but not detailed explanation of full procedure. Unclear when each assessment was completed and where assessment took place.	2
Rationale for choice of data collection tool(s)	Rationale provided for some but not all measures	2

Detailed recruitment data	Described as from commercial mailing lists, unsure what this means or how obtained. Don't know how many contacted or how selected.	1
Statistical assessment of reliability and validity of measurement tool(s) (Quantitative only)	Some description, alphas and inter-rater	2
Fit between stated research question and method of data collection (Quantitative only)	Yes, clear fit. Longitudinal study fits question.	3
Fit between research question and method of analysis (Quantitative only)	Could have used latent variables in analysis. Some informant measures excluded due to small n's. EF not measured at follow-up.	2
Good justification for analytic method selected	Good description of analysis plan and justification. Not all variables explained e.g. unsure what 'low inhibitory control means'	2
Evidence of user involvement in design	No mention	0
Strengths and limitations critically discussed	Good discussion of strengths and limitations considers a range of issues.	3

Appendix 3: PROSPERO registration form

Systematic review

Please complete all mandatory fields below (marked with an asterisk *) and as many of the non-mandatory fields as you can then click *Submit* to submit your registration. You don't need to complete everything in one go, this record will appear in your *My PROSPERO* section of the web site and you can continue to edit it until you are ready to submit. Click *Show help* below or click on the icon to see guidance on completing each section.

1. * Review title.

Give the working title of the review, for example the one used for obtaining funding. Ideally the title should state succinctly the interventions or exposures being reviewed and the associated health or social problems. Where appropriate, the title should use the PI(E)COS structure to contain information on the Participants, Intervention (or Exposure) and Comparison groups, the Outcomes to be measured and Study designs to be included.

Do measures of executive function in infancy and pre-school predict internalising psychopathology: A systematic review.

2. Original language title.

For reviews in languages other than English, this field should be used to enter the title in the language of the review. This will be displayed together with the English language title.

3. * Anticipated or actual start date.

Give the date when the systematic review commenced, or is expected to commence.

02/10/2017 4. * anticipated completion date.

Give the date by which the review is expected to be completed.

31/05/2018 5. * Stage of review at time of this submission.

Indicate the stage of progress of the review by ticking the relevant Started and Completed boxes. Additional information may be added in the free text box provided.

Please note: Reviews that have progressed beyond the point of completing data extraction at the time of initial registration are not eligible for inclusion in PROSPERO. Should evidence of incorrect status and/or completion date being supplied at the time of submission come to light, the content of the PROSPERO record will be removed leaving only the title and named contact details and a statement that inaccuracies in the stage of the review date had been identified.

This field should be updated when any amendments are made to a published record and on completion and publication of the review.

The review has not yet started: No

Review stage	Started
Preliminary searches	No
Piloting of the study selection process	No
Formal screening of search results against eligibility criteria	Yes
Data extraction	No
Risk of bias (quality) assessment	No
Data analysis	No
Provide any other relevant information about the stage of the review here (e.g. Funded proposal, protocol not yet finalised).	

6. * Named contact.

The named contact acts as the guarantor for the accuracy of the information presented in the register record.

Catherine Kay **Email salutation (e.g. "Dr Smith" or "Joanne") for correspondence:**

Dr Kay **7. * Named contact email.**

Give the electronic mail address of the named contact.

catherine.kay@manchester.ac.uk

8. Named contact address

Give the full postal address for the named contact.

Clinical Psychology, 2nd Floor, Zochonis Building, University of Manchester,
Brunswick Street, Manchester, M13 9PL 9. **Named contact phone number.**

Give the telephone number for the named contact, including international dialling code.

07908962238 10. *** Organisational affiliation of the review.**

Full title of the organisational affiliations for this review and website address if available. This field may be completed as 'None' if the review is not affiliated to any organisation.

University of Manchester **Organisation web address:**

11. **Review team members and their organisational affiliations.**

Give the title, first name, last name and the organisational affiliations of each member of the review team. Affiliation refers to groups or organisations to which review team members belong.

Dr Catherine Kay. University of Manchester
Professor Adrian Wells. University of Manchester
Professor Jonathan Green. University of Manchester

12. *** Funding sources/sponsors.**

Give details of the individuals, organizations, groups or other legal entities who take responsibility for initiating, managing, sponsoring and/or financing the review. Include any unique identification numbers assigned to the review by the individuals or bodies listed.

Unfunded doctoral dissertation conducted at the

University of Manchester

13. *** Conflicts of interest.**

List any conditions that could lead to actual or perceived undue influence on judgements concerning the main topic investigated in the review.

None

14. Collaborators.

Give the name and affiliation of any individuals or organisations who are working on the review but who are not listed as review team members.

15. * Review question.

State the question(s) to be addressed by the review, clearly and precisely. Review questions may be specific or broad. It may be appropriate to break very broad questions down into a series of related more specific questions. Questions may be framed or refined using PI(E)COS where relevant.

To what extent do measures of executive function in infancy and pre-school predict internalizing problems? 16. * Searches.

Give details of the sources to be searched, search dates (from and to), and any restrictions (e.g. language or publication period). The full search strategy is not required, but may be supplied as a link or attachment.

PsycINFO, MEDLINE and Embase will be searched for records between 1990 and 21 Dec 2017. Restricted to English Language, Human populations, Infancy (1-23 month) and pre-school (24 month - 5 years) age groups. 17. URL to search strategy.

Give a link to the search strategy or an example of a search strategy for a specific database if available

(including the keywords that will be used in the search strategies).

https://www.crd.york.ac.uk/PROSPEROFILES/86822_STRATEGY_20180122.pdf

Alternatively, upload your search strategy to CRD in pdf format. Please note that by doing so you are consenting to the file being made publicly accessible.

Do not make this file publicly available until

the review is complete 18. * Condition or

domain being studied.

Give a short description of the disease, condition or healthcare domain being studied. This could include health and wellbeing outcomes.

Internalising psychopathology

e.g. depression, anxiety 19. *

Participants/population.

Give summary criteria for the participants or populations being studied by the review. The preferred format includes details of both inclusion and exclusion criteria.

Inclusion

1. Typically developing population
2. Participants have a mean age of 5 years when a measure of executive function is administered.
3. A measure of internalising psychopathology (anxiety, depression, worry, emotional disorder) is administered at a subsequent time point to the executive function measure.

Exclusion

1. Atypical population group, e.g. children with identified psychopathology, physical disability or characteristic e.g. ADHD, Autism, pre-term birth etc. 20. *

Intervention(s), exposure(s).

Give full and clear descriptions or definitions of the nature of the interventions or the exposures to be reviewed.

N/A 21. * Comparator(s)/control.

Where relevant, give details of the alternatives against which the main subject/topic of the review will be compared (e.g. another intervention or a non-exposed control group). The preferred format includes details of both inclusion and exclusion criteria.

N/A 22. * Types of study to be included.

Give details of the types of study (study designs) eligible for inclusion in the review. If there are no restrictions on the types of study design eligible for

inclusion, or certain study types are excluded, this should be stated. The preferred format includes details of both inclusion and exclusion criteria.

The review will include studies that use longitudinal multiple panel designs where a measure of executive function is administered at a mean age of ≤ 5 years old and a measure of internalising psychopathology (anxiety, depression, worry, emotional disorder) is administered for the same participant at a subsequent time point to the executive function measure. **23. Context.**

Give summary details of the setting and other relevant characteristics which help define the inclusion or exclusion criteria.

24. * Primary outcome(s).

Give the pre-specified primary (most important) outcomes of the review, including details of how the outcome is defined and measured and when these measurement are made, if these are part of the review inclusion criteria.

Measure of association between executive function (including inhibitory control, shifting, attention, working memory or planning) and internalising psychopathology (index of severity/presence of anxiety, depression, emotional disorder) e.g. reported Odds Ratio, Beta value, t statistic or correlation coefficient.

Timing and effect measures

Internalising psychopathology measured at a subsequent time to executive function measured during infancy and/or pre-school (mean age of ≤ 5 years old)

25. * Secondary outcome(s).

List the pre-specified secondary (additional) outcomes of the review, with a similar level of detail to that required for primary outcomes. Where there are no secondary outcomes please state 'None' or 'Not applicable' as appropriate to the review

None

Timing and effect measures

n/a

26. Data extraction (selection and coding).

Give the procedure for selecting studies for the review and extracting data, including the number of researchers involved and how discrepancies will be resolved. List the data to be extracted.

All titles and abstracts retrieved using the search strategy will be screened by one review author (CK) to identify studies that may meet the inclusion criteria outlined above. Twenty percent of titles will be screened by a second independent reviewer. Discrepancies will be discussed and further titles reviewed by the second reviewer if necessary. Inter-rater reliability will be calculated and reported. The full text of potentially eligible studies will be retrieved and assessed for eligibility by CK. Reasons for exclusion of full text studies will be recorded and reported.

A standardised pre-piloted form will be used to extract data from the included studies for assessment of quality and evidence synthesis. Extracted information will include study population and demographics, executive function and internalising measures including informant, length of time between administration of executive function and internalizing measures, age of participants at administration of measures, information for quality assessment.

27. * Risk of bias (quality) assessment.

State whether and how risk of bias will be assessed (including the number of researchers involved and how discrepancies will be resolved), how the quality of individual studies will be assessed, and whether and how this will influence the planned synthesis.

Risk of bias will be assessed using the standard quality assessment tool described by Sirriyeh et al (2011). The assessment will consider evidence of consideration of adequacy of sample size for analysis, specification of a-priori hypotheses, description of sample characteristics and recruitment, description of measures and data collection procedures, statistical assessment of reliability and validity of measures, fit of methodology to research question and aims, fit between research question and analysis methods, justification of analytic strategy, discussion of strengths and limitations.

Quality assessment will be carried out by CK. Thirty percent of studies will be assessed by an independent reviewer and inter-rater reliability will be calculated. Further discussion and review of quality assessment will be conducted should reliability be unsatisfactory, with the involvement of a third reviewer if necessary.

Studies will not be excluded on the basis of quality assessment but this will be considered in the discussion of study findings.

28. * Strategy for data synthesis.

Give the planned general approach to synthesis, e.g. whether aggregate or individual participant data will be used and whether a quantitative or narrative (descriptive) synthesis is planned. It is acceptable to state that a quantitative synthesis will be used if the included studies are sufficiently homogenous.

A narrative synthesis of findings from the included studies will be provided structured around the range of measures of executive function e.g. questionnaire versus laboratory; type of executive function task, e.g., attention, set-shifting etc., and outcome measures if appropriate. The synthesis will report extracted correlation and regression coefficients as measures of the magnitude of association between executive function and internalising outcomes. Comparison statistics (e.g., t tests and analyses of variance) and their effect sizes will also be included where relevant.

It is anticipated that heterogeneity will preclude a

quantitative synthesis.

29. * Analysis of subgroups or subsets.

Give details of any plans for the separate presentation, exploration or analysis of different types of participants (e.g. by age, disease status, ethnicity, socioeconomic status, presence or absence of comorbidities); different types of intervention (e.g. drug dose, presence or absence of particular components of intervention); different settings (e.g. country, acute or primary care sector, professional or family care); or different types of study (e.g. randomised or non-randomised).

It is not possible to specify subgroup analysis in advance.

30. * Type and method of review.

Select the type of review and the review method from the lists below. Select the health area(s) of interest for your review.

Type of review

Cost effectiveness

No

Diagnostic

No

Epidemiologic

No
Individual patient data (IPD) meta-analysis
No
Intervention
No
Meta-analysis
No
Methodology
No
Network meta-analysis
No
Pre-clinical
No
Prevention
No
Prognostic
No
Prospective meta-analysis (PMA)
No
Qualitative synthesis
No
Review of reviews
No
Service delivery
No
Systematic review
Yes
Other
No

Health area of the review

Alcohol/substance misuse/abuse
No
Blood and immune system
No
Cancer
No

Cardiovascular
No

Care of the elderly
No

Child health
No

Complementary therapies
No

Crime and justice
No

Dental
No

Digestive system
No

Ear, nose and throat
No

Education
No

Endocrine and metabolic disorders
No

Eye disorders
No

General interest
No

Genetics
No

Health inequalities/health equity
No

Infections and infestations
No

International development
No

Mental health and behavioural conditions
Yes

Musculoskeletal
No

Neurological
No

Nursing

No

Obstetrics and gynaecology
No

Oral health
No

Palliative care
No

Physiotherapy
No

Pregnancy and childbirth
No

Public health (including social determinants of health)
No

Rehabilitation
No

Respiratory disorders
No

Service delivery
No

Skin disorders
No

Social care
No

Tropical Medicine
No

Urological
No

Wounds, injuries and accidents
No

Violence and abuse
No

31. Language.

Select each language individually to add it to the list below, use the bin icon to remove any added in error. English

There is not an English language summary [32. Country.](#)

Select the country in which the review is being carried out from the drop down list. For multi-national collaborations select all the countries involved. England

33. Other registration details.

Give the name of any organisation where the systematic review title or protocol is registered (such as with The Campbell Collaboration, or The Joanna Briggs Institute) together with any unique identification number assigned. (N.B. Registration details for Cochrane protocols will be automatically entered). If extracted data will be stored and made available through a repository such as the Systematic Review Data Repository

(SRDR), details and a link should be included here. If none, leave blank.

34. Reference and/or URL for published protocol.

Give the citation and link for the published protocol, if there is one

Give the link to the published protocol.

Alternatively, upload your published protocol to CRD in pdf format. Please note that by doing so you are consenting to the file being made publicly accessible.

No I do not make this file publicly available until the review is complete

Please note that the information required in the PROSPERO registration form must be completed in full even if access to a protocol is given.

35. Dissemination plans.

Give brief details of plans for communicating essential messages from the review to the appropriate audiences.

Give words or phrases that best describe the review. Separate keywords with a semicolon or new line. Keywords will help users find the review in the Register (the words do not appear in the public record but are included in searches). Be as specific and precise as possible. Avoid acronyms and abbreviations unless these are in wide use.

Executive function; pre-school; infancy; internalising; childhood psychopathology; predictors of mental health; neuropsychological **37. Details of any existing review of the same topic by the same authors.**

Give details of earlier versions of the systematic review if an update of an existing review is being registered, including full bibliographic reference if possible.

38. * Current review status.

Review status should be updated when the review is completed and when it is published. Please provide anticipated publication date

Review_Ongoing

39. Any additional information.

Provide any other information the review team feel is relevant to the registration of the review.

40. Details of final report/publication(s).

This field should be left empty until details of the completed review are available.

Give the link to the published review.

Appendix 4: Ethical approval



Research Governance, Ethics and Integrity

2nd Floor Christie Building
The University of Manchester
Oxford Road
Manchester

M13 9PL

Tel: 0161 275 2206/2674

Email: research.ethics@manchester.ac.uk

Ref: 2017-0525-2638

27/04/2017

Dear Miss Catherine Kay, Prof Jonathan Green, Prof Adrian Wells

Study Title: Meta-cognition and Theory of Mind in Adopted Adolescents

University Research Ethics Committee 1

I write to thank you for submitting the final version of your documents for your project to the Committee on 21/04/2017 13:46 . I am pleased to confirm a favourable ethical opinion for the above research on the basis described in the application form and supporting documentation as submitted and approved by the Committee.

Please see below for a table of the title, version numbers and dates of all the final approved documents for your project:

Document Type	File Name	Date	Version
Advertisement	Participant advert version 1	04/01/2017	1
Participant Information Sheet	Information for Children	06/01/2017	1
Consent Form	Parental consent version 1	06/01/2017	1
Consent Form	Child Assent version 1	11/01/2017	1
Additional docs	Letter to SOCiAL parents_invite	11/01/2017	1
Additional docs	Participant advert version 1	11/01/2017	1
Topic Guide	Strange Stories	13/01/2017	1
Questionnaire	Background Questionnaire v1	13/01/2017	1
Questionnaire	SDQ_English(UK)_p4-17full	13/01/2017	1
Questionnaire	schoolagecbcl	13/01/2017	1
Questionnaire	MCQ A	13/01/2017	1
Questionnaire	TCQ-A final version	13/01/2017	1
Distress Protocol/Debrief Sheet	Distress Policy	20/04/2017	2
Additional docs	Supporting letter from Adoption UK	20/04/2017	1
Participant Information Sheet	Parental PIS v.2	20/04/2017	2

This approval is effective for a period of five years however please note that it is only valid for the specifications of the research project as outlined in the approved documentation set. If the project continues beyond the 5 year period or if you wish to propose any changes to the methodology or any other specifics within the project, an application to seek an amendment must be submitted for review. Failure to do so could invalidate the insurance and constitute research misconduct.

You are reminded that, in accordance with University policy, any data carrying personal identifiers must be encrypted when not held on a secure university computer or kept securely as a hard copy in a location which is accessible only to those involved with the research.

Reporting Requirements:

You are required to report to us the following:

1. [Amendments](#)
2. [Breaches and adverse events](#)
3. [Notification of progress/end of the study](#)

Feedback

It is our aim to provide a timely and efficient service that ensures transparent, professional and proportionate ethical review of research with consistent outcomes, which is supported by clear, accessible guidance and training for applicants and committees. In order to assist us with our aim, we would be grateful if you would give your view of the service that you have received from us by completing a **UREC Feedback Form**. Instructions for completing this can be found in your approval email.

Automatic Email from the UoM Ethical Review Manager (ERM) system: APPROVED: UREC
Amendment Ref: 2017-0525-4256 donotreply@infonetica.net

Sent: 20 November 2017 14:43

To: Catherine Kay; Adrian Wells; Jonathan Green

Cc: University Research Ethics Committee 1



The University of Manchester

Please ensure you read the contents of this message. This email has been sent via the Ethical Review Manager (ERM) system on behalf of the University of Manchester.

Dear Miss Catherine Kay,

Thank you for submitting your amendment request on 13/11/2017 13:26 for project: 2017-0525-4256 ; entitled: Meta-cognition and Theory of Mind in Adopted Adolescents which has now been approved. Your documentation has been suitably updated to reflect the proposed changes, please ensure you use this documentation. Please note that if you have submitted revised supporting documents to accompany your amendment request, the approved versions of these are listed in a table below.

Document Type	File Name	Date	Version
Additional docs	Parental PIS v.4	10/11/2017	4
Additional docs	Information for Children V 3	10/11/2017	3
Additional docs	Introduction letter to parents	10/11/2017	1
Additional docs	participant advert v4 word	13/11/2017	4
Additional docs	Contact Information v 2	13/11/2017	2

We wish you every success with the research.

Best wishes,

Dr Karen Lythe

Secretary to University Research Ethics Committee 1

Appendix 5: Participant information sheets



Social Outcomes and Early Life Experiences: Thoughts and Behaviour in Adolescence Participant Information Sheet

Researchers from the **University of Manchester** would like to invite you and your adolescent to participate in a new extension of the *Social Outcomes and Early Life Experiences (SOCiAL) study*.

Please take some time to read the following information carefully and talk it over with your family and friends if you wish. Please don't hesitate to **contact Catherine.kay@manchester.ac.uk** if there is anything that is not clear or if you would like further information. Full contact details are provided on the last page of this information sheet.

What is the Purpose of the Study?

The SOCiAL study is interested in understanding how individual children adapt in response to their early social environment. We are particularly interested in the social outcomes (how children think and respond in social situations) of children who have experienced different types of care in their early life. This might include changes of caregiver, maltreatment and other types of adversity. Previous research has shown that a subgroup of children may experience difficulties in their social relationships after such experiences. Our study aims to contribute to this understanding so that new and more effective approaches to helping these children may be developed in the future.

This new extension to the SOCiAL study is interested in finding out more about how children adapt during adolescence and whether the way in which they think about themselves and others changes over time and relates to behaviour or difficulties.

Why have we been invited to take part?

Adoption UK has kindly agreed to assist us in this study by inviting members to take part. Children who have been adopted have frequently experienced a change in their primary caregiver i.e. they have moved to a new home and a new family. Sometimes, they may also have had negative experiences in their very early life.

- We would like adopted children who are **aged 11 to 17 years old** and their families to take part in this research.
- Your child **does not** need to have experienced maltreatment or adversity to take part.

- Your child **does not** need to be having social difficulties at the moment to take part.

We are inviting all families who took part in the SOCiAL study to take part.

We are also inviting families who **have not yet** participated in the SOCiAL study to take part in the assessments detailed in this information sheet.

Do we have to take part?

No - your family **DOES NOT** have to take part. If you do decide to take part, you are free to change your mind and **withdraw** from the study at any point without giving any reason. If you would like, we will destroy any information that you have already provided as long as you notify us prior to the production of any written publications based on the data (i.e. a thesis or peer reviewed journal article).

What will happen if we decide to take part?

If you decide to take part you will need to provide consent using the online information and consent forms that can be found here:

<https://apps.mhs.manchester.ac.uk/surveys/TakeSurvey.aspx?PageNumber=1&SurveyID=SOCIAL2017&Preview=true> or by requesting and returning paper copies to us in a freepost envelope. Email Catherine.kay@manchester.ac.uk for paper copies of forms.

Your adolescent will also need to indicate that they are happy to take part. We will ask you to provide some contact details so that we can arrange to send you some postal questionnaires and complete a telephone interview with your child. This information will be stored on a secure server separately to the information that you provide in the questionnaires listed below.

There are three parts to the study:

2. An online or postal questionnaire about your adolescent's behaviour that will take about 10 minutes to complete. We would like your adolescent to complete an online or postal questionnaire about their thinking style (e.g. beliefs that thoughts can be dangerous) that will take about 20 minutes to complete.
3. A postal questionnaire for you to complete about your adolescents' feelings and behaviour (15 mins). If you have **not** previously participated in the SOCiAL study, we will also send you a questionnaire about your adolescents' early experiences. We will provide a freepost envelope for return. Alternatively, we can complete these in a telephone call with you if you wish.
4. We will arrange to speak to your adolescent on the telephone to complete a short task that aims to understand how they think about other peoples' thoughts, taking about 10 minutes. **This is optional.**

What are the possible benefits of taking part?

The results of this research may help to inform future studies, the development of interventions for children who experience social difficulties and will be used in dissemination activities that aim to inform service development and policy (see 'what will happen to the results of the study?' below).

Adolescents will be provided with a £5 gift card for taking part.

Will our participation be confidential?

- All the information that you provide us with will be kept completely CONFIDENTIAL and will not be shared with anyone outside of the research team.
- The only exception to this rule of confidentiality is if you or your child discloses information which indicates that they may be at risk of harm.
- You will be allocated with an identification number which will appear on all of your information so that it cannot be identified as yours by anyone other than the research team.
- Your name, your child's name or any other identifiable information will not appear on any reports of results that we produce.

What will happen to our information?

The University of Manchester has strict policies and procedures concerning the use and storage of personal information:

- All information will be stored in locked cabinets in a special office in a secure, access restricted building at the University of Manchester.
- Any personal information (i.e. your name, address and phone number) will be stored on a secure, encrypted database which will be located on a password protected hard drive on the University of Manchester server. This will be accessible to members of the research team only and will not be stored on laptops or other portable storage devices.

If you have any questions about what will happen to your information please don't hesitate to contact Dr Catherine Kay on Catherine.kay@manchester.ac.uk

What will happen if my adolescent or I become distressed or do not want to complete a part of this study?

It is up to you and your child to decide whether or not to take part. If you do, you will be given this information sheet to keep and be asked to sign a consent form. Even after you have given us your consent to take part in an interview you are still free to withdraw at any time and without giving a reason.

It is not possible to say in advance whether something may come up in the interviews or assessments that someone may find upsetting or difficult. However, if you do find a topic or question upsetting then you will not have to answer it. We will remind adolescents that they are free to tell us, at any time, if they do not wish to answer a particular question or that they do not wish to continue. It is up to you and your child, how much or how little information you want to share with us.

If you or anyone else becomes distressed whilst completing any aspect of this study then we would request that you discontinue the questionnaire or interview if you like and contact your GP, local health service provider or Childline (0800 1111) for assistance. Please also contact Dr Kay on Catherine.kay@manchester.ac.uk to inform us of any problems. Please note that this address is not continually monitored so cannot be used in emergency.

What will happen to the results of the study?

The results of the study will be published in journals for professionals and researchers as well as publications and newsletters for adoptive parents and children. The researchers have a track record of disseminating results of previous phases of the study to policy makers and professionals involved in service design and policy surrounding adoption support and mental health services. The results of the present study will be similarly disseminated. The details of people who took part in the study will not be recognisable in any of these publications or dissemination work. All participants will receive a summary of the results within six months of end of the study.

Who is organising the research?

This study is being completed as part of Dr Catherine Kay's thesis for the Doctorate in Clinical Psychology at the University of Manchester. Professor Adrian Wells and Professor Jonathan Green are supervising the research conduct. We are being kindly assisted by Adoption UK.

All Researchers hold valid enhanced Disclosure and Barring Service Check.

How do I take part?

Once you have read all of the information provided, are happy that you and your family understand what is involved and would like to take part, please complete the attached or online **consent form (link)**. Write your initials/tick the appropriate boxes and sign your name at the bottom. You can return it to us at the address below. Alternatively contact a researcher via any of the methods listed below.

CONTACT INFORMATION

If you would like more information about the study or you have any questions about it please contact:

Dr Catherine Kay
Catherine.kay@manchester.ac.uk

Professor Adrian Wells
adrian.wells@manchester.ac.uk

Professor Jonathan Green
Jonathan.green@manchester.ac.uk

Dr Catherine Kay
Division of Clinical and Health Psychology
2nd Floor, Zochonis Building
University of Manchester
Manchester
M13 9PL

Thank you for taking the time to read this information



Social Outcomes and Early Life Experience Information for Children

Researchers from the **University of Manchester** would like to invite you and your family to take part in the study that is part of the *Social Outcomes and Early Life Experience – SOCiAL study*. This sheet will tell you about the study. You can talk it over with your family and contact the researchers if you have any questions.

What is the Research About?

We want to learn more about the way that young people think about themselves and other people, especially as they're getting older.

Some young people may have problems getting along with their family and friends or feel bad sometimes. We would like to help find out why this is. This could help us to think of better ways to help children who have problems in the future.

Who can take Part?

Young people who have been **adopted** and are **aged 11 to 17 years old** can take part.

You **do not** need to be having any problems to take part.

What will happen if we take part?

Your parent/s will be asked to tell us that you are happy to take part in the research. We will ask your parent/s to do some questionnaires about your early childhood, how you're getting on now (e.g. whether you're happy a lot or sometimes sad). We will also ask you to fill in some questionnaires about your thoughts and to speak to a researcher to answer some questions about some short stories.

What will I be asked to do?

1. Fill in a questionnaire on a special website on the Internet or on paper that we will send you in the post. It will take about 20 minutes to fill in.
2. Talk to a researcher on the phone for about 10 minutes. The researcher will read you some short stories about people in different situations and ask you a few questions about them. There are no right or wrong answers; we're just interested in what you think about the stories. **This is optional.**

Will I get anything for taking part?

You will be given a £5 gift voucher for taking part. You will be given a choice of voucher e.g. Argos, Amazon or Love 2 Shop. The voucher will be sent to you in the post soon after you have finished taking part in the study. The results of the study will also be used to try and help young people who have social difficulties and adoptive families in the future.

Will anyone else find out what I say or do if I take part?

- Nobody outside of the research team and your parents/guardians will find out what you say or do when taking part in the research.
- **But** – if you said something that made the researchers think that you or someone else is at risk of harm, we would have to decide who we tell about this.
- You will be given an identification number so that your name will not be written on any of your information or results.

What happens if I don't want to answer all the questions?

If you find a question upsetting or too hard to answer, then you will not have to answer it. If you feel tired during the tasks, you can have a break or choose to finish the tasks another time.

Contact Information

If you would like more information about the study or you have any questions about it please contact:

Dr Catherine Kay
Catherine.kay@manchester.ac.uk

Professor Adrian Wells
adrian.wells@manchester.ac.uk

Professor Jonathan Green
Jonathan.green@manchester.ac.uk

Appendix 6: Consent forms



**Social Outcomes and Early Life Experience:
Thoughts and Behaviour in Adolescence
Parental Consent**

This form tells us whether you consent to your child taking part in this study. Once you have read and understand the information provided please read ALL the statements below and initial the boxes to tell us that you agree. If you would like further information, please contact Catherine Kay on catherine.kay@manchester.ac.uk

	Initial
1. I confirm that I have read the information sheet for parents (version 4) on the above project and have had the opportunity to consider the information, ask questions and had these answered satisfactorily.	Initials
2. I confirm that my child is adopted and is currently aged between 11 and 17 years old.	Initials
3. I understand that my family’s participation in the study is voluntary and that we are free to withdraw at any time without giving a reason and without detriment to us.	Initials
4. I consent to my child taking part in this research.	Initials

Name of Parent _____

Name of Child _____

Child DOB: _____

Date today: _____

Social Outcomes and Early Life Experience
Young Person Assent Form

This Consent form forms part of the **Information Sheet for Young People** version 3. This form tells us whether you agree to take part in the study. Please read ALL of the sentences below and initial the boxes if you agree with them. If you have any questions you can contact Catherine Kay on catherine.kay@manchester.ac.uk

5. I have read the information for young people.

Initials
Initials
Initials
Initials
Initials

6. I have asked all of the questions that I want and had the answers explained to me.

7. I understand that I do not have to take part, I can stop taking part at any time and there will be no bad effects for me, my family or my care.

8. I agree to take part in the study.

Your name	Date	Signature
Your parent or guardian must write their name here too if they are happy for you to do the project.		
Parents name	Date	Signature

If you DO want to take part, please write your name and today's date.

Appendix 7: Research proposal

University of Manchester
Clin.Psy.D
Large Scale Research Project
Proposal Submission Proforma

Do not exceed the physical limits of this form - should not be double sided

Name	Catherine Kay
Title of Project	Relationship between meta-cognitive beliefs, theory of mind and psychopathology in children who have experienced early adversity.
Is this LSRP linked to another LSRP? No	If so, please provide name(s) of other trainee(s): N/A
Supervisor(s)	
First academic supervisor	Professor Adrian Wells
Second academic supervisor	Professor Jonathan Green
Clinical/Field supervisor	N/A

Checklist for submission with proforma

- Letters of support from service leads/managers (NOT field supervisor) indicating willingness to support research where recruitment involves input from external agencies (e.g., clinical services, charitable organisations, etc.)
- Other supporting documentation as appropriate (e.g., correspondence with pols)
- Questionnaires [if appropriate]
- Interview schedule [if applicable]
- Online requirements discussed with Austin Lockwood [if applicable]

INTRODUCTION

Children who experience maltreatment and adversity show high rates of psychopathology (Meltzer et al, 2003; Ford et al, 2007), attachment disorder (Zeanah et al, 2002; Kay and Green, 2013; Kay et al, 2016) and autistic spectrum conditions (ASC; Green, Leadbitter, Kay & Sharma, 2016). Such children are frequently placed in substitute looked after care (LAC) or with adoptive families and present a significant clinical challenge – with multiple co-morbid forms of psychopathology being common. There is currently a dearth of evidence-based interventions for these groups.

Important questions remain regarding the underlying developmental and cognitive mechanisms of childhood psychopathology following maltreatment and disrupted care, with the potential to inform intervention. Models of adult psychopathology suggest that biases in the self-regulation of thought – *metacognition* (beliefs about thoughts and biases in thought processes) - are a central process in the development and maintenance of psychopathology (Wells, 2009). Metacognitive biases (MCB) have been implicated in the development and maintenance of a range of anxiety disorders, depression, psychosis and bipolar disorder (Mansell, Morrison, Reid, Lowens & Tai, 2007; Morrison, French & Wells, 2007; Wells, 2009). This has led to the development of psychological intervention approaches for adults based on identifying and altering MCB (Wells, 2009). Recent research extends MCB theories of psychopathology to child and adolescent populations, finding similar associations between MCB and psychopathology (Myers, 2012). MCB have also been shown to mediate the relationship between emotional abuse and negative affect in young adults (Myers and Wells, 2015). No research has explored MCB in maltreated children or adolescents, or whether MCB play a mediating role in the relationship between maltreatment and childhood psychopathology.

Another growing body of literature suggests that deficits and biases in social cognition (the thought processes that facilitate social understanding and interaction) may be implicated in childhood psychopathology and developmental disorders. Most notably, a deficit in *'theory of mind'* (ToM) - the ability to recognize that others have thoughts, intentions and feelings that differ from ones' own - has been observed in ASC (Baron-Cohen, Leslie & Frith, 1985). Genetically informed and observational studies show that ToM development is susceptible to the quality of early social environmental as well as genetic influence (Hughes et al., 2005), and there is growing evidence that the quality of early parent-child interaction is important for ToM development (Dunn, Brown, Slomkowski, Tesla & Youngblade, 1991; Ensor, Spencer & Hughes, 2011; Meins et al., 2003). ToM deficits have been reported in young maltreated children (Cicchetti et al., 2003), maltreated foster children (Pears and Fisher, 2005) and maltreated adolescents in UK LAC (Kay & Green, 2015). Deficits in ToM have been found in association with childhood attention deficit hyperactivity disorder (ADHD), conduct disorder, early onset psychosis and bipolar

disorder (Poletti & Adenzato, 2013). Few studies have examined association between ToM and internalising disorders in childhood or adolescence.

The present study aims to investigate whether MCB and deficits in ToM mediate the relationship between early adverse experience and psychopathology in a sample of adolescents adopted from UK LAC. The relationship between MCB and ToM with both internalising and externalising psychopathology will be explored in order to establish whether there is evidence of differential independent associations e.g. is ToM an independent predictor of externalising psychopathology whilst MCB predicts emotional disorder? Associations between ToM deficits and MCB will also be explored for the first time.

OUTLINE OF PROPOSED LITERATURE REVIEW

Provisional title: A systematic review and meta-analysis of executive function tasks in children and adolescents following early adverse experience.

Aims: The main aim will be to review the evidence for an association between executive function (EF) and early adverse experience in children and adolescents. It will explore variation in performance on EF tasks in association with; i) task characteristics e.g. aspect of executive function under study; ii) sample characteristics e.g. age, gender, IQ; iii) type and/or timing of adverse experience e.g. familial maltreatment or institutional rearing and iv) psychopathology. It will also explore whether there is any evidence to support the hypothesis that EF abilities mediate the relationship between early adverse experience and psychopathology.

Justification: Executive function (EF) refers a set of higher order cognitive processes that enable goal-directed behaviour and adaptive responses to the environment, including inhibitory control, cognitive flexibility and working memory (Hughes, Graham, & Grayson, 2004). EF is crucial for self-regulation of emotion and behaviour and is thought to support both ToM development and meta-cognitive processes (Fernandez-Duque, Baird & Posner, 2000; Carlson & Moses, 2001). EF deficits have been associated with a range of psychopathology, including ADHD, conduct disorder and emotional disorders (Pennington & Ozonoff, 1996). Rapid development of EF abilities is thought to occur during infancy and early childhood, which is influenced by the quality of parent-child interactions (Fay-Stammach, Hawes & Meredith, 2014). EF may therefore be compromised by exposure to more adverse childrearing experiences, such as maltreatment and psychosocial deprivation. Deficits in EF may mediate the relationship between such experiences and subsequent psychopathology.

Feasibility: A recent review of the literature on neurocognitive deficits in children and adolescents following maltreatment identified 16 empirical studies that used measures of EF (Kavanaugh et al, 2016). This review did not include studies of children who have experienced other types of early adverse care e.g. psychosocial deprivation in institutional settings, and did not perform a meta-analysis of the study data. A scoping exercise using Scopus found approximately 14 additional papers.

AIMS AND HYPOTHESES

State the principal aims of the research, hypotheses to be tested, and also subsidiary hypotheses or questions to be investigated.

Aim: Investigate whether meta-cognitive biases (MCB) and deficits in theory of mind (ToM) mediate or moderate the relationship between early adverse experience and psychopathology in adolescence.

Main Hypotheses:

1. Early adverse experience will be positively associated with deficits in ToM
2. Early adverse experience will be positively associated with MCB.
3. Early adverse experience will be positively associated with psychopathology.
4. MCB will be positively associated with psychopathology
5. Deficits in ToM will be positively associated with psychopathology

Exploratory Research Questions:

1. Is the relationship between early adverse experience and psychopathology dependent on ToM deficits and/or MCB?
2. Are MCB or ToM deficits independent predictors of externalising or internalising psychopathology?
3. Is there an association between MCB and ToM deficits?

METHOD

STUDY DESIGN

The study will be a longitudinal repeated measures cohort study. Data on ToM, MCB and psychopathology will be collected at two time points in order to perform tests of mediation (see analysis section).

PARTICIPANTS

Participants will be 60 adolescents who have been adopted from UK local authority care.

Inclusion criteria

- Adopted from UK local authority care
- Age 11-16 years at the time of recruitment.

Exclusion criteria

- Learning disability or severe mental health problem that precludes completion of self-report questionnaires.

RECRUITMENT STRATEGY

Recruitment will be via an existing sample of 60 adopted children and adolescents (current mean age = 13 years) who consented to take part in the Social Outcomes and Early Life Experiences (SOCiAL) Study (see Kay et al, 2016). All participants agreed to be contacted about further research. Eighty percent of the sample was retained in a recent two-year follow-up study. Based on this retention rate, it is anticipated that 42 of these adolescents will be included in the present study. The sample will be supplemented by recruitment of a new sample of adopted adolescents via advertisement on the Adoption UK charity website and information materials. Potential participants will be provided with a link to the online study information and consent forms (see procedure below).

POWER CALCULATION/EXPECTED NUMBER OF PARTICIPANTS

A meta-analysis of studies investigating the relationship between MCB and psychopathology in adolescents found an average effect size of $r = 0.49$ for the relationship between negative beliefs about worry and psychopathology (Myers, 2012). Assuming that $r = 0.49$, 90% power ($\beta = .01$) and 95% probability ($\alpha = 0.05$, two-tailed), 42 participants would be required for bivariate correlation analysis. A sample size of 50 will allow 5 simultaneous predictors of psychopathology to be entered in to multiple regression analysis (ToM, MCB, age, gender and language). A further 10 participants will be required to allow for a 20% rate of attrition. 60 participants will be recruited to the study in total.

MEASURES

Early adversity: care history (age-at-entry to care, number of care placements, age at adoption) and maltreatment experiences (category and severity of maltreatment) will be collected from adoptive parent questionnaire used in SOCiAL (Kay et al, 2016). Existing data will be used for participants of the SOCiAL study.

Theory of mind: The Strange Stories advanced test of ToM (Happé, 1994) will be used. It has been used to identify ToM deficits in maltreated adolescents (Kay & Green, 2015) and in SOCiAL (Kay & Green, in preparation). It was validated against false-belief paradigms traditionally used to assess ToM (Happé, 1994) and includes a set of stories designed to control for task demands such as attention and comprehension (White, Hill, Happé & Frith, 2009).

Meta-cognitive biases: The Meta-cognitions Questionnaire-Adolescent version (MCQ-A; Cartwright-Hatton et al, 2004) is a 30-item self-report questionnaire assessing beliefs about worry and intrusive thoughts in adolescents. Five subscales assess positive beliefs about worry, uncontrollability and danger beliefs, cognitive confidence, superstition, punishment and responsibility beliefs and cognitive self-consciousness. The scale has good psychometric properties (Cartwright-Hatton et al, 2004). The Thought Control Questionnaire Adolescent Version (TCQ-A; Gill, Papageorgiou, Gaskell & Wells, 2013) is a 28-item self-report questionnaire assessing strategies used to control unpleasant or unwanted thoughts. It has good internal consistency, retest reliability and concurrent validity (Gill et al, 2013).

Psychopathology: Parents will complete the Strengths and Difficulties Questionnaire (SDQ; Goodman, Ford, Simmons, Gatward & Meltzer, 2000); a brief screening questionnaire designed to assess common emotional and behavioural difficulties. Established cut-offs for emotional, behavioural, hyperactivity and total problem sub-scales have good sensitivity and positive predictive value for mental health disorder in looked after children (Goodman et al, 2004). To assess a broad range of psychopathology, the Child Behaviour Checklist (CBCL; Achenback & Edelbrock, 1983) will also be used. Ninety-nine items assess internalising and externalising psychopathology, producing eight empirically derived and six DSM oriented sub-scales. CBCL have good internal consistency and concurrent validity (Ebesutani et al, 2009).

Language and intellectual ability: Parents will be asked if the adolescent has a known intellectual disability or language impairment, a health and education plan or statement of special educational needs, has received additional support for learning or attends a special educational needs school or unit. This information will be used to control for language and intellectual ability in multivariate analysis using ToM and MCB data.

PROCEDURE

Informed Consent: Potential participants will be sent a link to online participant information and consent forms **for parents and young people** to gain informed consent and contact information. The researcher will ensure that consent has been obtained from both parents and young people during the course of the telephone interview.

T1 data collection: Once consent has been obtained parents will be invited to complete an online questionnaire (discussed and agreed with Austin Lockwood) including demographics, language, intellectual ability and the SDQ (approx 15 minutes completion time). Young people will be invited to complete the MCQ-A and TCQ online (approx 20 mins). Following this, the early adversity questionnaire will be posted to parents of those who did not participate in the SOCiAL study, with a freepost envelope for return. Data on early adversity was previously collected in the same manner for participants of the SOCiAL study. All families will be contacted to arrange a telephone appointment to complete the Strange Stories task with the young person (approx 20 mins) and CBCL with the parent (approx 10 mins). The Strange Stories will be read aloud by the experimenter and responses recorded verbatim for subsequent scoring. Participants (parents and young people) will be encouraged to contact the researcher if they become distressed at any point during completion of the study. This will be outlined on the information sheets and at the end of online questionnaires. The researcher will also provide debriefing during the telephone assessment.

T2 data collection: 3 months following completion of T1 data collection, the family will be sent a link to complete the online SDQ, MCQ-A and TCQ for a second time. The Strange Stories and CBCL will be completed in a second telephone interview using the same procedures.

STATISTICAL ANALYSIS

Data will be analysed using the latest version of SPSS.

Descriptive statistics will be used to examine the distribution of scores on the MCQ-A, TCQ, Strange Stories, CBCL and SDQ, and to explore maltreatment and care history experience in the sample.

Univariate analysis: bivariate correlation will be used to test the associations predicted in hypotheses 1-5 between adverse experience and ToM, MCB and psychopathology, both cross-sectionally and longitudinally. Association between

ToM deficits and MCB will also be tested using bivariate correlation analysis to explore research question 3.

Multivariate analysis: multiple regression analysis will be used to test whether there are unique relationships between adverse experience, ToM, MCB and psychopathology whilst controlling for age, gender and language (hypothesis 1-5). Path analysis will be used to test whether any relationship between early adverse experience and psychopathology is mediated or moderated by variance in T1 ToM and MCB scores (exploratory question 1). Independent relationships between ToM, MCB and externalising and internalising psychopathology on the CBCL will also be tested using multiple regression analysis controlling for age, gender and language (exploratory question 2).

CONTINGENCY PLAN

In the event that it is not possible to recruit a suitable number of new participants to the study to reach the target sample size *or* that it is not possible to complete the proposed data collection in full (e.g. all data at both T1 and T2), the following contingency plan will be put in place:

- Data on ToM, psychopathology (SDQ) and early adversity is available for the SOCiAL sample of adopted children at age 6-11 (n = 60) and 8-13 (n = 50).
- Data on MCB and concurrent psychopathology (SDQ/CBCL) will be collected for the present SOCiAL cohort (n = 42) and any additional participants recruited at that time. If possible, data on ToM will also be collected.
- This data will be used to test hypotheses 1 – 5 regarding the relationship between adverse experience, MCB, ToM and psychopathology.
- The relationship between ToM and MCB will also be explored (research question 3).

This would provide the basis for a novel and highly feasible study.

The contingency plan will be implemented if it has not been possible to recruit and collect both data points for a suitable number of participants by November 2017. In addition to this, the trainee will prioritise recruitment and initial data collection, should there be difficulties in recruitment, so that there is a sufficient sample for testing of hypothesis 1-5.

COSTS

CBCL: record forms x 3 packs = £75

CBCL hand scoring templates x 4 packs = £100

CBCL DSM oriented scoring templates x 3 packs = £75

CBCL reusable templates = £11

CBCL manual = £11

Attendance at 1 day of the BPS developmental section annual conference = £112

Payment of parent advisor = £15/1 hour

Total cost = £399

TIME BUDGET

The time budget has been designed to allow sufficient time for recruitment (10 months = 6 participants/month) and for 3 month follow-up data collection at the end of recruitment (Oct-Dec 2017). The average number of data collection points will be 9 per month. The systematic review and data preparation will be conducted alongside recruitment and data collection. Thesis preparation will begin in September 2017.

	2016				2017					2018			
	Sep	Oct	Nov	Dec	Jan - Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
Submit proposal													
Prepare ethics													
Submit ethics													
Systematic review													
Ethical approval													
Recruitment													
Data collection													
Data preparation													
Thesis preparation													
Analysis													
Thesis Submission													

PATIENT AND PUBLIC INVOLVEMENT (PPI)

Findings will inform the development of models of mediation of outcome in children who have experienced early adversity. This will have implications for developmental cognitive models of psychopathology in childhood and adolescence, relevant to caregivers, charities, clinical, health, social care and education professionals. Although such models have been substantially researched, validated and translated in to clinical practice for adult populations, similar research with children and adolescents is only just emerging. There are a dearth of evidence based psychological interventions for childhood psychopathology, particularly following maltreatment and adversity.

Adoptive parents who provided consultation on the SOCiAL study reported significant difficulties in accessing appropriate support, particularly from Child and Adolescent Mental Health Services, and felt a sense of blame by professionals for their child's continuing difficulties. They welcome research that aims to further understand the developmental impact of early adversity and maintenance of difficulties, which may inform future intervention and raise awareness of the nature of their families' needs.

Adoptive parents will be further consulted in the preparation of the ethical application, participant information materials and final data collection protocol to ensure acceptability and feasibility of the study. A parent advisor will be identified and consulted.

BRIEF SUMMARY OF PROPOSAL IN LAY TERMS (200-300 WORDS)

Research shows that children and young people who have been abused or neglected are more likely to develop mental health problems. This research will look at whether abuse and neglect affects the way that young people think about their own thoughts, e.g. 'thoughts are dangerous and need to be controlled'. It will also look at how well young people can think about other people's thoughts, e.g. other people have thoughts that are different to their own. It will test whether differences in thinking about own and others thoughts are related to mental health problems. This will provide information on how abuse and neglect leads to mental health problems. It may also show new ways to treat these problems, e.g. by improving understanding of other peoples thoughts or by changing how they think about their own thoughts. A group of 60 adopted young people aged 11 to 16 years old will be asked to do some questionnaires and interviews. These will show the way they think about their own thoughts and if they are able to think about other people's thoughts. Their adoptive parents will be asked for information about the young persons history of abuse and neglect and their mental health problems. The information will be used to see whether there is a relationship between abuse and neglect, thoughts about own and others thoughts and mental health problems.

Flesch-Kincaid Reading Ease = 69.6

DIFFICULTIES

Recruitment – recruitment will be closely monitored to ensure that it progresses within the proposed time frame. If problems are identified steps will be taken to broaden the recruitment pool by contacting additional adoptive parent groups and charities. The Trainee and second supervisor have previously collaborated with several large adoption charities. However, previous experience on the SOCiAL study has shown that adoptive families are highly motivated to take part in research.

Participant retention –Retention rates and follow-up time-frames will be monitored. Effects of variation in follow-up time on the main outcomes will be explored in analysis and controlled if necessary. The total sample size has been adjusted to allow for a 20% rate of attrition at follow-up. If attrition exceeds this value efforts will be made to recruit additional participants. If this is not possible, the contingency plan set out above will be put in place. The trainee is experienced in retaining participants for research and will adapt the protocol in the event that data collection is found to be unacceptable or unfeasible.

Language and intellectual ability – it will not be possible to obtain a standard measure of language or IQ, although subtests of the CELF-4 language assessment are available at age 6-11 and 8-13 years in the SOCiAL cohort. Language and intellectual ability may confound analyses that use the ToM and MCB measures, increasing the chance of type-2 error. The ToM measure includes a control task that may eliminate some of this confound. No association between CELF-4 scores and ToM was found in the SOCiAL sample at age 6-11 or 8-13 years. This study will use parent report indices of language and intellectual ability as outlined in the measures section. These will be validated against existing CELF-4 scores in the SOCiAL cohort.

QUESTIONS FOR THE COMMITTEE

List any questions that you would like the committee to advise on.

KEY REFERENCES

Provide up to 10 (max) key references

Cartwright-Hatton, S., Mather, A., Illingworth, V., Brocki, J., Harrington, R. & Wells, A. (2004). Development and preliminary validation of the Meta-cognitions Questionnaire – Adolescent version. *Journal of Anxiety Disorders*, 18, 411-422.

Goodman, R., Ford, T., Corbin, T & Meltzer, H. (2004). Using the Strengths and Difficulties Questionnaire (SDQ) multi-informant algorithm to screen looked-after children for psychiatric disorders. *European Child and Adolescent Psychiatry*, 13, 1125-1131.

Kay, C., Green, J. & Sharma, K. (2016). Disinhibited Attachment Disorder in UK Adopted Children During Middle Childhood: Prevalence, Validity and Possible Developmental Origin. *Journal of Abnormal Child Psychology*, doi:10.1007/s10802-016-0131-2.

Kay, C., & Green, J. (2016). Social cognitive deficits and biases in maltreated adolescents in UK out-of-home care: Relation to disinhibited attachment disorder and psychopathology. *Development and Psychopathology*, 28, 73-83.

Meltzer, M., Gatward, R., Corbin, T., Goodman, R., & Ford, T. (2003). *The Mental Health of Young People Looked After by Local Authorities in England*. The Stationery Office: London.

Myers, S. & Wells, A. (2015). Early trauma, negative affect and anxious attachment: the role of metacognition. *Anxiety, Stress and Coping: An international journal*, 28, 634-649.

Myers, S. (2012). *A study on the relationship between early experience, metacognition and negative affect*. Unpublished Thesis, University of Manchester: Manchester, UK.

Poletti, M. & Adenzato. (2013). Theory of mind in non-autistic psychiatric disorders of childhood and adolescence. *Clinical Neuropsychiatry*, 10, 188-195.

Wells, A. (2009). *Metacognitive Therapy for Anxiety and Depression*. The Guilford Press: New York.

Appendix 8: Development and Psychopathology author guidelines

Development and Psychopathology strongly encourages contributions from a wide array of disciplines because an effective developmental approach to psychopathology necessitates a broad synthesis of knowledge. Manuscripts will be considered that address, for example, the causes and effects of genetic, neurobiological, biochemical, cognitive, or socioemotional factors in developmental processes with relevance to various risk or psychopathological conditions. The journal also seeks articles on the processes underlying the adaptive and maladaptive outcomes in populations at risk for psychopathology.

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Please follow the complete instructions on this website to avoid delays. The instructions will prompt the author to provide all necessary information, including the corresponding author's contact information, which includes complete mailing address, phone and fax numbers, and an e-mail address. The website also requests suggested reviewers. The website will automatically acknowledge receipt of the manuscript and provide a manuscript reference number. The Editor-in-Chief will assign the manuscript to an Editor who will choose at least two other reviewers. Every effort will be made to provide the author with a rapid review. If the Editor requests that revisions be made to the manuscript before publication, a maximum of 3 months will be allowed for preparation of the revision. For additional information on the new online submission and review system, please read the Tutorial for Authors or the Tutorial for Reviewers available from ScholarOne Manuscripts.

Manuscript Preparation and Style

General. All manuscripts must be provided in MSWord format in 12-point type with 1-in. margins on all sides. The entire manuscript must be double-spaced and numbered consecutively. The language of publication is English.

Style and Manuscript Order. Follow the general style guidelines set forth in the *Publication Manual of the American Psychological Association* (6th ed.). The Editor may find it necessary to return manuscripts for reworking or retyping that do not conform to requirements. Do not use embedded references, end notes, or bookmarks. Manuscripts must be arranged in the following order:

Title Page. To facilitate blind review, all indication of authorship must be limited to this page, which should be submitted as a separate file. Other pages must only show the short title plus page number at the top right. The title page should include the (a) full article title; (b) name and affiliations of all authors; (c) acknowledgments; (d) mailing address and telephone number of the corresponding author; (e) address of where to send offprints, if different from the corresponding author; and (f) a short title of less than 50 characters.

Acknowledgments. These should be placed below the affiliations. Use this section to indicate grant support, substantial assistance in the preparation of the article, or other author notes.

Abstract Page. Include (a) a full article title, (b) an abstract of no more than 200 words, and (c) up to five keywords for indexing and information retrieval.

Text. Use a standard paragraph indent. Do not hyphenate words at the ends of lines or justify right margins.

References. Bibliographic citations in the text must include the author's last name and date of publication and may include page references. Examples of in-text citation style are Cicchetti (2002), Durston (2008, pp. 1133–1135), Hunt and Thomas (2008), (Hunt & Thomas, 2008), (Posner, Rothbart, Sheese, & Tang, 2007), and subsequently (Posner et al., 2007). If more than one, citations must be in *alphabetical* order. Every in-text citation must be included in the reference section; every reference must be cited in the text. Examples of reference styles:

Journal Article

Haltigan, J. D., Roisman, G. I., & Fraley, R. C. (2013). The predictive significance of early caregiving experiences for symptoms of psychopathology through midadolescence: Enduring or transient effects? *Development and Psychopathology*, 25, 209–221.

Book

Buss, A., & Plomin, R. (1984). *Temperament: Early developing personality traits*. Hillsdale, NJ: Erlbaum.

Chapter in an Edited Book

Gottlieb, G., & Willoughby, M. T. (2006). Probabilistic epigenesis of psychopathology. In D. Cicchetti & D. Cohen (Eds.), *Developmental psychopathology* (Vol. 1, 2nd ed., pp. 673–700). Hoboken, NJ: Wiley.

An Endnote style that reflects the *Publication Manual of the American Psychological Association* (6th ed.) is available for download [here](#).

Appendix (optional). Use only if needed.

Tables. Tables must be submitted as a separate MSWord file. Each table should begin on a separate page, and be typed double-spaced, numbered consecutively with an Arabic numeral, and given a short title (e.g., Table 5. Comparisons on language variables). All tables must be clearly cited in the text, and must be clearly labeled at the location they are to appear, e.g. "TABLE ONE HERE".

Figures. Figures must also be submitted as separate files, in either .TIFF or .JPG format. Each figure must be numbered consecutively with an Arabic numeral and a descriptive legend. Legends must be provided separately from the artwork (e.g., Figure 3. The progress in language development). Figures, which are normally in black and white, should be no larger than 6 × 9 in. If authors request color figures in the printed version, they will be contacted by CCC-Rightslink who are acting on our behalf to collect Author Charges. Please follow their instructions in order to avoid any delay in the publication of your article. Online-only color is provided free of cost. Diagrams must be computer generated. All labels and details must be clearly presented and large enough to remain legible at a 50% reduction. Artwork should be identified by figure number and short title. All figures must be cited in the text, and their location labeled in the same manner as Tables.

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