**Investigating cognitive biases in adolescents with externalising difficulties**

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**Table of Contents**

**1. Executive Summary ………………………………………………………….…5**

1.1 Introduction 5

1.2 Systematic Review 6

1.3 Empirical Study 9

1.4 Integration, Impact and Dissemination 12

**2. The clinical implications of Cognitive Bias Modification of Interpretation training for adolescents: A systematic review……..………….…………………14**

2.1 Abstract 15

2.2 Introduction 16

2.3 Method 22

2.3.1 Methods for reviewing efficacy 22

2.3.2 Search strategy 22

2.3.3 Study selection 22

2.3.4 Data collection and analysis 24

2.3.5 Synthesis of results 25

2.3.6 Assessment of risk of bias 25

2.4 Results 26

2.4.1 Participant characteristics 28

2.4.2 Study characteristics 30

2.4.3 Clinical outcomes 35

2.4.4 Risk of bias 55

2.5 Discussion 56

2.5.1 Summary of main findings 56

2.5.2 Comparison of findings with other reviews 60

2.5.3 Limitations and future directions 60

2.6 Conclusion 62

**3. Empirical Study: Investigating cognitive biases in adolescents with externalising difficulties….…………………………………………..……………64**

3.1 Abstract 65

3.2 Introduction 66

3.2.1 Biases in adults 67

3.2.2 Cognitive behavioural therapy 67

3.2.3 Adolescence 69

3.2.4 Cognitive biases in children and adolescents 69

3.2.5 Evidence base for biases and internalising difficulties 71

3.2.6 Evidence base for biases and externalising difficulties 72

3.2.7 Measuring cognitive biases 77

3.2.8 Developmental changes in biases 78

3.2.9 Understanding biases in adolescents with externalising difficulties 79

3.2.10 Aim and research questions 79

3.3 Method 80

3.3.1 Design 80

3.3.2 Participants and sampling 80

3.3.3 Power analysis 81

3.3.4 Exclusion criteria 82

3.3.5 Measures 83

3.3.6 Procedure 89

3.3.7 Ethical considerations 89

3.3.8 Service user involvement 90

3.4 Results 90

3.4.1. Missing data 90

3.4.2 Group formation 90

3.4.3 Outliers 91

3.4.4 Normal distribution 91

3.4.5 Demographics 92

3.4.6 Gender effects 95

3.4.7 Age effects 96

3.4.8 Research Question 1 97

3.4.9 Research Question 2 99

3.4.10 Research Question 3 100

3.5 Discussion 102

**4. Integration, impact and dissemination plan………………………………….108**

4.1 Integration 108

4.1.1 Systematic Review 108

4.1.2 Empirical Paper 110

4.1.3 Integration of both studies 114

4.2 Impact 117

4.3 Dissemination 119

**5. References 122**

**6. Appendices 157**

**1. Executive Summary**

**1.1 Introduction**

* Cognitive biases of interpretation refer to patterns of thinking that are negatively biased. In the adult literature, cognitive biases are reported to be associated with psychopathology and are considered to be maintenance factor for a number of mental health problems.
* Challenging unhelpful cognitive biases is a key focus of Cognitive Behavioural Therapy (CBT), an intervention used to treat a variety of symptoms of psychopathology in both adults and youth. Therefore, understanding the presence of cognitive biases across different groups could have treatment implications. Research investigating cognitive biases in adults has informed the development of CBT interventions. These interventions have subsequently been applied to adolescents.
* Adolescence is a period of unique developmental and endocrinological change. To account for developmental differences, cognitive biases in this group should be researched independently of children and adults. Understanding the presence of cognitive biases in this group could inform more developmentally appropriate treatments, including CBT adaptations.
* The majority of research investigating cognitive biases in adolescents has predominantly focused on those experiencing internalising difficulties such as anxiety and depression.
* Externalising disorders are the most common form of psychopathology affecting adolescents and have a detrimental impact on both the individual and society. Those experiencing these difficulties are more likely to have on-going mental health problems in adulthood as well as poorer outcomes in terms of wellbeing, educational level, substance misuse and are more likely to be involved in the criminal justice system.
* Recently, Cognitive Bias Modification of Interpretation Training has been developed which focuses on altering cognitive biases. CBM-I was initially used with adults but has recently been extended for use with young people. However, the evidence for its efficacy appears to be mixed. Previous meta-analyses of these studies have combined CBM-I with another training and have also included studies with children.
* Synthesising the studies that have been conducted specifically investigating CBM-I training with adolescents may provide an insight into the clinical implications of training for this group.
* Understanding the presence of cognitive biases amongst adolescents with externalising difficulties could have implications regarding the use of CBM-I with this group.

**1.2 Cognitive bias modification of interpretations training for psychopathology in adolescents: a systematic review**

**Background**

* Previous meta-analyses have reported mixed conclusions about the efficacy of CBM-I interventions for young people. However, these studies have collapsed research of both children and adolescents which may have obscured any effects for adolescents alone.
* As CBM-I training is a relatively new area of research, understanding how future studies could be optimised is of importance.

**Aim**

* Aim: To analyse and synthesise existing qualitative research investigating the clinical efficacy of CBM-I training for adolescents.
* Research Question 1: To what extent does CBM-I alone modify cognitive biases in adolescents?
* Research Question 2: Does CBM-I have an impact on mood/ symptoms of psychopathology?

**Method**

* A systematic review of published evidence was undertaken following the Preferred Reported Items for Systematic Reviews and Meta-analysis (PRISMA) Statement.
* Relevant studies were identified by searching major internet-based bibliographic databases PSYCINFO and Web of Science.
* Inclusion criteria: CBM-I training, adolescent participants (11-19 years), Randomised Controlled Trial, measures of interpretation bias (any), measures of mood or well-being or symptoms related to mental health pre and post intervention (any).
* Data extraction items included (a) Population, (b) Age range, (c) Percentage of male participants, (d) Number of participants, (e) Ethnicity, (f) Location of the study
* Data items regarding study characteristics were also retrieved including: (a) Training paradigm, (b) Number of training trials, (c) Control condition, (d) Concurrent treatment, (e) Follow Ups, (f) Use of an Imagery exercise pre-training, (g) Verbal or imagery paradigm, (h) Location of delivery of training.
* Outcomes of the studies were extracted in relation to: (a) Comparison/ Control group, (b) Measure of interpretation bias, (c) Changes in interpretation bias post-training, (d) Effect size for significant bias change, (e) Measure of mood/symptom/well-being   
  (f) Changes in mood/symptoms/well-being post-training, (g) Effect size for significant mood/symptom/well-being change.
* Risk of bias was assessed using the risk of bias tool developed by the Cochrane Collaboration.

**Results**

* Electronic and hand searching identified 199 citations. Duplications were removed and citations not meeting inclusion criteria were excluded resulting in 15 citations included in the review.
* The majority of studies (92.9%; n=13) employed ambiguous scenario paradigms, but the content varied across studies. One study adapted a picture-word generation procedure, another compared a verbal scenario CBM-I group with an imagery CBM-I group.
* Eight studies employed single CBM-I sessions, others ranged from 2 to 20 sessions.
* 28.6% compared CBM-I to a negative CBM-I training, 35.6% used a CBM-I neutral training as control, 14.3% used a control where participants were presented with half positive and half negative training trials.

**Clinical Efficacy**

***Modified Biases***

* Measures of Interpretation Bias: All studies employed the Recognition Test to assess changes in bias endorsement from pre to post-training. Seven studies employed alternative measures additionally.
* 78.6% reported significant training-congruent differences on interpretation bias

***Impact on Mood/Symptoms***

* 50% reported beneficial mood effects related to CBM-I. 71.43% of these used the Visual Analogue Scale, a non-standardised measure as an assessment of mood changes.
* The quality of the studies included as measured by the Cochrane’s Risk of Bias tool was suboptimal.

**Discussion**

* Results appeared promising in terms of the impact of the CBM-I training on interpretation biases. However, there are questions around the validity of the use of the Recognition Test as a measure of interpretation bias due to the similarity of its content and that of the training trials. Future research should employ alternative measures of bias.
* The majority of significant findings in relation to mood changes were assessed with Visual Analogue Scales. Future research should utilise standardised measures of mood/symptoms.
* CBM-I research is in its infancy. More methodologically rigorous studies are needed before conclusions can be drawn regarding clinical efficacy.

**1.3 Empirical Study: Investigating the presence of cognitive biases in adolescents with externalising difficulties**

**Background**

* Some researchers have questioned whether applying adult models of CBT is developmentally appropriate for adolescents, as they do not consider the cognitive processes of adolescence and the developmental changes experienced during this critical time period. Adolescents receiving CBT have also been found to have poorer outcomes compared with children. Understanding the presence of cognitive biases (a key focus of CBT) in adolescents could allow for treatments to be appropriately tailored to meet the specific needs of this group.
* The majority of research investigating cognitive biases in adolescents has focused on those experiencing internalising difficulties such as anxiety and depression. Research with adolescents with externalising difficulties has predominantly specifically investigated hostile attributional bias.
* The biases that have commonly been investigated across internalising disorders include; underestimating ability to cope, personalising without mind-reading, overgeneralising, selective abstraction, mind-reading (all assessed by the Children’s Negative Cognitive Error Questionnaire; CNCEQ-R), threat interpretation and attributional bias. In the few studies that have investigated any of these biases in relation to externalising difficulties, results have been conflicting.
* A difficulty within cognitive research is the method of measuring biases. This is typically done using self-report measures which have been developed to assess specific biases. Self-report questionnaires are subject to response bias as they rely on the participant providing accurate information about how they tend to think in certain situations. Experimental measures offer an alternative means of assessing biases. This study will employ both methods for a more robust measurement of threat interpretation bias (using a commonly employed experimental measure of this bias).
* There is also some evidence of age-related changes in biases. This study aims to investigate whether this applies to adolescents with externalising difficulties by examining any developmental differences cross-sectionally.

**Aim**

* The study aimed to investigate the pattern of cognitive biases in adolescents with high levels of externalising difficulties and to investigate whether this pattern changes across adolescent development. The following research questions were established:

1) Is there a significant difference between adolescents with high levels of externalising difficulties and those with low levels of these difficulties on the five biases measured by the CNCEQ-R?

2) Is there a significant difference between adolescents with high levels of externalising difficulties and those with low levels of these difficulties on threat interpretation bias as measured by a self-report measure and experimental of this bias?

3) Is there a significant difference between adolescents with high levels of externalising difficulties and those with low levels of these difficulties on attributional bias (as measured by a self-report questionnaire)?

4) Is there an association between age and changes in the endorsement of certain biases across the high and low externalising groups?

**Method**

* The study used an independent group design to compare biases in a group of adolescents at high risk of an externalising disorder (high externalising group) and a group with low risk of an externalising disorder (low externalising group).
* A sample of N=48 adolescents were recruited from a school and Pupil Referral Units, with 24 participants in each group. Participants ranged from 13 to 16 years.
* Participants were assigned to groups based on their score on the Externalising Difficulties subscale of a measure of psychopathology, the Strengths and Difficulties Questionnaire (SDQ).
* Measures of cognitive bias included: Children’s Negative Cognitive Errors Questionnaire Revised (CNCEQ-R; Maric et al., 2011) – self-report measure assessing underestimation of ability to cope, personalising without mind-reading, selective abstraction, overgeneralising and mind-reading; Children’s Attributional Style Questionnaire Revised (CASQ-R) – self-report measure assessing attributional bias; Ambiguous Situations Questionnaire (ASQ) – self-report measure assessing threat interpretation bias; Homophone Ambiguous Word Task (HAWT) – experimental measure assessing threat interpretation bias.

**Results**

* Independent samples t-tests were run to examine differences between the groups on age, gender and internalising difficulties. They revealed no significant differences between the groups.
* 1) A MANOVA revealed that that scores on the five cognitive biases as measured by the CNCEQ-R did not differ significantly among the high and low externalising difficulties groups, F (5,42) =.647, p=.666, Wilks’ Lambda = 0.929, partial n2 = .071.
* 2) Independent samples t-tests revealed no significant differences between the high and low groups on threat interpretation bias, as assessed by both self-report (t (46) =1.45, p.153) and experimental measures (t(43)=.805, p=.426). Surprisingly, correlational analysis between scores on the self-report and experimental measures of threat interpretation bias was non-significant.
* 3) A significant difference was found between the high and low externalising groups on attributional bias. A one-way ANOVA revealed a significant difference between the groups on positive attribution scores, F (1,46) =11.198, p=.002 with the low externalising group reporting significantly greater numbers of positive attributions (M=7.5, SD=2.38) than the high externalising group (M=5.24, SD=2.3). A statistically significant result was not found for differences between the groups on negative attribution scores, however results did indicate a trend towards significance, F (1.46) = 3.643. p=.063.
* 4) Correlations between age and scores on the measures of cognitive biases were non-significant, indicating no effect of age.

**Discussion**

* Results suggests that adolescents with externalising difficulties do not differ significantly from adolescents without these difficulties in the endorsement of the negative biases assessed. However, results indicate that adolescents with externalising difficulties endorse significantly fewer positive attributions than adolescents without these difficulties.
* This has implications for treatments such as CBT and CBM-I.
* This research raises questions around the suitability of current measures of cognitive biases for adolescents with externalising difficulties.

**1.4 Integration, Impact and Dissemination**

* Both studies consider cognitive biases in adolescents. Findings may have treatment implications for adolescents with externalising difficulties. Both studies reveal limitations of the measures used in this field.
* The research emphasises the lack of research in this area with adolescents with externalising difficulties in comparison to youth with internalising difficulties.
* The findings could impact both service-users and practitioners through improving wellbeing and optimising evidence-based treatments. Additionally, improvements in treatments for externalising difficulties could have wider impact in terms of economic costs.
* Findings will be disseminated through publication, conferences and consultation with service-users.

**2. Cognitive bias modification of interpretations training for adolescents and its impact on psychopathology: a systematic review**

**2.1 Abstract**

**Background**: There has been a recent surge of interest in the use of cognitive bias modification of interpretation (CBM-I) training for both adults and young people. Emerging evidence suggests that these interventions may have clinical utility for both of these populations. However, to date, no systematic review has been conducted to investigate the clinical efficacy of such interventions for adolescents specifically. **Methods**: Studies were identified through a systematic literature search of online databases PsycInfo and Science Direct as well as hand searches. Studies included in the review aimed to target interpretation biases; had a randomised controlled trial (RCT) design; assessed mood/symptoms of psychopathology as an outcome and included 11-19-year olds. **Results:** The review identified 15 studies that met eligibility criteria. These studies provided some evidence of modification of interpretation bias as a result of CBM-I training. The impact of CBM-I training on mood/symptoms of psychopathology was inconsistent. The review highlighted a number of concerns around methodological rigour as well as the appropriateness of measures employed. **Conclusion:** Research in this area is in its infancy and future research is warranted before conclusions regarding efficacy can be drawn. Findings raise concerns about the use of current outcome measures of bias (such as the Recognition Test) and recommends future studies employ alternative measures of bias in addition to well-validated measures of psychopathology with strong psychometric properties.

**2.2 Introduction**

Cognitive biases, or negative thinking patterns have been defined as *“exaggerations of thinking errors that we all experience from time to time when we are emotionally aroused. They reflect normal fluctuations in our information-processing styles”* (p.172, Westbrook, Kennerley, & Kirk, 2014).

Although cognitive biases are considered as normal oscillations in an individual’s information processing style, it is thought that these biases can be problematic when they become chronic or extreme. Research has found that adolescents without mental health difficulties endorse cognitive biases but that higher levels of these biases are associated with psychopathology (Mathews & MacLeod, 2005). Numerous studies with adults have found clear associations between psychopathology and higher levels of cognitive biases, proposing that these biases may play a maintenance role for a number of different mental health difficulties (Harvey, Watkins, Mansell, & Shafran, 2004).

This research influenced the development of cognitive bias modification interventions. The two main types include cognitive bias modification of attention (CBM-A) and cognitive bias modification of interpretations (CBM-I) training. CBM-A training involves teaching participants to re-direct their attention from negative stimuli towards neutral or positive stimuli whereas CBM-I trains participants to make positive or neutral interpretations of ambiguous situations (Cristea, Mogoase, David & Cuijpers, 2015). CBM-I was initially utilized to investigate the causal link between interpretation biases and psychopathology (Mathews and Macintosh, 2000). In this seminal study, CBM-I was used to train participants to make either anxious or non-anxious interpretations of ambiguous situations. Individuals who were trained to make non-anxious interpretations of ambiguity reported significant reductions in anxiety. Consequently, the authors proposed that these procedures could be developed into an intervention by directly targeting cognitive biases and in turn improving mood. Other researchers replicated this work in laboratory settings and found similar results (Mackintosh, Mathews, Yiend, Ridgeway, & Cook, 2006; Salemink, van den Hout, & Kindt, 2007; Yiend, Mackintosh, & Mathews, 2005).

In turn, CBM-I training was developed, based on the principle of training people to interpret emotionally ambiguous information in a consistent direction, in particular from negative interpretations to more benign or positive alternatives through repeated training trials (Mathews & Macintosh, 2000). Initial studies with adults suggested that CBM-I may have potential as a cost-effective, accessible intervention (Kazdin & Blase, 2011). Research has investigated the use of CBM-I training in reducing a variety of symptoms including social anxiety (Murphy, Hirsch, Mathews, Smith and Clark, 2007), depression (Lang, Blackwell, Harmer, Davison & Holmes, 2011), OCD (Williams & Grisham, 2013) and trait anxiety (Mathews, Ridgeway, Cook & Yiend, 2007). However, there have been mixed results regarding the efficacy of these interventions (Menne-Lothman et al., 2014; Cristea, Kok & Cuijpers, 2015).

Previous research has revealed that interpretation biases are present in young people with symptoms of mental health difficulties (Dearing & Gotlib, 2009; Miers, Blote, Bogels & Wastenberg, 2008). For example, threat interpretation bias (the tendency to interpret ambiguous situations as threatening) has been found to be associated with anxiety in adolescents in a number of studies (Muris & Field, 2010). A large body of evidence has found an association between attributional style (i.e. the tendency to attribute negative events to internal factors) and depression in adolescents (Gladstone & Kaslow, 1995; Joiner & Wagner, 1995). Similarly, hostile attribution bias (the tendency to interpret ambiguous situations as hostile) has been associated with behavioural difficulties (Bailey & Ostrov, 2008; Pornari & Wood, 2010).

This research has influenced the recent development of CBM-I training adapted for use with children and young people. Across youth and adult populations, CBM-I aims to target cognitive processing styles (e.g. attributional bias). These styles have been found to develop in childhood and stabilise across adolescence (Lau & Eley, 2008; Lau, Rijsdijk, & Eley, 2006; Nolen-Hoeksema, Girgus, & Seligman, 1992). Therefore, theoretically, adolescence may be an optimal time to target such cognitive processing styles as they may be more amenable to change during this time period (Krebs et al., 2017). While traditional therapies utilize explicit strategies such as learning new coping strategies, CBM-I is based on implicit, reinforcement learning (Krebs et al., 2017). These learning mechanisms may be more appropriate for youth as they are likely to have developed interpretation biases initially through social learning from their parents or peers (Muris & Field, 2010).

CBM-I training has been used predominantly with non-clinical samples of children and young people (Belli & Lau, 2014; Burnett-Heyes et al., 2017; De Winter Bosmans & Salemink, 2017; Lau et al., 2013). A limited number of studies have also investigated the use of CBM-I training with clinical child/adolescent samples (Fu, Du, Au & Lau, 2015; Klein et al., 2015; Micco, Henin & Hirshfeld-Becker, 2014). As in the adult literature, the studies have reported mixed findings. Meta-analyses have been conducted to interpret this body of research.

To date, to the researcher’s knowledge, two meta-analyses have investigated the effectiveness of CBM training with children and young people. Cristea and colleagues (2015) investigated the clinical efficacy of both CBM-I and CBM-A training concurrently. Their meta-analysis examined 23 studies that reported on four different outcomes: mental health (all outcomes related to mental health problems regardless of their nature in addition to distress), anxiety (anxiety specific outcomes were analysed separately), depression (depression specific outcomes were analysed separately) and bias. These trials consisted of both child and adolescent populations. They found moderate and significant effects on the targeted biases (g of 0.53 (95% CI 0.33 to 0.73), but did not find any significant effects for mental health outcomes generally or anxiety or depression specifically (effect sizes ranged from Hedges *g*=.02 to *g*=.12). They raise concerns about the use of CBM training clinically for youth populations. However, they note that by collapsing CBM-I and CBM-A training together, this may have obscured any effects of CBM-I alone.

Krebs and colleagues (2017) acknowledged that the Cristea study may have lacked sufficient power to detect small effects of CBM-I as they only included 13 studies of CBM-I alone (N=909). Their meta-analysis investigated the impact of CBM-I training specifically on anxiety in children and young people. They report contrasting findings to Cristea and colleague’s meta-analysis, explaining that their results revealed that CBM-I has potential but weak effects in reducing anxiety in young people. They reported a moderate to large effect size for CBM-I versus comparison on post-training biases (g = \_0.70; 95% CI \_0.80 to \_0.53) and a significant small effect size for improvements in anxiety post-training (g = \_0.17; 95% CI \_0.31 to \_0.02), They highlight a number of difficulties with the published studies such as heterogeneity of training and limited use of standardized measures of mood.

Both of these meta-analyses combined studies of children and adolescents. Adolescence is a distinct period of development encompassing both endocrinological change and neuro-cognitive change (e.g. working memory, inhibitory control, abstract thought, decision making and perspective taking), affective and social change (Ahmed, Bittencourt-Hewitt, & Sebastian, 2015; Blakemore & Robbins, 2012; de Veld, Riksen-Walraven, & de Weerth, 2012; Dumontheil, 2014; Gilbert, 2012; Somerville & Casey, 2010; Spear, 2009). For this reason, it is likely that CBM-I may work through different mechanisms and/or have different clinical implications for this population. As such, combining studies with both children and adolescents is likely to obscure any differential effects due to developmental differences.

Cristea and colleague’s meta-analysis included studies of participants aged 18 and under but did not conduct subgroup analyses between child and adolescent studies. Although Krebs and colleagues did not find any statistically significant moderating effect of age, they reported that CBM-I was effective for children but not for adolescents. Age ranges for these categories varied across studies, with some child studies including participants up to 14 years and some adolescent studies including participants aged 9 years. This may have impacted on results. Additionally, the authors note that methodological differences between child and adolescent studies may have confounded results. The majority of the studies in this meta-analysis (15 of 26) utilised child samples. As such, this may have impacted on their ability to find differential effects related to the adolescent population. Investigating studies of adolescents independently from children is imperative due to the variety of changes occurring during this period that may confound results.

CBM-I training instructs participants to imagine themselves in particular scenarios, which requires theory of mind or “mentalising”, the ability to understand their own or other’s mental states including intentions, desires and beliefs. Research has found that brain regions associated with these abilities show changes from childhood to adolescence and from adolescence to adulthood (Blakemore, 2008). There is also evidence that both social cognition and executive function undergo changes during adolescence (Blakemore & Choudhury, 2006). This may be particularly relevant for CBM-I training trials which consist of ambiguous social scenarios.

Previous research has highlighted the importance of distinguishing between developmental periods in theoretical accounts of interpretation biases in children and adolescents (Waite, Codd & Creswell, 2015). There is evidence that interventions that target interpretation biases are likely to be beneficial for adolescents but have limited effect for children. By combining child and adolescent studies together in previous meta-analyses, specific effects for adolescents may have been obscured. This review acknowledges adolescence as a distinct developmental period and sought to investigate the clinical implications of CBM-I training for this population.

Previous reviews have noted the large heterogeneity of studies in relation to the population studied, the measures used, the number of training sessions as well as the training paradigm employed. Initial studies utilized single session CBM-I training, whereas some more recent studies have extended this to multiple sessions. Many of these studies have investigated the use of semantic-verbal training paradigms where participants are presented with a series of ambiguous scenarios ending in a word fragment. For example, in the original Mathews and Macintosh’s (2000) study, in the non-anxious training group, correct resolution of the word fragment disambiguated the story positively. However, for the anxious training group, the resolution resulted in the story being disambiguated negatively. For example, a scenario *“You have decided to go caving even though you feel nervous about being in an enclosed space. You get to the caves before anyone else arrives. Going deep inside the cave you realise you have completely lost your….”* can be interpreted positively or negatively. Those in the positive-training group are presented with a word fragment (e.g. “fe\_r”) allowing for the scenario to be disambiguated positively whereas the negative-training group are presented with a different word fragment (e.g. “w\_y”) prompting them to negatively disambiguate the scenario. To strengthen a valenced interpretation of the ambiguous scenario, the scenario is then followed by a comprehension question (e.g. “Are you feeling afraid in the cave?”). Feedback is given to participants about their response accuracy (Mathews, 2012). Some studies have also extended training paradigms to use imagery (Holmes, Lang, & Shah, 2009). Such trainings are based on the same principle but make use of pictures instead of written scenarios.

Some researchers have acknowledged that training paradigms require participants to imagine themselves in particular scenarios and have employed the use of imagery exercises to aid participants in engaging with the imaginative element of the tasks (Holmes et al,. 2009). However, the use of these tasks varies across studies.

Initial studies of CBM-I training appeared promising but subsequently its clinical efficacy has been contested (Cristea et al., 2015). There are theoretical arguments supporting the advantages of such an intervention with youth, for example CBM-I’s use of reinforcement learning. Only two meta-analyses have investigated the use of such interventions with children and young people. The first of these combined both CBM-I and CBM-A interventions (Cristea et al., 2015), which may have obscured effects for CBM-I alone. A number of new studies have also been published since this review was conducted in 2015. The second review (Krebs et al., 2017) focused specifically on CBM-I but for both children and young people and focused exclusively on anxiety. Adolescence is a unique period of developmental and cognitive change and as such studies of this population should be considered independently of studies with children due to cognitive differences between the groups. An understanding of the clinical efficacy of CBM-I training for adolescents from studies conducted thus far would enable a better understanding of any potential benefits of training, beneficial components across studies and provide a direction for future research.

The study aimed to analyse and synthesise existing quantitative research investigating the effectiveness of CBM-I training for adolescents and any subsequent effects on psychopathology. The review specifically aimed to investigate a) the extent to which CBM-I alone modifies cognitive biases in adolescents b) the impact of CBM-I alone on mood/ symptoms of psychopathology.

**2.3 Method**

**2.3.1 Methods for reviewing efficacy**

In order to investigate the effectiveness of the clinical implications of CBM-I training for adolescents, a systematic review of published research evidence was undertaken. This review followed the Preferred Reported Items for Systematic Reviews and Meta-Analysis (PRISMA) Statement (Moher, Liberati, Tetzlaff, Altman, & The, PRISMA Group, 2009). The study took place between October 2017 and February 2018.

**2.3.2 Search Strategy**

Relevant studies were identified by searching major internet-based bibliographic databases: PSYCINFO, GoogleScholar and Web of Science. This was carried out on the 13th of January 2018. The following search terms were used “cognitive bias modification”, “interpret\*bias AND training”, “interpret\*bias AND modif\*” and adolescents or teenagers or young adults or teen or youth or children or young people or minors or juvenile. A broad search strategy was employed; searches included RCTs, empirical papers, abstracts and dissertations. Bibliographies of previous reviews and retrieved articles were also searched. In order to identify further relevant studies, clinical experts were contacted, and references of retrieved articles were also searched. In order to ascertain the reliability of the search terms, key articles identified before the search were identified again through the systematic database searches.

**2.3.3 Study Selection**

**2.3.3.1 Types of Studies**

This review sought to include only studies that generated quantitative data regarding the clinical implications of CBM-I training for adolescents. Studies were restricted to RCTs due to the high rigour of this design (Akobeng, 2005). The studies were not restricted by setting or date of publication.

**2.3.3.2 Types of Participants**

Adolescents were defined as participants aged 11 to 19 years. Definitions of adolescence vary throughout the literature and there are limitations using chronological age alone to define adolescence (Jaworska & MacQueen, 2015). However, this range has been used in previous studies as 11 years is the average onset of puberty (Kail & Cavanaugh, 2016) and the age that most young people begin secondary school (Foxman, Tansuhaj & Ekstrom, 1989). Studies that included participants younger than 11 or over 19 years were excluded. This review included studies with both clinical and no-clinical populations.

**2.3.3.3 Types of Interventions**

CBM-I training was defined as interventions where the primary focus was on modifying cognitive biases of interpretation through “extended exposure to task contingencies that favour predetermined patterns of processing selectivity” (MacLeod & Mathews, 2012, p.191). The review excluded studies that focused exclusively on attention bias modification training (CBM-A), whereby participants are trained to re-direct their attention (Cristea et al., 2015). As the use of CBM-I for young people is a newly developing area of research, to allow for a sufficient amount of studies to be included, both studies of single and multiple sessions of CBM-I training were included. Additionally, those that investigated CBM-I interventions where CBM-A techniques were incorporated were included. Studies where CBM-I was implemented as an adjunct to another therapy were also included. However, studies that investigated the modification of action tendencies to approach or avoid stimuli (approach/avoid biases) were excluded.

**2.3.3.4 Types of Outcome Measures**

Inclusion criteria was broad for outcome measures. The review allowed for any measures of interpretation biases or any measures of mood or well-being or symptoms related to mental health pre and post intervention.

**2.3.4 Data Collection and Analysis**

**2.3.4.1 Selection of studies**

The results of the database and hand searches were investigated to exclude references that were not relevant to the review. Titles and abstracts were assessed by two independent reviewers (the author and a final year Clinical Psychology Doctorate student). Where there was a lack of clarity with a citation, the full article was retrieved and reviewed. Disagreements were resolved through consensus.

**2.3.4.2 Data Collection Process**

A data extraction form was adapted from the Cochrane Collaboration (2014) and piloted and tested by the author. Data was extracted from each article by the author. Any uncertainties were resolved through discussion with an independent reviewer.

**2.3.4.3 Data Items**

The following information regarding participant characteristics was extracted from each study: (a) Population, (b) Age range, (c) Percentage of male participants, (d) Number of participants, (e) Ethnicity, (f) Location of the study.

Information regarding study characteristics was also retrieved including (a) Training paradigm, (b) Number of training trials, (c) Control condition, (d) Concurrent treatment, (e) Follow Ups, (f) Use of an Imagery exercise pre-training, (g) Verbal or imagery paradigm, (h) Location of delivery of training.

Additionally, outcomes of the studies were extracted in relation to (a) Comparison/ Control group (b) Measure of interpretation bias (c) Changes in interpretation bias post-training (d) Effect size for significant bias change (e) Measure of mood/symptom/well-being (f) Changes in mood/symptoms/well-being post-training (g) Effect size for significant mood/symptom/well-being change.

Effect sizes were extracted where possible. Where studies did not report effect sizes, these were calculated using an online calculator (<https://www.uccs.edu/lbecker/>). Where studies did not provide sufficient information for effect size calculation, “could not obtain” was recorded.

**2.3.5 Synthesis of Results**

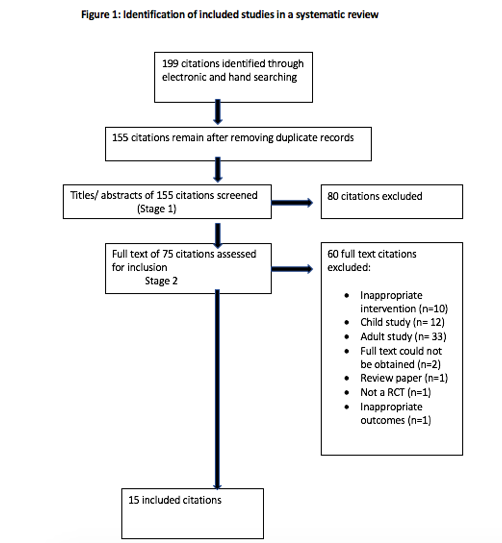
A narrative summary is an appropriate method for synthesising data when there is a large degree of heterogeneity across studies (Popay et al,. 2006; Ryan, Cochrane Consumers & Communication Review Group, 2013). Krebs and colleagues (2017) reported a significant level of heterogeneity in their meta-analysis (ranging from I2 = 42% to I2 = 64%) and questioned whether summary effect sizes were meaningful. As the use of CBM-I is a new area of research, with substantial variation across studies, a narrative summary was deemed the most appropriate method for combining results of studies.

**2.3.6 Assessment of risk of bias in included studies**

Risk of bias within each individual study was assessed by the author using the risk of bias tool developed by the Cochrane Collaboration (Higgins et al., 2011). Any uncertainties were resolved through consensus with an independent reviewer. This process was undertaken following the data extraction stage in order to minimise researcher bias when extracting data. This tool was developed specifically for RCTs. Each study was assessed on the following criteria: (a) adequacy of sequence generation (b) adequacy of allocation concealment (c) adequacy of blinding personnel and participants (d) blinding of outcome assessment (e) adequacy of methods used to address incomplete outcome data, (f) evidence of selective outcome reporting; and (g) other bias. Assessment categories included “low”, “unclear” or “high” risk of bias. Guidelines presented in Chapter 8 of the Cochrane Handbook for Systematic Reviews of Interventions (Higgins et al., 2011) provided the basis for coding decisions.

**2.4 Results**

Electronic and hand searches identified 199 citations. Duplications were removed which left 155 studies. Each of these studies were screened for inclusion (Figure 1). Stage 1 screening involved the use of inclusion criteria to screen titles and abstracts for their relevance. Articles identified as relevant by either reviewer were retrieved in full text. Abstracts without sufficient details were labelled as “potentially relevant studies” and were included at this point and retrieved in full text. This resulted in 75 studies being retained.

The full text of these studies was obtained. Inclusion criteria was applied to each of these studies (Stage 2 selection) resulting in the exclusion of 60 studies; 10 due to inappropriate intervention, 12 were studies based on children, 33 were studies based on adults, one was a review paper, one was not a RCT, one investigated inappropriate outcomes and full text could not be obtained for two studies. Reliability between the two independent raters was good, 83.5%, kappa=.71. This resulted in 15 citations being included in the systematic review. One of these studies (De Hullu, Sportel, Nauta & de Jong, 2017) is a follow-up study from Sportel and colleagues (2013) study. As such, the data from these two papers has been combined for the purpose of this review and will be referred to in combination as one study (De Hullu et al., 2017).

From the selected 15 studies, data was extracted and synthesised into three tables; participant characteristics (Table 1), study characteristics (Table 2) and study outcomes (Table 3).

**2.4.1 Participant Characteristics**

A comprehensive summary of the main participant characteristics of the studies are provided in Table 1. This review included data from 1109 participants from across 14 studies. Participants age ranged from 11 to 19 years. Eight of these studies used non-clinical participants. Three studies used participants with clinical diagnoses; one study focused on OCD, another MDD and the third on GAD or social anxiety. Two studies used participants with heightened symptoms; Fu Du et al. (2015) selected adolescents with high levels of anxiety and De Voogd et al. (2017) utilised youth with heightened symptoms of anxiety or depression. De Hullu and colleagues (2017) used participants with moderate levels of social/test anxiety. Seven of the studies were conducted in the UK, four in the Netherlands, two in China and one in the USA. There was a variation of ethnicities represented in the studies

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| --- | --- | --- | --- | --- | --- | --- |
| Table 1  *Participant Characteristics* | | | | | | |
| Study | Population | Age range | % male | No. of Participants | Ethnicity | Location |
| Belli & Lau (2014) | Non-clinical | 15-17 | 20.3 | 69 | White 85.5%  Asian 7.2%  Black 1.4%  Mixed 4.3%  Did not report 1.4% | U.K. |
| Burnett Heyes et al. (2017) | Non-clinical | 11.9 – 16.3 | 100 | 60 | Not reported | U.K. |
| Chan et al. (2015) | Non-clinical | 16-18 | 9.5 | 74 | White 91.9% | U.K. |
| De Hullu et al. (2017) &  Sportel et al. (2013) | Moderate  Social/ test anxiety | 12-16 | 27.5 | 240 | Not reported | Netherlands |
| De Voogd et al. (2017) | Heightened symptoms of anxiety or depression | 12-18 | 37 | 119 | Not reported | Netherlands |
| Fu et al. (2015) | Selected for high anxiety | 12-18 | 51 | 77 | 100% Chinese | China |
| Fu et al. (2013) | GAD\* or social phobia | 12-17 | 46.4 | 28 | 100% Han Chinese | China |
| Lau et al. (2013) | Non-clinical | 12-18 | 50 | 40 | Not reported | U.K. |
| Lau et al. (2011) | Non-clinical | 13-18 | 36 | 39 | 86% Caucasian | U.K. |
| Le Moult et al. (2017) | MDD\* | 13-17 |  | 46 | 76.1% Caucasian | USA |
| Lothmann et al. (2011) | Non-clinical | 13-17 | 44.3 | 82 | 97% Caucasian | U.K. |
| Salemink & Wiers (2011) | Non-clinical (no inclusion or exclusion criteria) | 14-16 | 46.5 | 170 | 98.2% born in Netherlands | Netherlands |
| Salemink et al. (2015) | OCD\* diagnosis | 12-19 | 37.5 | 16 | Not reported | Netherlands |
| Telman et al. (2013) | Non-clinical | 15-18 | 21.7 | 49 | 73.9% Caucasian | Oxfordshire |

*Note:* GAD = generalised anxiety disorder, MDD = major depressive disorder, OCD=obsessive compulsive disorder

**2.4.2** **Study Characteristics**

Study characteristics are summarised in Table 2. All studies included in this review used an RCT design.

**2.4.2.1 Training Paradigms**

Two types of cognitive bias paradigms were employed across the studies: ambiguous scenario paradigms (ambiguous situations/ scenario training) and mental imagery generation. Ambiguous scenario paradigms included social and/or non-social situations. For these paradigms, participants were presented with verbal scenarios that appeared ambiguous. Those in the intervention group were prompted to complete a word fragment that would resolve the emotional ambiguity of the scenario in a positive way.Mental imagery paradigms applied the same principle with the use of visual imagery as opposed to verbal scenarios.

The majority of studies (92.9%; n=13) used ambiguous scenario paradigms, though within these studies, there was a variation of the specific scenarios used. Some studies reported using paradigms as presented in Lothmann’s (2011) paper others adapted versions from Mathews and Macintosh’s (2000) study with adults. Some studies focused exclusively on social scenarios (n=2), for example, *“You are working on a school assignment with some other children at your house. You turn on your favourite music and based on their reactions, you understand that they l-ke your choice of music.”* (like). Others additionally included non-social ambiguous situations such as “*Your father helps you to study for your mathematics test. When your teacher hands back the exams and you see the grade, you know that your father will be very \_\_\_.”* (Fu et al., 2013).

Two studies extended CBM-I training from verbal tasks to imagery. Burnett-Heyes and colleagues (2017) adapted a picture-word generation procedure from previous studies with adults. Pictures were paired with a positive or negative resolution. For example, a picture of a phone would be paired with “funny text” (positive condition) or “ignoring me” (comparison condition). De Voogd and colleagues (2017) also compared a verbal scenario CBM-I group with an imagery CBM-I group. Salemink, Wolters and de Haan also used CBM-A techniques in conjunction with their CBM-I training.

**2.4.2.2 Number of Training Sessions and Trials**

Eight studies employed single session training. The remaining studies varied from 2 to 20 sessions of CBM-I. There was a large range of the number of trials of CBM-I (i.e. number of scenarios/images presented) undertaken by participants, varying from 40 to 420.

**2.4.2.3 Duration of the study**

As the majority of the studies involved single session training, they were conducted on the same day. For the remaining studies, the follow-up times varied greatly: from 24hours to 2 years post-training.

**2.4.2.4 Control Conditions**

Paritcipants in the CBM-I training group were prompted to resolve ambiguity in a positively valenced way. All studies compared the training group to a control group whereby participants did not receive such prompts. However, studies in this review varied in terms of their control conditions. Four studies (28.6%) compared the CBM-I training to groups receiving a negative interpretation CBM-I training paradigm. Participants in these studies were prompted to resolve the ambiguity with a negatively valenced words. Other studies (35.6%; n=5) compared the CBM-I training group against participants receiving a CBM-neutral, whereby participants were presented with scenarios similar to those in the intervention group, however these were resolved in a neutral way. Additionally, two other studies (14.3%) used a CBM-I neutral training where participants were presented with half positive training and half negative training trials. The remaining studies compared the intervention to treatment as usual.

**2.4.2.5 Concurrent Treatments**

Due to the sparse amount of research in this area, this review included studies whereby participants were receiving alternatively treatment alongside the CBM-I training. For the majority of studies (n=13), participants solely received CBM-I. Salemink, Wolters and de Haan’s study reported that participants were also receiving CBT.

**2.4.2.6 Imagery Exercise**

Some researchers reported that, as the training paradigms require participants to imagine themselves in particular scenarios, the use of imagery exercises may aid participants in engaging with the imaginative element of the tasks. For this purpose, 10 studies (78.6%) revealed that, prior to the CBM-I training, participants were instructed to engage with an imagery exercise. De Voogd and colleagues (2017) instructed participants to rate their ability to imagine the scenario. However, three studies (21.4%) did not use any imagery task.

**2.4.2.7 Delivery Location**

The majority of studies (n=7) conducted the training in schools. One study reported the delivery site as a laboratory and another reported it as a room in a university. Another study reported that participants could access the training on the internet and could complete it at home or at any facility with internet access. Unfortunately, it was unclear from the remaining studies where the training took place.

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| Table 2:  *Study Characteristics* | | | | | | | | | |
| Study | Training Paradigm | No. of training sessions | Total no. of training trials | Control Condition | Concurrent Treatment | Follow Ups | Imagery Exercise | Verbal or Imagery | Delivery |
| Belli & Lau (2014) | Ambiguous situations (social) | 1 | 50 | CBM-I (neutral)  CBM-I tested immediately after | - | Immediately after  24 hours after | Yes (based on Holmes et al 2006; 2009) | Verbal | School |
| Burnett Heyes et al. (2017) | Mental imagery generation procedure: Ambiguous photos | 2 | 20 | Mixed imagery | - | No | Yes (Pictet, 2011) | Imagery | University |
| Chan et al. (2015) | Ambiguous situations | 2 | 80 | CBM-I (neutral) | - | Immediately after  1-week post training | Yes (based on Lothmann 2011) | Verbal | School |
| De Hullu et al., (2017) & Sportel et al. (2013) | Ambiguous social scenarios | 9 | 360 | CBT  Control (no training) | - | 2-year follow-up  6 months  12 months | Yes (based on Holmes et al 2006; 2009) | Verbal | School |
| De Voogd et al. (2017) | Scenario training  Mathews & Macintosh | 8 | 420 | CBM-I neutral | - | 4 weeks  3 months  6 months | No – but rated how able they were to imagine scenario  Yes, for picture word training group | Two groups – verbal and picture-word training | School |
| Fu et al. (2015) | Lothmann et al 2011  Social & non-social | 1 | 50 | CBM half positive half negative | - | No – just immediately after | Yes (based on Holmes et al 2009) | Verbal | School |
| Fu et al. (2013) | Lothmann et al 2011  Social & non-social | 1 | 50 | CBM half positive half negative | - | No | Yes (based on Holmes et al 2009) | Verbal | Mental Health Facility |
| Lau et al. (2013) | Ambiguous situations | 1 | 50 | Negative training | - | No | Yes (based on Lothmann, 2011) | Verbal | Laboratory |
| Lau et al. (2011) | Ambiguous situations | 1 | 50 | CBM-I negative | - | No | Yes (based on Lothmann, 2011) | Verbal | Unclear |
| Le Moult et al. (2017) | Ambiguous situations | 7 | 644 | CBM-I neutral | - | Post training (2 weeks to complete) | No | Verbal | 1st in lab  Subsequent at home that day |
| Lothmann et al. (2011) | Ambiguous situations | 1 | 50 | CBM-I negative | - | No – immediately after | Yes | Verbal | Unclear |
| Salemink & Wiers (2011) | Ambiguous situations (social) | 1 | 40 | Neutral training | - | No | No | Verbal | School |
| Salemink et al. (2015) | Scenario based (Clerkin & Teachman 2011) | 8 | 336 | TAU + placebo training | CBT | Post – 2 weeks after initial assessment | No | Verbal | Home or anywhere with internet access |
| Telman et al. (2013) | Ambiguous scenarios | 1 | 50 | CBM-I negative | - | No – immediately after | Yes (based on Lothmann et al., 2011) | Verbal | Unclear |

*Note:* TAU= treatment as usual.

**2.4.3 Clinical Outcomes**

This review aimed to investigate the clinical efficacy of CBM-I training for adolescents. Table 3 summarises the main findings of each study in terms of the impact of the training on biases as well as one or more measures of symptoms of mental health difficulties. The clinical implications of studies were assessed in regard to two outcomes: impact of training on modification of cognitive biases and impact of training on mood or symptoms of mental health difficulties.

**2.4.3.1 Measures of interpretation biases**

Interpretation bias was measured in eight different ways across the 14 studies including the Recognition Test (n=14), the Scrambled Sentences Task (n=3), Interpretation Bias Questionnaire (n=2), reaction times to probes (n=2), Ambiguous Social Scenarios Interpretation Questionnaire (ASSIQ; n=1), Adolescent Interpretation and Belief Questionnaire (AIBQ; n=1), the Blended Word Task (n=1) and pleasantness ratings of photos (n=1).

All studies (n=14) utilised a “Recognition Test” (RT; also referred to in some studies as the Interpretation Bias Test/ Interpretational Style Test; Mathews and Macintosh, 2000) in order to assess changes in bias endorsement from pre-training to post-training. For this task, participants were presented with ambiguous scenarios in addition to a title. They were provided with the same instructions as in the training phase. In contrast to the training, completing word fragments did not disambiguate the emotional valence of the scenario and comprehension questions were void of emotional content. Participants were then presented with titles of each scenario they had seen, followed by four statements that were related but not an exact match. The statements included one positive and one negative interpretation of the scenario (targets). The remaining two statements (foils) were not a valid match of the scenario and included one positively valenced statement and one negatively valenced statement. Participants were asked to rate statements on their similarity to the original scenario. Bias induction would be deemed successful if the CBM-I positive group rated positive targets as more similar. Similarity of foils was deemed to assess whether training induced a general affective bias towards items of either a positive or negative valence.

The Scrambled Sentences Task was utilised by three studies (SS; Burnett-Heyes et al., 2017; De Voogd et al., 2017; Le Moult et al., 2017). This experimental measure required participants to unscramble sentences as quickly as possible into a grammatically correct sentence of five words. Each scrambled sentence contained two possible sentences: one negative and one positive (e.g. “good impression I make bad”). Each sentence was self-referent. It was expected that participants with higher levels of positive interpretation bias would resolve a higher number of sentences in a positive way and those who endorsed more negative interpretation biases would resolve more sentences in a negative way.

Two studies (Fu et al., 2013; Fu et al., 2015) employed the Interpretation Bias Questionnaire (IBQ). This 26-item questionnaire was modified from an adult questionnaire (Stopa & Clark, 2000). Participants were presented with a number of vignettes describing ambiguous social and non-social scenarios, followed by three interpretations. The interpretations included one negative and two benign interpretations. Participants were instructed to choose the most likely explanation for the scenario. A higher number of negative interpretations chosen were indicative of a more negative interpretive style.

Two studies assessed interpretation bias through the use of reaction times (Salemink & Wiers, 2011; Salemink, Wolters & de Haan, 2015). Participants were presented with ambiguous scenarios that included one positive and one negative word fragment in each block. Participants were assessed on the time it took to resolve these word fragments. Participants with higher levels of positive interpretation bias are expected to resolve positive word fragments more quickly and negative less quickly and the converse for those who endorse negative biases more strongly.

One study (Belli & Lau, 2014) employed the Ambiguous Social Scenarios Interpretation Questionnaire (ASSIQ; Amir, Foa & Coles 1998; Stopa and Clark, 2000). However, the researchers only used this measure pre-training to ensure there were no differences between the groups in the endorsement of negative interpretations before the training. This questionnaire consisted of ambiguous scenarios which each had a choice of three explanations; one negative and two benign. Participants were asked to choose the statement that they felt was the most likely explanation.

One study (De Hullu et al., 2017) employed the Adolescent Interpretation and Belief Questionnaire (AIBQ). This questionnaire measure presented adolescents with ambiguous scenarios, both social and non-social. Participants were instructed to read three different interpretations of the scenario which included one positive, one neutral and one negative interpretation of the scenario. They were then asked to rate, on a scale from 1-5, whether this explanation had also popped into their mind.

One study utilised the Blended Words Task. (Le Moult et al., 2017) Participants were instructed to listen to ambiguous auditory stimuli. These stimuli were constructed by blending two words that differed by only one phoneme (e.g. sad-sand). After each sound, participants were instructed to indicate which word they heard. The task consisted of negative-neutral sounds, positive-neutral sounds, test stimuli and control stimuli. Control stimuli were composed of non-blended words, including negative, positive and neutral words. Interpretation bias is measured by the number of negative and positive interpretations indicated following ambiguous stimuli. This task can also be used to assess general task performance from the unambiguous trials as there is a clear correct answer.

Pleasantness ratings of photos were also used as a measure of interpretation bias (Burnett Heyes et al., 2017). Participants were instructed to rate pleasantness of a series of ambiguous photograph stimuli pre and post training. Changes in pleasantness ratings were compared across the training and comparison groups to assess change in bias.

Assessing biases is a difficulty within the literature and the aforementioned measures have varying limitations. Self-report measures (i.e. ASSIQ, AIBQ) are subject to response biases as they rely on participants accurately identifying and reporting their cognitions. Additionally, experimental measures (i.e. SST) do not always yield the same results as self-report measures (Rude, Durham-Fowler, Baum & Rooney, 2010).

**2.4.3.2 Evidence for association between modified interpretation biases and CBM-I training**

Eleven studies (78.6%) reported significant training congruent differences on interpretation biases post-training on at least one measure, suggesting that the CBM-I training had been successful in modifying interpretation biases. One study (De Voogd et al., 2017) reported a marginally significant reduction (*p*=0.108) in negative interpretation bias that was absent in the control group.

However, studies varied in their assessment of training congruent differences. Ten studies (71.4%) measured interpretation bias at pre-training as well as post-training. Four studies (28.6%) did not ascertain any baseline measure of participant’s interpretation bias before the training. As such, it is possible that the significant changes in interpretation biases reported in these studies were due to differences between the groups at baseline. Of the studies that measured interpretation bias at pre and post-training, nine reported significant differences (90%).

The studies included in this review measured interpretation bias using a variety of measures which hindered the ability to draw direct comparisons. The Recognition Test was used in all studies, although some papers employed this in conjunction with other measures. Some studies have suggested that CBM-I is effective in modifying biases based on scores on the RT alone (Belli & Lau, 2014; Chan et al., 2015; Lau et al., 2011, Lothmann et al., 2011; Telman et al., 2013). However, some researchers have raised concerns about the use of the RT (Chan et al., 2015; Krebs et al., 2017). They argue that the similarity between the Recognition Test and the CBM-I training paradigms may give rise to demand characteristics and influence participants performance on the RT post-training. It is interesting that one of the only two studies that did not find an effect on the RT, utilised an imagery paradigm. As such, this paradigm was less similar to the RT measure and it is likely that participants were less susceptible to demand characteristics than those receiving a scenarios CBM-I paradigm. This raises concerns about drawing conclusions about bias modification based on the RT alone.

De Hullu and colleagues (2017) used both the RT and the AIBQ. They reported that interpretive bias became more positive and less negative for the CBM group as measured by the RT. However, they conclude that although the CBM training was effective in modifying interpretative bias as measured by the RT, this long-term effect was not evident using the AIBQ as a measure.

The scrambled sentences task was used in three studies. All of these studies used this measure in addition to the RT. Two studies (De Voogd et al., 2017; Le Moult et al., 2017) reported significant changes in biases as per the RT but failed to find any significant effects when using the SS task as a measure. Le Moult and colleagues (2017) additionally employed the Blended Words task and found no significant effects for changes on this measure. Burnett Heyes and colleagues (2017) used the RT and SS in addition to a third measure of pleasantness ratings of photos. In contrast to the aforementioned studies, they found no significant effects using the RT. However, they reported that the training group reported greater increases in pleasantness ratings post-training compared to the control group and fewer negative interpretations on the SS task.

Two studies measured interpretive bias with both the RT alongside an additional measure of interpretive bias; the Interpretation Bias Questionnaire (IBQ). Fu and colleagues (2015) revealed that both measures yielded significant results; that those in the CBM-I group reported significantly less negative interpretations from pre to post-training than the control group. However, Fu and colleagues (2013) found the same results when using the RT but reported that training effects were not observed on the IBQ.

An additional two studies measured interpretive bias using the RT as well as an additional measure: reaction times to probes. Salemink and Wiers (2011) reported significant effects for differences between the groups on interpretation biases both as measured by the RT and reaction times. However, Salemink and colleagues (2015) found that CBM-I was successful in modifying interpretations biases as measured by reaction times; the CBM-I group took longer to complete the Obsessive Compulsive relevant probes compared to those in the control condition. However, they did not find any significant training-congruent effects on interpretation bias as measured by the RT. However, unlike other studies, participants in this research were receiving treatment as usual, both in the control group as well as in the training group who were receiving CBM-I as an adjunct. The authors note that the absence of significant differences between the groups on interpretation bias as measured by the RT may be due to interpretation bias modifications being made through treatment as usual (ceiling effect).

The majority of the studies in this review report significant training-related changes in biases. However, the measurement of interpretation bias is an area in need of development. Across studies, there is a wide variety of different measures employed, hindering the ability to draw comparisons. There are some difficulties with the most commonly used measure, the Recognition Test. Studies have attempted to overcome this by employing alternative measures additionally, however results are mixed across studies.

**2.4.3.3 Impact of CBM-I training on mood/ symptoms.**

Of the 14 studies included in this review, only seven (50%) reported any beneficial mood effects related to CBM-I training. Chan and colleagues (2015) reported a greater reduction in negative affect for the CBM group post-training in comparison to the control as measured by the Visual Analogue Scales (VAS). The VAS, taken from the Positive and Negative Affect Schedule (PANAS; Watson, Clark & Tellegen, 1988) consisted of two 10-item scales assessing participants positive and negative affect in the present moment. This study also investigating changes in mood as measured by the Beck Depression Inventory (BDI-II; Beck, Steer & Brown, 1996), a 21-item scale measuring symptoms of depression as well as the State and Trait Anxiety Inventory (STAI; Spielberger, Gorsuch, Lushene, Vagg & Jacobs, 1983), consisting of two 20-item scales measuring state anxiety (STAI-S) and trait anxiety (STAI-T). They reported that all participants reported increased positive interpretation, decreased negative interpretations, reduced depressive symptoms and no change in trait anxiety. However, they failed to find any significant effects on these measures relating to training condition. In addition, after the authors controlled for differences in training performances between the groups, all the mood effects disappeared.

De Voogd and colleagues reported a marginally significant effect (adjusted p=0.168) for the hypothesised Condition X Time interaction on symptoms as measured by the Strengths and Difficulties Questionnaire Parent Version (SDQ; Goodman, 1997), a parent-report questionnaire assessing symptoms of emotional problems, conduct problems, hyper-activity and peer problems in addition to pro-social behaviour. They reported a significant reduction in socio-emotional and behavioural symptoms in the group at the first follow-up compared to the control group. However, this study also employed a variety of other measures to assess mood and found no significant effects on any of these (see Table 3).

Burnett Heyes and colleagues (2017) was the only study in this review to utilise a picture-word generation procedure over a verbal training paradigm. This study also used the VAS scale to assess changes in mood. The authors revealed that, as hypothesised, positive mood increased more post-training for individuals in positive group (training condition) than participants in the mixed imagery (control condition). They note that this effect was only present from a field (and not observer) perspective which was in line with expectations due to the self-referent nature of field perspective.

Lau and colleagues (2013) utilised a stressor task in their study. They did not find any significant training-congruent benefits on mood as measured by the VAS. However, they reported that the CBM-I group demonstrated a reduction in anxiety levels after but not before the stressor task. They conclude that CBM-I training may modify anxious responsivity.

Lothmann and colleagues (2011) also used the VAS to measure changes in affect. They revealed that participants in the CBM-I group reported a significant decrease in negative affect whereas the control group (CBM-I negative) reported a significant decrease in positive affect but for male participants only.

Salemink and colleagues (2015) appeared to report some promising results in relation to the impact of CBM-I on symptoms of OCD. They revealed a trend for significant reduction of symptoms on both the obsessive scale of the Children’s Yale-Brown Obsessive-Compulsive Scale (CY-BOCS; Scahill et al., 1997) and the OCD subscale of the Revised Child Anxiety and Depression Scale (RCADS; Chorpita, Moffitt & Gray, 2005). Additionally, the reported a trend towards a significant reduction in anxiety as measured by the RCADS. However, these results must be interpreted with extreme caution. The effects reported reveal only a trend towards significance and this study employed a very small sample size.

Telman and colleagues (2013) used the VAS scale as a measure of change in affect pre and post-training. They also investigated changes in appraisal of recent stressors by employing the use of an adapted version of the Adolescent Perceived Events Scale (Compas et al., 1987) and the Child Life Events Checklist (Johnson & McCutcheon, 1980). They revealed that CBM-I participants rated recent stressors as having less impact on their life than the control group (CBM-I negative). They also revealed that participants in the CBM-I negative group experienced a significant increase in negative affect post-training, an effect that was absent in the CBM-I positive group. They did not find an effect for positive affect. The authors conclude that positive interpretation styles may boost resilience. However, it must be noted that this measure was only completed post-training and results may be impacted by differences between the groups at baseline.

Half of the studies reported some beneficial effects on mood or symptoms. Across the studies, there was a great degree of heterogeneity in terms of population, comparison group, mood or symptoms measures and measures utilised. As such, it was difficult to draw direct comparisons to gain an understanding of potential important factors.

***2.4.3.3 .1 Another study of note.***

Although not a direct beneficial impact of training, Lau and colleagues (2011) study also revealed a potential link between CBM-I training and mood. This study also employed the VAS as a measure to assess changes in mood. Similarly, they did not find any direct significant training-congruent effects on mood. However, their study included a measure of perceived self-efficacy, the Self-Efficacy Questionnaire for Children (SEQ-C; Muris, 2001). They revealed a significant 3-way interaction between time, training group and self-efficacy for positive affect. Further analyses revealed that for individual in the control group, who received CBM-I negative, participants who reported lower self-efficacy demonstrated a significant reduction in positive affect from pre to post training. The authors tentatively conclude that CBM-I training may have implications for prevention.

**2.4.3.4 Outcome measures.**

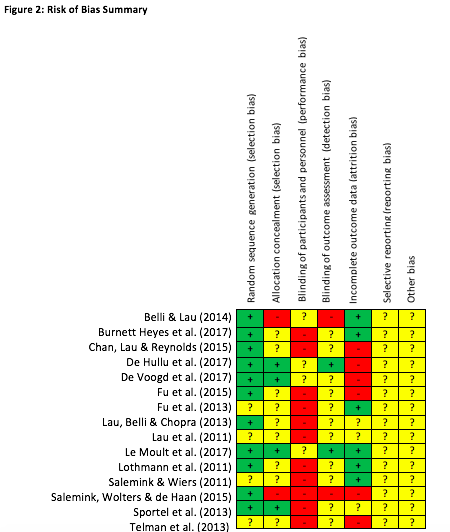
From the studies that reported significant beneficial impacts on CBM-I training on mood, the majority 85.7% (n=6) assessed changes in mood using a VAS measure. Only one study (Salemink, Wolters & de Haan, 2015) reported any beneficial impact of training on other standardized measures (CY-BOCS and RCADS). Table 3 displays the range of different validated, symptom specific-measures used in different studies (e.g. SCARED, CDI). However, with the exception of Salemink and colleagues (2015) research, these studies did not reveal any significant impact of CBM-I on mood. This raises the question of the validity of the findings in the aforementioned studies.

**2.4.3.5 Number of sessions.**

A slight majority of the above studies (57.1%) employed multiple sessions of CBM-I. However, three of the studies made use of just a single session. Of the studies that did not find any effects on mood or symptoms, the majority (66.7 %) used single session.

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| --- | --- | --- | --- | --- | --- | --- | --- |
| Table 3  *Study outcomes* | | | | | | | |
| Study | Comparison | Bias  Outcome Measure | Significant training  related changes in biases | Effect Size & p value | Mood/ Symptom Outcome Measure | Significant training related changes in mood/symptoms | Effect Size & p value |
| Belli & Lau (2014) | CBM-I positive  CBM-I (neutral)  CBM-I tested 24 hours after | ASSIQ  Recognition Test  (*Pre-& post)* | No differences between groups on biases pre-training  Same Session CBM-I positive vs CBM-I neutral  CBM-I significantly greater decrease in negative interpretations  Same-Session and 24 h groups  No sig. differences  CBM-Neutral vs 24-hour CBM-I positive  CBM-I positive showed greater increase in positive interpretations | *d*= 0.67  *p*<.029  η2= .086  *p*=.009 | VAS  *(pre-& post)*  *-Positive Affect*  *-State Anxiety*  *-Negative Affect* | - |  |
| Burnett Heyes et al. (2017) | Positive Imagery Training  Mixed imagery (control) | Pleasantness of photos  (*pre and post)*  Scrambled sentences task  *(post)*  Recognition Task  *(post)* | Greater increase in pleasantness ratings for Positive group compared to mixed imagery  Decreased negativity scores for Positive group compared to Mixed imagery condition  - | *d*=1.12  *p*=.008  *d*= .558  *p*=.038 | VAS  *(pre-&post)*  *Positive Mood*  *Negative Mood* | Greater increase for Positive group compared to Mixed imagery condition  - | *ηp2*=.024  *p*=.021 |
| Chan et al. (2015) | CBM-I positive  CBM-I neutral | Recognition test  *(Pre, Post, Post-stressor)* | - | - | BDI-II  *(Pre-&post)*  STAI-S  *(Pre-&post)*  STAI-T  (Pre-&post)  PANAS positive  *(Pre, Post, Post-stressor)*  PANAS negative  *(Pre, Post, Post-stressor)* | -  -  -  -  Time 1 to Time 2  CBM-I positive showed significant reduction in negative affect  Time 2 to Time 3  CBM-I showed significant increase in negative affect  Time to Time 3  CBM-I positive showed a significant reduction in negative affect  No effects found for comparison group. | -  -  -  -  *d*=0.37  *p*=.045  *d*=0.36  *p*=.049 |
| De Hullu et al. (2017)  Sportel et al. (2013) | CBM-I positive  No treatment  CBT | 2 Year FU  Adolescent Interpretation and Belief Questionnaire  *(pre-&post)*  Recognition task  *(pre-&post)*  Recognition Task  (pre-&post)  AIBQ  (pre-&post) | -  CBM-I group reported greater decrease in biases from baseline to 2 years post training compared to the control  CBM vs CBT &Control CBM showed greater reduction in negative biases than comparison groups  CBM showed greater increase in positive biases than comparison groups  CBM v Control CBM showed greater reductions in negative biases than control | *d*=-1.44  *p*<0.05  Could not obtain  “ “ | *All pre-& 2-year follow-up*  RCADS – SAD  Spielberger  TAI  ADIS-C  RSES (self-esteem)  VSVJ (pro social behaviour from MESSY)  stIAT (Implicit social-threat associations)  BFNE-II (Fear of negative evaluation)  *All pre (T1), post (T2), 6month post (FU1), 12 months post (FU2)*  RCADS  TAI  stIAT  Presence of social anxiety (ADIS-C) | -  -  Only a very small fraction  of the participants received a diagnosis of SAD - these data could not be meaningfully subjected to statistical analysis.  -  -  -  -  From FU1 to FU2 CBM showed greater increase in positive automatic associations than CBT & control    Could not be analysed (see De Hullu et al., 2017) | N/A  -  -  *d*=0.61  *p*=.003 |
| De Voogd et al. (2017) | CBM-I (scenario training)  CBM-I  (Picture-word training)  CBM-I neutral | Recognition Task  *(pre-&post)*  Scrambled Sentences Task  *(pre-& post)* | Scenario v Control  Marginally significant reduction in negative interpretation bias for scenario group compared to control  Non-significant after adjustment  - | *d*=0.34  *p*=.108 | SCARED  CDI  BDI  Stress reactivity  Self esteem & Perseverative thinking questionnaire  SDQ-Parent  *All pre, (T1), post (T2), 3 months follow-up (FU1), 6 months follow-up (FU2)* | -  -  -  -  -  Scenario v Control  Marginally significant (adjusted *p* = 0.160) reduction in parent-reported social-emotional and behavioral symptoms in the scenario training group at FU1 compared to the control group (adjusted *p* = 0.168) | -  -  -  -  *d*=0.48 |
| Fu et al. (2015) | CBM-I positive  CBM-I neutral  (half positive half negative) | Interpretation Bias Questionnaire  *(pre-&post)*  Recognition Test  *(post)* | CBM-I positive group showed greater decrease in negative interpretations from pre-post training. These changes were not significant for comparison group.  High anxious group showed significantly greater interpretation bias than low-anxious group at pre-training, but interpretation bias did not differ between the groups following positive CBM-I training.  CBM-I related changes in bias only significant for high anxious group  Target  CBM-I positive endorsed more positive interpretations than the comparison  CBM-I positive endorsed less negative interpretations than the comparison  Foils  CBM-I positive endorsed more positive interpretations than the comparison  CBM-I positive endorsed less negative interpretations than the comparison | *d*=0.65  *p*=.001  *d*=1.24  *p*=.001  *d*= 0.87  *p*=.001  *d*=0.58  *p*<.05  *d*=0.88  *p*<.001  *d*=0.54  *p*<.05  *d*=0.95  *p*<.001 | VAS  Negative mood  Positive Mood | -  - |  |
| Fu et al. (2013) | CBM-I positive  CBM -I neutral  (half positive half negative) | Recognition Test  Interpretation Bias Questionnaire | CBM-positive group showed a significant reduction in negative bias compared to comparison group  - | *d*=1.26  *p*<.01 | VAS  Negative Mood  Positive Mood | -  - |  |
| Lau et al. (2013) | CBM-I positive  CBM-I negative | Interpretation Test  (post) | Targets  CBM-I positive group endorsed more positive interpretations than comparison group  CBM-I positive group endorsed less negative interpretations than comparison group  Foils  CBM-I positive group endorsed more positive interpretations than comparison group  CBM-I positive group endorsed less negative interpretations than comparison group | *d* =1.76  *p*<.001  *d* =2.11  *p*<.001  *d* =4.54  *p*<.001  *d*= 1.20  *p*=.003 | VAS  (pre: T1,post:T2, post stressor: T3) | T2 to T3  CBM-I positive group showed significantly lower anxious mood ratings than the comparison group post-stressor | *d*=0.81  *p*=.01 |
| Lau et al. (2011) | CBM-I positive  CBM-I negative | Recognition Test  (post) | Targets  CBM-I positive group endorsed more positive than negative targets  Significant difference between positive targets between training groups  Significant difference in ratings of negative targets between groups  Foils  CBM-I positive gave higher ratings for positive than negative foils | *d* = .76  *p*=.025  *d* = .71  *p*=.004  *d*=1.03  *p*=.004 | VAS  VAS & SEQ-C  (pre&post) | -  Participants who reported lower self-efficacy and received CBM-I negative showed a significant reduction in positive affect | Could not obtain |
| Le Moult et al. (2017) | CBM-I positive  CBM-I neutral | Recognition Test  (post)  Scrambled Sentences Task  (pre-&post)  Blended Words Task  (pre-&post) | CBM-I positive group endorsed more positive sentences than those in the control group (targets & foils)  -  - | η2 = 0.126  *p*=.017 | CDI  CDRS-R | -  - |  |
| Lothmann et al. (2011) | CBM-I positive  CBM-I negative | Recognition Test  (post) | Targets  CBM-I positive group endorsed more positive interpretations than the comparison group  CBM-I positive endorsed less negative interpretations than the comparison group | *r* = .34  *p*<.01  *r* = -.5  *p*<.01 | VAS  Negative Affect  Positive Affect | CBM-I positive group reported significant decrease in negative affect from pre to post-training  This did not occur in the comparison group.  Positive affect decreased in boys receiving negative training | *r*=.40  *p*<.01  *r*=.54  *p*<.05 |
| Salemink & Wiers (2011) | CBM-I positive  CBM-I neutral | Reaction Times (to probe scenarios)  Recognition Test  (pre-&post) | CBM-I positive were quicker to solve positive than negative word fragments  The control group did not differ significantly in their responses to positive or negative words.  CBM-I positive were significantly quicker to complete positive probes compare to comparison group  No differences between groups in interpretations pre-training.  Post-training, CBM-I positive endorsed more positive interpretations and less negative interpretations | *d*=0.5  *p*<.001  *d*=0.4  *p*=.01  *d*=0.4  *p*=.01  *d*=0.8  *p*<.001 | STAI-C | - |  |
| Saleminket al. (2015) | CBM-I + TAU  TAU + placebo training | Reaction Times  Recognition Test  (pre-&post) | CBM-I positive group significantly slower in completing Obsessive-Compulsive relevant probes compared to placebo condition  - | *d*=.64  *p*=.03 | OBQ-CV  CY-BOCS  RCADS  OCD subscale  CDI:  Anxiety & Depressive symptoms | -  Obsessive Scale  Trend for predicted GroupX Time interaction effect  Further analyses revealed decrease in obsessions in CBM-I group but not in placebo  Trend for predicted Group X Time interaction  Significant decrease in OC symptoms in CBM-I group but not placebo  Anxiety Trend for Group X Time interaction  Significant reduction in anxiety symptoms in CBM-I group but not placebo | *d*=0.64  *p*=.005  *d*=0.78  *p*=.018  *d*=0.89  *p*=.01 |
| Telman et al. (2013) | CBM-I positive  CBM-I negative | Recognition test  (post) | CBM-I positive endorsed more positive targets than the negative training group  CBM-I positive endorsed fewer negative targets than the negative training group  CBM-I positive endorsed more positive foils than the negative training group | *d*= 1.15  *p*<.001  *d*=1.07  *p*<.001  *d*= 1.20  *p*<.001 | VAS  Negative Affect  Positive Affect  *(Pre:T1, Post:T2, T3, T4)*  Appraisal of recent stressors: Life event scale - impact | -    -  Negatively-trained individuals rating events as having a greater impact than positively-trained adolescents. | *d*= .69  *p*<.05 |

**Risk of Bias**

All 15 studies were assessed for risk of bias. A separate risk of bias assessment was conducted for the Sportel (2013) and de Hullu (2017) studies. This was done following the data extraction stage to prevent bias in extracting data. Overall, the risk bias was unclear (see Figure 2). Many studies did not provide sufficient information. Generally, studies employed appropriate randomisation procedures, however a number of studies did not report how they had randomised. Allocation concealment was predominantly rated as “unclear” as there was generally a lack of information provided to allow a judgement. In relation to performance bias, many studies did not blind assessors, however most trainings were computerised and did not involve administration from the assessors. Despite this, many studies were rated as high risk for this category as it was deemed likely the participants could understand the aims of the training due to repetitive the nature of the task and the similarity between the training and the main assessment measure (recognition task). Chan and colleagues (2015) reported that 94% participants accurately guessed the purpose of the CBM-I training. In relation to detection bias, very few studies reported whether outcome assessors were blinded. For attrition bias, studies were marked as low risk if missing data was less than 5% or were not reflective of selective attrition (e.g. due to technical issues).

**2.5 Discussion**

**2.5.1 Summary of Main Findings**

CBM-I training interventions are a newly developing area of research. Owing to this fact, there are a limited number of studies currently available investigating the efficacy of such interventions. Amongst available studies, there is a large amount of heterogeneity. This is linked to the fact that it is an emerging an exploratory field with the best measures not yet well established. As these studies differ in a number of fundamental ways, it is difficult to make clear conclusions regarding the clinical implications of such training for adolescents. However, compiling such exploratory research sheds some lights on promising areas of development as well as factors to be considered in future research. It provides a helpful analysis of the range of measures currently being employed and their strengths and limitations. This in turn enables some recommendations for future research, particularly in relation to measurement of changes in biases and mood/symptoms of psychopathology.

Despite the recent interest in the efficacy of CBM-I training for youth, there has been little consideration of important developmental differences between children and adolescents with previous meta-analyses combining both of these populations. Adolescents experience a number of cognitive changes that may have an impact on their cognitive styles (interpretation biases) and interventions aiming to modify these. As such, this review sought to investigate the clinical implications of CBM-I specifically for adolescents.

The clinical implications discussed in this review were two-fold; the impact of CBM-I on the modification of interpretation biases as well as the impact of this training on mood and/or symptoms of mental health difficulties. Results appeared promising in terms of the impact of CBM-I training on interpretation biases. The majority of studies reported significant training congruent differences on interpretation bias post-training on a at least one measure. However, further investigation revealed that the majority of these significant effects were based on the use of the Recognition Test. There have been concerns about the validity of this task as a measure of interpretation bias following CBM-I training due to the similarity between it and training tasks (Krebs et al., 2017). Future studies should account this by employing an additional measure and/or obtaining information from participants about their understanding of the purpose of the task to control for demand effects.

Many studies in the review that employed additional measures of interpretation bias did not find significant effects following CBM-I training. However, there was a wide variety of measures used across studies making it difficult to draw clear comparisons or conclusions. Future research would benefit from the use of established measures of interpretation bias (e.g. the Children’s Attributional Style Questionnaire Revised; Kaslow & Nolen-Hoeksema, 1991) or development of similar measures with strong psychometric properties which could be used at both pre and post-training.

Change in interpretation bias was also commonly assessed by investigating whether treatment groups experienced an increase in positive interpretations post training or a decrease in negative interpretations. Significant effects for these changes were inconsistent across the studies; some studies reported significant findings for change in positive interpretations and others changes in negative interpretations. Studies often reported that CBM-I had been successful in modifying interpretation bias if either, not both, of these changes were statistically significant. Additionally, interpretation bias was not measured at baseline in almost a third of studies. As such, it was not always clear whether differences between the groups on interpretation bias following training were a result of training or due to differences between the groups at baseline. Future research would benefit from including measures of baseline which would enable pre and post training comparisons of levels of biases.

The majority of significant findings in relation to a beneficial impact of CBM-I training on psychopathology were assessed with Visual Analogue Scales (VAS). Salemink and colleagues (2015) study was the sole paper in this review to find any beneficial impact of training on mood/symptoms as measured by an alternative, standardized measure. However, the reported effects were only trends towards significance and were based on a very small sample size (*n*=16). As such, these results must be interpreted with extreme caution. The psychometric properties of VASs are questionable, with wide variabilities of test-retest reliability although there is some evidence supporting their use in the measurement of state anxiety (Williams, Morlock & Feltner, 2010), However, future studies would benefit from the use of validated measures of psychopathology such as the Strengths and Difficulties Questionnaire (Goodman, 1997). Such a measure would allow for the exploration of a variety of symptoms, both internalising and externalising. At this early stage in the research, investigating potential benefits of a wide variety of symptoms may be beneficial. Cognitive biases have been found to be linked to psychopathology in adolescents with a range of difficulties (Mathews & MacLeod, 2005). As such, it is possible that CBM-I training interventions may have beneficial impact on different symptoms.

Although many studies failed to find significant improvements in mood or symptoms following CBM-I training, some studies reported some interesting, less direct findings. These include proposals that CBM-I may have utility as a prevention tool (Lau et al., 2013), may modify anxious responsivity (Belli & Chopra, 2013) and improve resilience (Telman et al., 2013). Such findings suggest that simple pre-post designs investigating the impact of CBM-I directly on mood/symptoms may miss important, more complex interactional effects. Cognitive biases are considered to be a maintenance factor in psychopathology (Mathews and Macleod, 2005). However, further research investigating these biases and how they change throughout effective cognitive therapy may be required to aid the understanding of the mechanisms and this clinical efficacy of CBM-I.

Although previous studies have argued that multisession CBM-I may be required for beneficial mood changes to occur (Fu et al, 2015), it is difficult to ascertain this from the results of the studies included in this review. Of the studies that reported beneficial impacts of training on mood/symptoms, there was little difference between those who had provided single or multiple sessions of CBM. However, from studies that reported no significant results in terms of impact of CBM-I on mood, the majority had only provided single sessions.

There was also heterogeneity in regard to training paradigms employed in the studies. While the majority used ambiguous scenarios, there was variation within these. Some studies reported exclusively using social scenarios whereas others included both social and non-social scenarios. Two studies (Burnett Heyes et al., 2017 & De Voogd et al., 2017) employed imagery tasks. Both of these studies reported some apparent beneficial impact of training. Burnett Heyes and colleagues (2017) put forward a theoretical argument for the use of imagery for CBM-I training. They provide evidence that mental imagery is a key feature in many different mental health disorders and that adolescents may be more susceptible to emotional (including imagery) symptoms as a result of continuing changes in cognition, emotion regulation abilities and motivational and social concerns. Adult studies have reported that CBM-I trainings that employ imagery are more effective in producing emotional change that scenario paradigms (Holmes, Lang & Shah, 2009). It is very difficult to draw any conclusions on the sole basis of two studies, however the use of imagery in CBM-I training appears to be an interesting area for future exploration. The visual nature of this intervention may also be a more engaging means for adolescent populations. Future research would benefit from the standardisation of CBM-I training paradigms (i.e. through manualisation) to allow for direct comparisons across studies to enable the identification of common beneficial components.

**2.5.2 Comparison of findings with other reviews**

There were two previous reviews conducted in this area. Cristea and colleagues (2015) concluded that CBM-I appears to have little clinical utility for non-adult populations, whereas Krebs and colleagues (2017) had a more positive finding and reported that CBM-I trainings have small to moderate effect size for young people with anxiety. Despite presenting conflicting findings, both studies highlighted the potential role of demand characteristics in this body of research as well as the need for more methodological rigour in future studies. This review echoes the need for further research in this field. Although results from studies were inconsistent in regard to the clinical utility of CBM-I for adolescents, it is very difficult to draw conclusions due to the variety of methodological factors that need to be addressed. At this stage in the research, concluding that CBM-I has little clinical utility is premature. Future studies must employ more stringent measures of biases and mood or symptoms of psychopathology to allow for a comprehensive understanding of such interventions. Additionally, accounting for developmental differences between children and adolescents is imperative. There are a number of important cognitive differences between these groups and analysing studies of these different populations within the same review is likely to obscure any differential effects. The use of a narrative review allowed for exploration of heterogeneity across studies and understanding advantages/limitations of different methods (Popay et al., 2006).

**2.5.3 Limitations and Future Directions**

The review had some limitations which must be considered. Despite comprehensive database and hand searches, as with any literature review there is always a possibility that this review failed to include other relevant studies. The main aim of the review was to investigate the clinical efficacy of CBM-I training for adolescents. In order to ascertain as many studies as possible for this population, inclusion criteria were broad. However, due to the limited numbers of CBM-I studies with adolescents specifically, these criteria remained broad in relation to training paradigms and clinical groups in order to remain exclusive to adolescent studies. As such, there was a wide amount of heterogeneity in targeted clinical groups and symptoms. When further studies provide, future research would benefit from focusing on a specific disorder to allow for better comparison across studies, particularly in relation to outcome measures.

It must be noted that the quality of the studies included in the review, as measured by the Cochrane’s Risk of Bias tool was suboptimal. However, this is linked to the new and exploratory nature of this research. Synthesising and analysing available evidence at this stage with lower quality studies is still important in terms of informing and optimising the development of future studies. The quality tool revealed that many studies did not provide sufficient information on procedures and had a number of sources of bias. Future research would benefit from undertaking more stringent research procedures. This assessment highlighted concerns around the similarity between the training tasks and the primary assessment of interpretation bias; the Recognition Task. Chan, Lau and Reynolds (2015) found that 94% of participants were able to accurately guess the aim of the CBM training. As such, it is likely that a measure so similar to training materials is susceptible to demand characteristics. Future studies would also benefit from utilising alternative measures of interpretation bias.

Training paradigms used generally focused on modifying negative interpretation biases to more benign/positive interpretations. Ambiguous scenarios contained a variety of threats including both social and non-social. It is possible that these trainings would be more effective if training paradigms were tailored to target specific, disorder-relevant biases. Some studies with adults have developed other, more targeted interventions from CBM-I, called CBM-error (Lee et al., 2011). This is specifically designed to target error categories that have been found to be prevalent in particular disorders (e.g. depression). It is possible that such trainings, tailored to biases relevant to the particular population being studied, would reveal greater beneficial impacts on mood and/or symptoms of mental health difficulties. This is an avenue for future research.

In order to further understand the relationship between developmental differences and impact of CBM-I training, it would be useful to directly compare CBM-I training with different age groups. Indeed, there is limited research on the different cognitive biases that different adolescents experience. Much of this research has focused solely on adolescents experiencing anxiety and depression, and there is evidence that these biases may change over time during this important developmental period (Slavny & Pote, under review). Future research would benefit from understanding the prevalence of different cognitive biases in adolescence as well as the developmental differences of these biases. Such understanding would inform the development of tailored CBM-I training.

While investigating the clinical efficacy of CBM-I training with adolescents, it is important to consider its use in light of naturally occuring developmental processes and in the context of wider systems. There is evidence for the normative development of cognitive biases throughout adolescence (Slavny & Pote, in press). This is thought to be linked to brain maturation of key front-limbic circuits responsible for the processing of emotional and social stimuli (Hallet, Kadosh, Scerif & Lau, 2015) . Consequently, this suggests that the aim of CBM-I should not necessarily be to eliminate such cognitive processes. Further research investigating the presence and development of biases throughout adolescence would aid this understanding. Additionally, these neurodevelopmental changes during adolescence may enhance plasticity to new learning through means such as CBM-I (Haller, Kadosh, Scerif & Lau, 2015).

CBM-I focuses solely on the individual. It recognises the association between cognitive biases and psychopathology and aims to reduce symptoms through changes in an individual’s cognitive processes. However, CBM-I does not account to systemic factors that may be contributing to or maintaining mental health difficulites. This is particularly important during adolescence as youth often have less control over environmental factors that may be problematic (e.g. living in a chaotic household). Successful individual therapy may be limited in the impact it has on an adolescent’s well-being if such maintenance factors are not addressed. CBM-I utilises principles from social learning theory. However, CBM-I sessions are limited and adolescents are likely to be more consistently exposed to observational learning from others in their system. Consequently, it is possible that they could have more exposure to cognitive styles or behaviours that are maladaptive and subsequently negatively impact on their well-being. Such factors should be considered when deliberating the clinical efficacy and potential use of CBM-I.

**2.6 Conclusion**

The aim of this review was to identify and evaluate the empirical literature on the clinical implications of CBM-I training for adolescents. The review specifically aimed to investigate a) the extent to which CBM-I alone modifies cognitive biases in adolescents b) the impact of CBM-I alone on mood/ symptoms of psychopathology. It included 15 studies, with dates of publication spanning from 2011 to 2017. The majority of studies (78.6%) reported significant beneficial trianing-congruent changes in biases. However, such findings were based on the use of the Recognition Test measure which is subject to response bias. Only 50% of studies reported any significant beneficial impact of training on mood or symptoms of psychopathology. The measures used and population investigated varied across these studies, limiting the generalisability of such findings. The results of the review highlight the large amount of heterogeneity in this area of research as well as some concerns around measurements being used. Although there was promising evidence in relation to the impact of CBM-I on bias modification, due to the minimal amount of research that has been conducted in this area with adolescents specifically, it is too early to draw definitive conclusions regarding the clinical efficacy of such interventions. However, this review provides a useful analysis of the range of training paradigms, measures and methodology currently being employed as well as their strengths and limitations. The findings raise concerns about the use of the Recognition Test in assessing bias and suggest that the use of imagery in CBM-I training has potential to be an avenue of promise. The review highlights the need for more stringent research methodology in this field and makes a number of recommendations for future research, in particular in relation to the measures employed. These include reducing the use of the VAS and employing well-validated measures with strong psychometric properties.

**3. Empirical Paper: Investigating cognitive biases in adolescents with externalising difficulties**

**3.1 Abstract**

**Background:** Cognitive biases have been found to be associated with psychopathology. Externalising difficulties are a common problem amongst adolescents and treatments often target biases which may maintain difficulties. In spite of this, little attention has been given to research investigating biases in this population. **Method:** This study used an independent group design to compare the presence of a variety of cognitive biases in adolescents at high risk of an externalising disorder (n=24) in comparison to a control group with low risk of an externalising disorder (n=24). Participants were presented with an experimental measure and a series of self-report questionnaires investigating cognitive biases. **Results:** Results indicated that adolescents with high levels of externalising difficulties experienced significantly lower levels of positive attributional bias in comparison to adolescents with low levels of externalising difficulties. MANOVAs did not reveal any significant differences between the groups on negative cognitive biases. **Conclusions**: Results are discussed in relation to clinical implications, such as the use of CBM-I training, as well as directions for future research and the need for more appropriate measures of biases for this population.

**3.2 Introduction**

Cognitive biases have been found to be associated with psychopathology in adults (Mathews & Macleod, 2005). Challenging cognitive biases is a key focus of current cognitive treatments such as Cognitive Behavioural Treatment (CBT). Despite the common use of such interventions with adolescents, much less in known about the presence of biases in this population. Within this smaller pool of research, associations have been found between higher levels of biases in adolescents and internalising difficulties (Mathews & MacLeod, 2005). However, much less is known about the presence of cognitive biases in adolescents with externalising difficulties. Investigating this area could have important treatment implications.

Cognitive theory postulates that people continuously make appraisals about the world around them and these directly impact on an individual’s affect and behaviour (Beck, Rush, Shaw, & Emery, 1979). Cognitive biases, or negative thinking patterns are one form of appraisal. They have been defined as “*exaggerations of thinking errors that we all experience from time to time when we are emotionally aroused. They reflect normal fluctuations in our information-processing styles*” (p.172, Westbrook, Kennerley, & Kirk, 2014). Within the child and adolescent literature, cognitive biases have also been referred to as “cognitive errors” (Leitenberg, Yost, & Carroll-Wilson, 1986). Due to the negative implications of this term, which arguably implies that there is a recognised right and wrong way of thinking, the term “cognitive biases” shall be used in this thesis.

Cognitive biases are considered to be normal fluctuations in an individual’s processing style. However, it is proposed that if theses biases become chronic or too extreme they can be problematic. In the adult literature, a large body of research has found clear links between psychopathology and higher levels of cognitive biases. Biases are thought to play a maintenance role for several different mental health difficulties (Harvey, Watkins, Mansell, & Shafran, 2004). In research with adolescents, those with and without mental health difficulties have been found to endorse cognitive biases, but higher levels of these biases are associated with internalising difficulties such as anxiety and depression. (Mathews & MacLeod, 2005). There is a lack of current research exploring how these biases may relate to externalising difficulties and how these biases may change during adolescence.

**3.2.1 Biases in Adults**Throughout the 1980s and 1990s, an abundance of research was conducted investigating these biases within the adult population, revealing an association between these thinking patterns and psychopathology. Cognitive biases are thought to be a fundamental factor in the onset and maintenance of a number of disorders including antisocial personality disorder which is characterised by externalising difficulties such as aggression and behavioural difficulties (Beck, 2008; Beck & Clark,1997; Clark, Beck, & Alford, 1999; Clark & Wells, 1995; Eysenck, 1997; Mathews & MacLeod, 2005; Rapee & Heimberg, 1997; MacLeod, Campbell, Rutherford, & Wilson, 2004; Lobbestael, Cima & Arntz, 2013). These studies have informed current treatments for a variety of mental health problems including cognitive-behavioural therapy (Mathews & MacLeod, 2005).

**3.2.2 Cognitive-Behavioural Therapy**

Cognitive behavioural therapy (CBT) has a strong evidence base as a psychological therapy and is the front-line treatment for a variety of psychological difficulties (Hofmann, Asnaani, Vonk, Sawyer, & Fang, 2012).NICE guidelines specifically recommends CBT for depression, anxiety and bipolar disorder (NICE, 2009; NICE, 2014a;NICE, 2014b ). A primary target of CBT treatment is challenging unhelpful cognitions and involves recognising and modifying cognitive biases (Westbrook, Kennerley & Kirk, 2014)

There is a body of evidence supporting the efficacy of CBT as a treatment for young people (Carr, 2016). NICE guidelines recommend CBT for a variety of difficulties including anxiety and depression (NICE 2005; NICE 2013b) and cognitive techniques are also used in treatments for externalising difficulties (NICE, 2013a). NICE guidelines recommend 9-14-year olds with conduct problems receive social and cognitive problem-solving programmes based on a CBT problem-solving model. For 11-17-year olds, a multi-modal approach is recommended such as multi-systemic therapy, which utilises cognitive techniques. CBT has been reported to be associated with moderate reductions of externalising symptoms in youth (Battagliese et al., 2015).

Understanding cognitive interpretations is a vital necessity in CBT, yet, despite the common use of CBT with young people, much less is known about cognitive biases in this population in comparison to the adult population (Stallard, 2003). The development of CBT and models of intervention has fundamentally been developed through research with adults (Stallard, 2003). These models and techniques have subsequently been applied to youth.

There is debate regarding whether young people have the cognitive ability necessary for successful engagement in CBT (Grave & Blissett, 2004). Consequently, interventions with children often focus on the behavioural rather than cognitive elements of treatment (Stallard, 2002). Similarly, the use of adult models of CBT with adolescents has been criticised, as they do not consider the impact of developmental changes occurring during this period (Grave & Blissett, 2004; Kinney, 1991; Ollendick, Grills, & King, 2001; Stallard, 2003). However, it has been conversely argued that the cognitive development of youth is more flexible and with appropriate adaptations to their developmental needs, they can engage successfully in therapy (Quakley, Reynolds & Coker, 2004).

Nilsen, Eisemann and Kvernmo’s (2013) meta-analysis indicated poorer outcomes for adolescents receiving CBT compared with children. In order to understand why differential outcomes exist for children and adolescents and to optimise the efficacy of these interventions, further research exploring the presence of these biases in young people is required. It could allow for therapy to be appropriately tailored to target specific biases relevant to this population. In the adult population, the use of disorder-specific approaches that target biases found to be associated with particular symptoms is conventional and supported by a solid evidence base (Westbrook, Kennerley, & Kirk, 2014; Schulte, Kunzel, Pepping & Schulte-Bahrenberg, 1992). In the child and adolescent literature, there is also research favouring such approaches, with disorder-specific treatments associated with larger effect sizes than disorder generic treatments (Reynolds, Wilson, Austin & Hooper, 2012).

**3.2.3 Adolescence**

It is important to consider why adolescent cognitive processes and biases might differ from those of adults. Adolescence is a unique developmental period characterised by endocrinological change, neuro-cognitive change (e.g. working memory, inhibitory control, abstract thought, decision making and perspective taking), affective and social change (Ahmed, Bittencourt-Hewitt, & Sebastian, 2015; Blakemore & Robbins, 2012; de Veld, Riksen-Walraven, & de Weerth, 2012; Dumontheil, 2014; Gilbert, 2012; Somerville & Casey, 2010; Spear, 2009). Research has indicated that adolescents continue to develop abilities of executive functioning throughout adolescence (Boelema, 2014). Changes in cognition may play a role in the presence of cognitive biases during this important time period. Therefore, it is imperative that research is done with this group independently as their profile may differ significantly from that of adults and children. Adolescence is also a period of increased risk for the development of psychopathology (Casey, Jones, & Hare, 2008; Lee, et al., 2014; Paus, Keshavan, & Giedd, 2008). Understanding the presence and development of cognitive biases is important for gaining a greater understanding of the development of psychological difficulties during this critical time period.

**3.2.4 Cognitive Biases in Children and Adolescents**

The research investigating biases in young people is much less expansive than the adult literature. In this small pool of research, a number of cognitive biases are examined together and measured using a single child self-report questionnaire: the Children’s Negative Cognitive Errors Questionnaire (CNCEQ; Leitenberg et al., 1986) and the revised version (CNCEQ-R; (Maric, Heyne, van Widenfelt, & Westenberg, 2011). The five biases measured are: underestimation of ability to cope, personalising without mind reading, selective abstraction, overgeneralising and mind-reading. The other two most widely researched biases include threat interpretation and attributional bias which are usually investigated separately (see Table 1 for definitions and examples). These biases have predominantly been investigated in relation to internalising difficulties but seldom in relation to externalising difficulties. Examining these biases across different disorders could have transdiagnostic implications. This is particularly important in relation to adolescents due to the high rates of comorbidity in this population with emotional and conduct disorders being the most common combination of difficulties (Green, McGinnity, Meltzer, Ford & Goodman, 2004). Slavny and Pote (under review) investigated biases across a community sample (*N*= 577) of adolescents (10-17 years) found that all seven of these biases were evident across at least three different quasi-diagnostic groups. Understanding whether there are particular cognitive processes common to multiple presentations of psychopathology could allow for the development of treatments capable of targeting multiple symptoms.

|  |  |  |
| --- | --- | --- |
| Table 1  *Definitions and examples of cognitive biases* | | |
| Name of Cognitive Bias | Definition | Example |
| Biases Measured by CNCEQ-R | | |
| Underestimation of ability to cope (UAC) | the tendency to judge oneself as unable to cope with potentially threatening situations | You are in the swimming pool and you are having a lot of fun. Someone in the pool says something unkind to you. This makes you feel bad. You think, ‘*I can’t deal with this bad feeling.’* |
| Personalising without mind-reading (PER) | the tendency to relate external events to oneself when there is no evidence for this and without assuming knowledge of what another person is thinking | Your class is having 4-person relay races in gym class. Your team loses. You think, ‘*If I had just been*  *faster we would not have lost*.’ |
| Selective Abstraction (SA) | the tendency to exclusively focus on one negative aspect or detail of a situation, magnifying the importance of that detail) | You are trying out for the school softball team. You get up four times and get two hits and make two outs. You think, ‘*What a lousy practice I had.’* |
| Overgeneralising (OV) | forming a general rule or conclusion on the basis of one or more isolated incidents and applying the concept to related and unrelated situations | Some of your friends have asked you if you’re going to try out for the school soccer team. You tried out last year but did not make it. You think, ‘*What’s the use of trying out, I couldn’t make it last year.’* |
| Mind-reading (MR) | the tendency to conclude that someone is reacting negatively or thinking negatively towards oneself without specific evidence to support that conclusion | You call one of the kids in your class to talk about math homework. H/She says: “I can’t talk to you now, my father needs to use the phone. You think, ‘*They didn’t want to talk with me.’* |
| Additional Biases | | |
| Threat Interpretation | a tendency to interpret a situation as threatening | Your eyes are sore. You think  “*There is something wrong with my eyes”* |
| Positive Attributional Bias | a tendency to attribute the causes of positive events or situations to internal, global and stable factors | *You get an A in an exam. You think “I am smart”* |
| Negative Attributional Bias | a tendency to attribute the causes of negative events or situations to internal, global and stable factors | You break a glass. You think “*I am not careful enough”* |

**3.2.5 Evidence base for the relationship between biases and internalising difficulties**

**3.2.5.1 CNCEQ-R biases**

Research investigating cognitive biases in young people has predominantly focused on anxiety and depression. Studies have reported an association between the biases measured by the CNCEQ and symptoms of depression (Cole & Turner, 1993; Kennard, Stewart, Hughes, Patel, & Emslie, 2006) and anxiety (Weems, Berman, Silverman, & Saavedra, 2001; Weems, Costa, Watts, Taylor, & Cannon, 2007; Cannon & Weems, 2010). Similar results have been reported using the CNCEQ-R (Maric et al., 2011; Maric, Heyne, de Heus, van Widenfelt, & Westenberg, 2012; Schwartz & Maric, 2015). Schwartz and Maric (2015) additionally reported significant age effects, with children indicating higher total bias scores in comparison to adolescents. However, these results are not consistent across the literature, with Weems et al. (2001) reporting higher bias scores in adolescents compared to children.

**3.2.5.2. Threat interpretation**

Several studies have investigated threat interpretation in young people, largely using the Ambiguous Situations Questionnaire (ASQ; Barrett, Rapee, Dadds, & Ryan, 1996). They have revealed a relationship between anxiety-related symptoms and this bias in both clinical (Hughes & Kendall, 2008; Waters, Wharton, Zimmer-Gembeck, & Craske, 2008) and non-clinical samples (Muris, et al., 2000; Muris, Luermans, Merckelbach, & Mayer, 2000; Muris, Jacques, & Mayer, 2004). Some studies have also found independent associations between the threat interpretation bias and symptoms of depression (Muris et al., 2000; Eley et al., 2008).

**3.2.5.3 Attributional bias**

There is a substantial body of research using the Children’s Attributional Style Questionnaire (CASQ; Seligman, et al., 1984) that has highlighted a relationship between negative attributional bias and depression in young people across community and clinical samples (Gladstone & Kaslow, 1995; Joiner & Wagner, 1995). Studies have also revealed a relationship between negative attributional bias and anxiety in young people in community and clinical samples (Garber, Weiss, & Shanley, 1993; Curry & Craighead, 1990). Overall, current research provides evidence of associations between internalising difficulties and the five biases on CNCEQ-R, threat interpretation bias and attributional bias. However, the research investigating these biases in relation to externalising difficulties is weaker.

**3.2.6 Evidence base for the relationship between biases and externalising difficulties**

Research with adolescents with externalising difficulties has predominantly focused on a single bias: hostile attribution bias. This refers to the tendency to interpret others’ behaviour as having hostile intent (Crick & Dodge, 1996; Dodge & Crick, 1990). Adolescents with externalising difficulties are significantly more likely to make hostile attributions to explain another young person’s behaviour (in a hypothetical scenario) compared to those without these problems (Bailey & Ostrov, 2008; Pornari & Wood, 2010; Schultz, Izard, & Ackerman, 2000). Studies examining other biases in this population are limited, hindering the ability to compare the endorsement of biases across diagnoses

**3.2.6.1 CNCEQ-R Biases**

Using the CNCEQ, some research suggesting that these biases are not solely correlated with symptoms of anxiety and depression (Curry et al., 2006; Kingery et al., 2009; Pereira, Barros & Mendoca, 2012; Watts & Weems, 2006; Weems et al., 2007). Some studies have suggested that these biases may also be related to externalising difficulties, however, the evidence is very mixed.

Messer and colleagues (1994) used the CNCEQ to investigate biases endorsed by a clinical sample of 11-18-year olds (*M*=15.3). They compared two diagnostic groups (as categorised by DSM-III-R criteria); those with predominantly major depressive disorder (*n*=44) and those with predominantly conduct disorder (*n*=56). T-tests failed to find a significant difference between the two groups on the total CNCEQ score, suggesting that adolescents with externalising difficulties may be susceptible to high levels of these biases. The two groups differed only on one of the five biases; overgeneralising. Additionally, Kempton and colleagues (1994; as cited in Schepman et al., 2014) compared a clinical sample of adolescents (*N*=135) formed into groups; depression only, conduct disorder only, depression and substance abuse, conduct disorder and substance abuse, all three diagnoses and none of the three diagnoses. They reported that on three of the four subscales, the depression only group and group with multiple diagnoses reported similar levels of biases. Each diagnostic group was also found to endorse different patterns of biases to other groups, suggesting that these biases may not just be specific to internalising difficulties.

Schepman and colleagues (2014) investigated 10-18-year olds by comparing a clinically depressed sample with conduct disorder (*n*=23), a clinically depressed sample without conduct disorder (*n*=29) and controls without psychiatric disorder. Both clinical groups endorsed CNCEQ biases significantly more than the control group (*d*=1.18; *d*=1.31 respectively). However, the high levels of depression may have confounded effects for externalising difficulties specifically.

Other studies have presented conflicting findings. Epkins (2000) used the CNCEQ to assess biases across a community sample of youth aged 8-12 years (*M*=9.98). The sample was divided into four groups on the basis of their scores on behavioural measures (Child Depression Inventory, Revised Children’s Manifest Anxiety Scale and Child Behaviour Checklist). The groups included externalising difficulties only (*n*=33), internalising only (*n*=41), comorbid externalising and internalising (*n*=53) and control (neither externalising or internalising; *n*=35). Both the internalising (*d*=.131) and co-morbid groups (*d*= .90) endorsed significantly more biases than the control, whereas no difference was found between the externalising and control groups. Epkins concluded that the biases measured by the CNCEQ are more related to internalising rather than externalising difficulties. Similarly, other studies investigating cognitive biases amongst young people with externalising problems reported no significant relationships (Leung & Wong, 1998; Ostrander et al., 1995).

The aforementioned studies utilised the CNCEQ. A revised version has since been developed (CNCEQ-R) which includes an additional two subscales (underestimation of ability to cope and mind-reading) which has been almost only exclusively used in studies investigating internalising difficulties. One recent study (Slavny & Pote, under review) used this to investigate biases across quasi-diagnostic groups in a community sample. They did not reveal any significant differences between the behavioural difficulties group (*n*=84) and the comparison group (*n*=187) on any of the five CNCEQ-R biases.

**3.2.6.2 Threat Interpretation**

A dearth of studies has attempted to investigate the relationship between threat interpretation and externalizing problems. Barrett *et al*. (1996) demonstrated that anxious children (*n*=152) and those with oppositional disorder (*n*=27) aged 7 - 14 years were more susceptible to threat compared to non-clinical children (*n*=26). Similarly, Muris, Merckelbach and Walczak (2002) found a positive correlation (*r*=0.22) between threat perception and self-reported high levels of aggression in a sample of 6-14-year olds (*N* = 103) with learning and behaviour difficulties. The sample was predominantly male (approximately 92%), but the results remained significant after the effects of gender, age and intelligence level were controlled for. This study also utilised three measures of aggressive behaviour; the Child Behaviour Checklist, the Teacher Report Form and the Youth Report Form. Significant correlations were only found between threat perception indices and the Youth Self Report. The authors note that children’s difficulties may be more reliably assessed by self-report as parents and teachers may have less insight. However, they raise the possibility that the findings were due to “source variance” and recommend that future studies employing a multi-modal approach should employ alternative measures in addition to self-report.

In contrast, Bogels and Zigterman (2000), did not find increased threat interpretation in youth with externalising difficulties. This study compared a group of young people with an anxiety disorder diagnosis including social phobia, separation anxiety and generalised anxiety disorder (*n*=15, 9-18 years, *M*=12.2) to a clinical group with externalising disorders including ADHD, oppositional disorder or conduct disorder (*n*=15, 9-17 years, *M*=13.5 years) and a non-clinical control group (*n*=15, 9-17 years, *M*=11.9). They revealed that the anxiety group judged scenarios as dangerous significantly more than the externalising and non-clinical control groups. The externalising group did not differ significantly from the control. However, the ambiguous stories paradigm used to assess threat interpretation included content specific to anxiety disorders and may have been less relevant to those experiencing externalising difficulties and contributed to the non-significant result. This study also included a wide range of young people, both children and adolescents (9-18 years). Using a relatively small sample (*n*=15) combining participants of a wide age range with varying developmental differences may have obscured their ability to find effects, particularly those related specifically to adolescents.

These studies all utilised ambiguous story paradigms, with the content of these stories varying across studies. This may account for some of the conflicting results and additionally hinders the ability to draw comparisons. Utilising a standardised measure investigating threat interpretation bias in adolescents with externalising difficulties is recommended. Additionally, both the aforementioned studies and the majority of studies investigating threat interpretation across internalising disorders focused primarily on children from 8-13 years (e.g. Muris et al., 2000; Muris, Rapee, Meesters, Schouten, & Geers, 2003; Waters et al*.,* 2008). Therefore, it cannot be assumed that these results apply to older adolescents due to cognitive maturation discussed previously. Slavny and Pote’s (under review) study investigated a community sample of adolescents (*N*=470) using a standardised measure of threat interpretation to investigate this bias across quasi-diagnostic groups. They reported that adolescents with behavioural difficulties endorsed significantly higher levels of this bias than the comparison group of adolescents without difficulties.

**3.2.6.3 Attributional bias**

Minimal research has investigated externalising difficulties and negative attributions. Schepman’s (2014) study of 10-18-year olds found that when compared to the control, the comorbid depression/conduct group (*n*=23) had significantly higher levels of negative attributional bias (*d*=1.16) as measured by the Children’s Attributional Style Questionnaire (CASQ). Ciarrochi, Heaven, & Davies, (2007) reported that positive attributional style predicted lower levels of fear (*r*=-.10) and hostility (*r*=-.24) in a community sample of young people (*N*= 636, 12-13 years, *M*= 12.3). The results of this study were based on the use of the PANAS, measuring current self-reported emotional state and the CASQ. It did not find a relationship between attributional style and emotional or behavioural problems. Another study did not find any significant differences in attributional style between a group of clinically depressed adolescents (14-18 years) and clinical controls which comprised of adolescents with disruptive behaviour disorder, substance abuse disorder and adjustment disorder (Gotlib, Lewinsohn, Seeley, Rohde, & Redner, 1993). However, the mixed nature of the clinical control group means it is difficult to determine whether attributional bias is specifically related to behavioural difficulties or confounded by other disorders. Recently, Slavny and Pote (under review) reported that adolescents with higher levels of behavioural difficulties reported significantly higher levels of negative attributional bias than adolescents without these difficulties (*d*=.61) in their community sample study. Further research could allow for a better understanding of the patterns of biases specific to externalising difficulties.

**Measuring Cognitive Biases**

A difficulty within cognitive research, is the method of measuring biases shown by young people. Most studies have predominantly utilised self-report measures. These include the commonly used CNCEQ and the revised version, the CNCEQ-R, which incorporate five different cognitive biases (see Table 1). For threat interpretation the adapted Ambiguous Situations Questionnaire (ASQ; Barrett et al., 1996) self-report measure has been frequently employed in research with young people. Attributional bias has largely been measured by the Children’s Attributional Style Questionnaire (CASQ; Seligman, et al., 1984; CASQ-R, Kaslow & Nolen-Hoeksema, 1991), also a self-report measure.

Self-report questionnaires function on the assumption that the young person has the cognitive skills required to describe their thinking processes in response to a hypothetical situation and accurately report them. Therefore, they are also subject to the possibility of response biases such as social desirability bias. Adolescents have been found to be more susceptible to social desirability influences than adults due to lower cognitive maturity (Brown & Kodadek, 1987; Mabe & Treiber, 1989; Mwamwenda, 1995). This is particularly relevant to measures such as the CNCEQ-R and CASQ-R which instruct respondents to make judgements about social situations.

Experimental measures provide an alternative means of measuring bias. The Homophone Ambiguous Word Task(HAWT**;**Eysenck, MacLeod, & Mathews,1987; Mathews, Richards, & Eysenck, 1989) is one of the main experimental measures of interpretive bias used with youth (Eley et al., 2008). For this task, a list of homophones is assembled, each having both a threatening and a neutral meaning and a different spelling associated with the two interpretations (e.g. hang). Participants hear each word presented auditorily and are asked to write down what they hear. These tasks, adapted from the adult literature, have shown a relationship between threat bias and anxiety in youth (Hadwin, Frost, French, & Richards, 1997; Taghavi, Moradi, Neshat-Doost, Yule, & Dalgleish, 2000).

Both self-report and experimental methods have limitations, however this study aims to overcome these associated limitations by employing both methods for a more robust measurement of cognitive bias, as has been done in the adult literature (e.g. Harvey, Richards, Dziadosz & Swindell, 1993; Stopa & Clark, 1993; Constans, Penn, Ihen & Hope, 1999). To minimise task fatigue, an experimental measure will be used to assess a single bias. Across the small pool of evidence, the findings suggest an association between externalising difficulties and threat interpretation bias over the other aforementioned biases. The current study will utilise the most widely used experimental measures of bias (HAWT) alongside a self-report measure, to assess threat interpretation. The HAWT has been used to investigate threat interpretation in relation to anxiety in young people as an independent measure (Hadwin et al., 1997; Gifford, Reynolds, Bell, & Wilson, 2008), but it has been less commonly used in conjunction with self-report measures (Eley et al., 2008).

**3.2.8 Developmental changes in biases**

There has been some evidence of age-related changes in biases through adolescence (Weems et al., 2010; Schwartz and Maric 2015). Slavny & Pote’s (under review) cross-sectional and longitudinal data demonstrated developmental trends in cognitive biases across adolescence. However, their study used quasi-diagnostic groups within a community sample limiting the validity of their findings amongst high-risk samples. Gaining an understanding of normative developmental trends of certain biases as well as trends within adolescents with common clinical problems such as externalising difficulties is essential in tailoring CBT treatments that target cognitive biases.

**3.2.9 Understanding Biases in Adolescents with Externalising Difficulties**

Conduct disorder is one of the most common difficulties affecting adolescents (Office for National Statistics, 1999; Green et al., 2004). Antisocial behaviour is considered to be stable across the lifespan, difficult and expensive to treat (Dodge, 2006). Anti-social behaviour related to behavioural disorders results in significant costs and harms to individuals, victims, families, carers and society at large (Welsh, 2008). Understanding factors contributing to the development or maintenance of these difficulties, such as cognitive biases, could have important treatment implications.

Gaining an understanding of any cross-sectional developmental differences in biases endorsed by this group is also important. As discussed previously, adolescence is a period of significant change. Developing further understanding of cognitive processes during this time and how they may differ according to age could allow for a better understanding of the development of psychopathology and subsequently aid prevention.

**3.2.10 Aims and Research Questions**

The study aims to investigate the pattern of cognitive biases in adolescents with high levels of externalising difficulties and to cross-sectionally investigate whether this pattern changes across adolescent development. It will examine biases that have been widely investigated across internalizing disorders but have seldom been examined in relation to externalizing difficulties. It will combine the use of self-report and experimental measures to measure threat interpretation (ASQ and HAWT) more robustly than previous self-report studies. The following research questions were established:

1) Is there a significant difference between adolescents with high levels of externalising difficulties and those with low levels of these difficulties on the five biases measured by the CNCEQ-R? Does age interact with this effect?

2) Is there a significant difference between adolescents with high levels of externalising difficulties and those with low levels of these difficulties on threat interpretation bias as measured by a self-report measure (ASQ) and experimental measure (HAWT) of this bias? Does age interact with this effect?

3) Is there a significant difference between adolescents with high levels of externalising difficulties and those with low levels of these difficulties on attributional bias (as measured by the CASQ, a self-report questionnaire)? Does age interact with this effect?

**3.3 Method**

**3.3.1 Design**

This study used an independent group design to compare a group of adolescents at high risk of an externalizing disorder with a group of those at low risk of an externalising disorder. Groups were formed based on participants scores on standard assessments of externalising difficulties. Groups were compared on their scores on dependent variables (measures of cognitive biases).

**3.3.2 Participants and Sampling**

A sample of *N*=48 adolescents participated, ranging in age from 13 to 16 years. Participants were recruited from one mainstream school, and two Pupil Referral Units across the South-East of England. Pupil Referral Units (PRUs) are defined as alternative schooling provision provided by the local education authority for pupils who would not be able to receive suitable education due to exclusion, illness or other reasons; education provided by schools for students on a fixed term exclusion; and pupils students who are placed in off-site schools to improve their behaviour. PRUs specifically for young people with behavioural difficulties. were utilised in the study to allow for the recruitment of participants with externalising difficulties at a severe level as to warrant exclusion from school (5% of the population; Department of Education, 2012). PRUs have a more transient population in that students may attend for fewer hours in the week over a short period with the aim of reintegration into mainstream education. There is also often a high rate of non-attendance and suspension thus requiring a more flexible method of data collection. Participants were additionally recruited from mainstream school to allow for recruitment of participants with lower levels of externalizing difficulties.

Recruitment and data collection was conducted jointly across two research projects with another trainee Clinical Psychologist. Mainstream schools and PRUs were opportunistically sampled. Mainstream schools were informed about the research via the South East Research Network (SERNS), which aims to connect researchers and practitioners to optimize the impact of research on practice within schools. Thirty-eight PRUs across London and surrounding borders were identified through internet searches and contacted. All schools were offered a psychologist-led workshop of their choice; seven were provided. Three PRUs and one mainstream school received workshops but did not subsequently participate in the study. For two of these schools this was due to changes in capacity, reasons could not be established for the remaining schools. A total of one mainstream school (consisting of Key Stage 3 and Key Stage 4 class) and two PRUs participated in the study.

**3.3.3 Power analysis**

An a priori analysis was conducted to determine the minimum number of participants required to achieve sufficient power (80%). There were no papers using similar analyses that provided a basis for estimating a relevant effect size. Slavny and Pote (under review) revealed medium effect sizes in the significant differences between a quasi-diagnostic behavioural difficulties group and a comparison group on threat interpretation (*d*=.55) and attributional bias (*d*=.61). As such, a priori calculations were conducted using a medium effect size.

Calculations using G\*Power indicated that to achieve a power of .80 when employing .05 criterion of statistical significance in a one-way MANOVA with two levels and three dependent variables using a medium effect size of *f2(V)=*0.06, a total sample size of *N* = 180 would be needed (Erdfelder, Faul & Buchner, 1996).

Calculations using G\*Power indicated that to achieve a power of .80 when employing .05 criterion of statistical significance in a one-way MANOVA with two levels and five dependent variables using a medium effect size of *f2(V)=*0.06, a total sample size of *N* = 212 would be needed (Erdfelder, Faul & Buchner, 1996).

Due to difficulties in recruitment (discussed in method), this study obtained a sample of *N*=48, with 24 adolescents in the high externalising difficulties group and 24 in the low externalising difficulties group. Consequently, it was underpowered. Actual power for each analysis (calculated using G\*Power) is reported in Section 3.4.

**3.3.4. Exclusion Criteria**

The study aimed to investigate adolescents with externalising difficulties. As this is a broad population with a likely varied range of determinants for their behaviours, some factors formed exclusion criteria to increase the internal validity of the study and increase the accuracy of the data collected. These included

1. General learning disability or organic brain injury
2. Severe English reading and/or writing difficulties

These criteria were shared with schools prior to collecting data to limit the number of participants whose data could not be used in the study. Based on this information, their knowledge of students and school records, teachers identified students who may be appropriate to participate.

Data were collected from *N*=74 participants. From this total sample, data from *n*=48 were analysed using SPSS. A total of 35% (*n*=26) were excluded on the basis of the below criteria:

1. Scoring in the “Slightly raised category” for the externalising difficulties subscale on the SDQ. Therefore, not meeting criteria for the low externalising group (scoring in the “Average” range of SDQ externalising subscale) or high externalising group (scoring in the “High” or “Very High” category on the SDQ externalising subscale).
2. Having more than 5% missing data on any measure (see Missing Data)

**3.3.5 Measures**

Participants were administered a questionnaire to obtain demographic information. Participants also completed a measure of psychopathology to determine groupings of high and low externalising difficulties. Additionally, participants completed a variety of measures assessing cognitive biases to allow for comparisons between the groups on scores on these dependent variables.

**3.3.5.1 Demographic questionnaire.**

Demographic information was gathered from participants in order to provide a comprehensive description of the sample in terms of age, gender, ethnicity and socio-economic status (see Appendix A). Participants were also requested to provide information on whether they had received a diagnosis of a mental health problem or learning disability, whether they were currently receiving counselling or had any previous contact with a mental health worker.

**3.3.5.2 Measure of psychopathology.**

***3.3.5.2.1 The Strengths and Difficulties Questionnaire (SDQ; Goodman, 1997; Goodman, Meltzer & Bailey, 1998).***

This is a 25-item self-report measure of psychological well-being for 11-17-year olds (see Appendix F). Respondents are instructed to rate statements about their behaviour and feelings over the past 6 months on a 3-point response scale: 0 (Not True), 1 (Somewhat True) and 2 (Certainly True). A three-subscale division of the SDQ can also be used which divides the items into “internalising problems” (emotional and peer symptoms, 10 items), externalising problems (conduct and hyperactivity symptoms, 10 items) and the prosocial scale (5 items).

Groups were formed on the basis of each participants scores on the SDQ. Those scoring in the “High” (score 11-12/20) or “Very High” (13-20/20) risk for externalising disorder formed the behavioural difficulties group and participants who scored in the “Close to Average range (0-8/20) formed the control group.

*Reliability and validity.*

The SDQ was chosen due to its extensive use in both research and clinical settings and as it has shown adequate reliability, factor validity and predictive validity. Large-scale studies have allowed for the establishment of normative data across several cultures (Goodman & Goodman, 2011; Richter, Sagatun, Heyerdahl, Oppedal & Røysamb, 2011). Goodman’s (2001) study on a sample of 10,438 adolescents reported satisfactory internal consistency (Cronbach’s α = .73), cross-informant correlation mean of *r* = .34 and mean test-retest stability after 4 to 6 months as *r* = .62. The three-factor structure of the SDQ has been supported by confirmatory factor analysis (Goodman et al., 2010). The internalising and externalising subscales demonstrated good convergent and discriminant validity across all respondents and in relation to clinical disorder. However, the authors report that discriminant validity was weaker between the emotional and peer subscales as well as between the behavioural, hyperactivity and prosocial subscales, particularly for respondents with low scores on the subscales. The authors recommend the use of these scales for community samples and utilising the five-factor model when screening for disorder. As this study included utilised a community sample, this factor structure was deemed appropriate for this study.

**3.3.5.3 Self-report measures of cognitive bias.**

A number of self-report measures were administered to measure a variety of cognitive biases.

***3.3.5.3.1 Children’s Negative Cognitive Errors Questionnaire Revised (CNCEQ-R; Maric et al, 2011)***

The CNCEQ-R (Maric et al., 2011) explores five different cognitive biases and is for use with children age 9-17years (see Appendix B). It is a 16-item measure covering the following biases: underestimation of the ability to cope (3 items), personalising without mind reading (3 items), selective abstraction (3 items), overgeneralising (3 items) and mind reading (4 items). The items can be categorised into three content areas; social (5 items), academic (6 items) and athletic (5 items). Respondents are presented with short descriptions of hypothetical situations or events, followed by a “thought” about the situation or event. Young people rate how similar this would be to their own thoughts - 1 = “not at all like I would think” to 5 = “almost exactly like I would think.” Higher scores reflect more dysfunctional cognition (Maric *et al*., 2011).

*Reliability and validity.*

The CNCEQ-R has been standardised with adolescents (9-18 years) using community samples and has established factor validity and good reliability (Maric et al., 2011). Good internal consistency was found (Cronbach’s αs = .80). Scores for internal consistency of subscales were low (Cronbach’s αs = .62), but this could be accounted for by the low number of items per subscale. High test-retest reliability was also reported for the total CNCEQ-R score (*r* = .90) and moderate to high for the subscales (*r*s = .71 to .85). A study of a clinical and community sample of 9-18-year olds (Stevanovic et al., 2016) also found support for the five-factor model through a confirmatory factor analysis which remained consistent across clinical and community samples, regardless of gender and age.

***3.3.5.3.2 Children’s Attributional Style Questionnaire Revised (CASQ-R; Kaslow & Nolen-Hoeksema, 1991)***

The Children’s Attributional Style Questionnaire - Revised (CASQ-R; Kaslow & Nolen-Hoeksema, 1991) is a 24 item, self-report measure (see Appendix C) initially used in exploring attributional bias in children (8 - 13 years) but has subsequently been used widely with older adolescents (Joiner & Wagner, 1995). Respondents are presented with 24 hypothetical situations and asked to imagine that they had just experienced each situation. Each situation is followed by a choice of two possible reasons for why the situation might have happened and respondents are asked to choose the most likely reason. Half of the items are positive situations and half are negative situations.

*Reliability and validity.*

Thompson and colleagues (1998) investigated the psychometric properties of the CASQ-R in a community sample of 9-12-year olds and reported fairly stable test-retest reliability (*r*=.38, p<.001) and good criterion-related validity. Reported reliability coefficients were low (ranging from .45 to .63). However, many studies have found a significant relationship between composite scores on the CASQ-R and depressive symptoms in young people (Jacobs, Reinecke, Gollan & Kane, 2008; Spence et al.,2002). The choice of using the CASQ-R in this study was also influenced by its extensive use in previous studies measuring attributional bias in young people (e.g. Gibb et al., 2006; Lau, Rijsdijk & Eley, 2006; McQuade, Hoza, Murray-Close, Waschbusch & Owens, 2011).

***3.3.5.3.3 Ambiguous Situations Questionnaire (ASQ; Barrett et al., 1996****)*

This self-report questionnaire measures threat interpretation bias (see Appendix D). Originally developed for use with 7-14-year olds (Barrett et al., 1996), it has subsequently been used with older adolescents (Schwartz & Koenig; 1996**).** Participants are presented with 12 ambiguous situations (6 physical and 6 social) which could be interpreted in either a threatening or non-threatening way. Respondents are provided with two possible interpretations for each scenario (one threatening and one non-threatening) and asked to choose which one they think is most likely. Threat responses received a score of 1 and non-threat a score of 0. Higher scores indicate a greater threat interpretation bias. Some studies have included free choice response questions in addition to the forced-choice items. These have been found to be highly correlated (Creswell, O’Connor and Brewin; 2006; Lester, Seal, Nightingale & Field, 2010) therefore only forced-choice responses were utilized in this study to shorten and simplify the measure to reduce time of assessment and demands on literacy ability.

*Reliability and validity.*

The ASQ was been chosen as it is the most widely used method of measuring threat interpretations in young people in research and has demonstrated good reliability (Creswell et al., 2006; Creswell and O’Conner 2011). In a study of 10-11-year olds, good internal consistency of the ASQ was reported across two time points, with a Cronbach’s α = .82 at Time 1 and a Cronbach’s α = .84 at Time 2. Similarly, Creswell and O’Conner (2011) found good internal consistency over three time points (Time 1 Cronbach’s α = .82; Time 2 Cronbach’s α = .84; Time 3 Cronbach’s α = .92).

**3.3.5.4 Experimental Measure of Cognitive Bias**

***3.3.5.4.1 Homophone Ambiguous Work Task (HAWT; Eysenck et al., 1987; Mathews et al., 1989; Taghavi et al., 2000)***

This has been used in relation to anxiety independently (Hadwin et al., 1997; Gifford et al., 2008) and in conjunction with self-report measures with fairly consistent results found across both methodologies (Eley et al., 2008).

Previous research has used both homophone (words that sound the same but have a different meaning e.g. tank) and homograph (words that are spelled the same but have two or more meanings e.g. rose). Homograph tasks are generally presented visually, by presenting the participant with a written word and asking them to form a sentence with it (Taghavi et al., 2000; Watters et al., 2008) whereas homophone tasks are presented aurally, participants hear a word and are asked to form a sentence using the word they hear (Eley et al., 2008; Owen, 2015) This study utilized the list of words used in Taghavi and colleagues (2000) study as these words were found to be appropriate for use with 8-17 year olds in the U.K. These words were both homophones and homographs. Although Taghavi and colleagues presented these words visually, it was decided to present these words aurally in this study, to reduce the demand on participant’s literacy ability and to introduce some variation from the other written measures. It was hoped that this may reduce testing fatigue, and the variation in task may allow for testing be more manageable particularly for participants with attention and concentration difficulties.

A list of 19 homophones were assembled each having both a threatening and a neutral meaning and a different spelling associated with the two interpretations (see Appendix E). A further 7 non-ambiguous “filler” words (e.g. mother, water) were also included. The list of words was presented in a pseudo-random order starting with a filler word and then with one filler word presented between every three homophones. Participants were instructed to listen carefully and to write whatever popped in to their head. They were encouraged to answer as truthfully as possible, that there were no “correct” answers and reminded that this would be anonymous. Participants were presented with an example to ensure that they understood the task. Sentences were coded to determine whether participants had provided a threat response, neutral response or “other” (where sentences were not codable). The measure was scored by the author and an undergraduate psychology student independently. The inter-rater agreement was good, Cronbach’s alpha = .901, (ICC=.81 and 95% confidence interval: 0.66-.89). As outlined by Eley and colleagues (2008), participants who were missing >25% of data were excluded from analyses. As a number of participants did not provide codable sentences, the difference scored was scaled as a fraction of allowable (threat plus non-threat) responses.

*Reliability and validity.*

This measure was chosen as it is one of the most common methods for measuring biases experimentally (Eley et al., 2008). However, there are several different versions of this task, adapted for use with different populations. This study utilized the version developed by Taghavi and colleagues (2000) as this was developed for use with adolescents. This measure was also adapted for use in a study by Eley and colleagues (2008) who reported that the measure had low internal consistency (Cronbach’s α = .27). The authors note that in selecting age-appropriate words for their sample of 8-year old’s led to a selection of words that did not reflect particular type of threat which may have affected the internal consistency. Despite this, they found associations between the measure and anxiety symptoms.

**3.3.6 Procedure**

Schools were provided with a written information sheet and opt-out consent form detailing both studies to send to the homes of caregivers at least one week before testing (see Appendix G). Testing was held in the respective schools and took place over one lesson (45 minutes in the mainstream school) or across a double lesson (90 minutes in PRUs). Young people were provided with an information sheet and given the opportunity to assent/consent (see Appendix H). Measures were administered in groups, in exam conditions whereby participants were required to respond individually to questionnaires. A teacher was also present to provide support to any student who required it and students were advised to request this as necessary. Any additional one-to-one support for children who usually receive that was provided. Teachers were briefed prior to testing about the importance of not influencing a participant’s response.

Each group completed the HAWT first, as this task required all participants to listen to the audio recording at the same time. Participants were able to complete the subsequent measures at their own pace. These remaining measures were randomised across groups to reduce response effects. These included the sociodemographic questionnaire, the ASQ, the CASQ-R, the CNCEQ-R and the SDQ. To minimise demand effects, the researcher emphasised that there is no right or wrong answers and encouraged honesty in responses.

**3.3.7 Ethical Considerations**

The study was approved by the Royal Holloway, University of London Research Ethics Committee (Appendix I).

Standard procedures for gaining consent and maintaining confidentiality were used (see Appendix A). Schools were informed about participants who scored above the clinical cut-off on the SDQ to ensure the caregiver and/or young person were aware of the meaning of this and how the child could access support if needed. Prior to testing, schools and respondents were informed of this procedure.

**3.3.8 Service User Involvement**

Teachers were used as stakeholder consultants throughout the project. They advised on test selection, data administration procedures and onsite data collection. Young people were also consulted to inform procedural aspects of the study, particularly regarding feedback on the information sheet and the suitability of the measures. They commented critically on the relevance of some of the demographic questionnaire items to all participants and so instructions were revised. Both teachers and students will be consulted regarding dissemination of the findings and developing a lay summary of the findings.

**3.4 Results**

**3.4.1 Missing Data**

Any respondents who had missing data on the SDQ behaviour and hyperactivity subscales were excluded from all analyses (n=3) as this impacted on the ability to assign them to the high or low externalising groups. Schafer (1999) stated that a missing rate of 5% or less is inconsequential. As such, participants who had more than 5% missing data on CNCEQ-R (n=4), ASQ (n=4), CASQ (n=3) or other subscales of the SDQ (n=0) were also excluded from all analyses (n=14). For the SDQ, CNCEQ-R, CASQ and ASQ, missing scores were imputed by calculating the participant’s mean score on other items on that scale.

**3.4.2 Group Formation**

Two groups were formed based on SDQ externalizing scores to create quasi-diagnostic groups. The SDQ can be used to predict the presence of a psychiatric disorder with good specificity and moderate sensitivity (Goodman, Renfrew & Mullick, 2000). The broader internalizing and externalising subscale division of the SDQ has been recommended for use in community samples (Goodman, Lamping & Ploubidis, 2010). The ‘high externalizing group’ contained participants who scored in the “High” (scores 11-12) or Very High” (scores 13-20) categories of the externalizing subscale and were seen of at risk of an externalizing disorder. A comparison group (low externalising group) was formed from those at little risk of an externalizing disorder as they scored within the “Close to Average” category (scores from 0-8). Respondents who scored in the “Slightly Raised” category of the externalising subscale were excluded from the analysis (n=12) to ensure a distinct difference between the groups. This resulted in a sample of 24 in the externalising group and 24 participants in the control group.

Descriptive statistics showed no significant difference between included (n=48) and removed data (n=26) on age, ethnicity and subscale scores on the SDQ. The only differences being school site; 46% of participants from PRUs were removed and only 30% of participants from mainstream schools removed. This was consistent with data collection observations which indicated more problems in data collection from PRU sites.

**3.4.3 Outliers**

For cases that were included in all analyses, outliers were explored by creating boxplots for the following variables; internalising scores, externalising scores, each of the CNCEQ-R subscales, ASQ scores, CASQ positive attribution scores, CASQ negative attribution scores and HAWT scores. One outlier was identified within the control group on the CNCEQ-R Selective Abstraction subscale. Further investigation revealed that this score (13) was less than three standard deviations from the mean of the sample (*M*= 8.21; *SD*=2.085). As such, this score remained in the data set (Field, 2009).

**3.4.4 Normal Distribution**

An assumption of the analyses described below is that data are normally distributed. In order to assess this, a z-test test of skewness and kurtosis was conducted. The results of this procedure indicated that all dependent variables (scores on the ASQ, CASQ, CNCEQ-R and HAWT) did not differ substantially from normality as they were within the critical value cut-off points from 2.58.

**3.4.5 Demographics**

Of the participants included in all analyses, 33.3% were male (n=16) and 66.7% were female (n=32). Participants age ranged from 13-16 (*M*=14.33, *SD*= .883). Table 3 describes the demographic breakdown across the externalising and control groups in terms of age, gender, ethnicity and socio-economic status (based on parental education level). Age range and ethnicity were similar across the groups. Ethnicity appeared relatively representative of the populations where participants were recruited from; Sutton, Brighton and Wokingham White is the majority ethnic group in these areas (approximately 71%, 81% and 84% respectively). The Asian population ranges from 2-10%, Mixed race population from 2-4% and Black population 1.5-5% (Office for National Statistics, 2012). The high externalising group comprised of participants from a lower socioeconomic background than those in the low externalising group, consistent with the literature that has found an association between lower socioeconomic status and higher levels of externalising difficulties (Sylva et al., 2012). Additionally, there were more males in the high externalising group, in line with the literature reporting higher incidence of externalising difficulties in males (Sylva et al., 2012).

As expected, significantly greater numbers of participants in the externalising group had contact with mental health practitioners. The SDQ total difficulties score was also used to provide an overview of levels of psychopathology in the groups. The high externalising group reported higher scores than the low externalising group. The low externalising group scores reflect similar scores found across the UK average norms, with 80% of children scoring “normal”, 10% “borderline” and 10% “abnormal” (Meltzer, Gatward, Goodman and Ford; 2000).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Table 3:  *Percentage distribution of demographic variables of participants and control groups* | | | | | |
| High Externalising Group (n=24) Low Externalising Group (n=24) | | | | | |
| Age | |  |  | |  |
| Range  Mean  SD | 13-16 years  14.25  .944 | |  | 13-16 years  14.42  .830 | |
| Gender |  |  |  |  |  |
| Male | 37.5% | (n=9) |  | 29.2% | (n=7) |
| School Type |  |  |  |  |  |
| PRU | 50% | (n=12) |  | 4.2% | (n=1) |
| Ethnicity | | | | | |
| White British | 70.8% | (n=17) |  | 79.2% | (n=19) |
| White Irish | 8.3% | (n=2) |  | - |  |
| White Other | 4.2% | (n=1) |  | 4.2% | (n=1) |
| Mixed White & Black Caribbean | 4.2% | (n=1) |  | - |  |
| Other Black | - |  |  | 4.2% | (n=1) |
| Other Mixed | 12.5% | (n=3) |  | - |  |
| Indian | - |  |  | 4.2% | (n=1) |
| Other Asian | - |  |  | 4.2% | (n=1) |
| Parental Education Level | | | | | |
| Mother – Highest level of Education | | | | | |
| Primary School | 8.3% | (n=2) |  | 0% |  |
| Secondary School | 41.7% | (n=10) |  | 41.7% | (n=10) |
| Undergraduate Degree | 20.8% | (n=5) |  | 8.3% | (n=2) |
| Postgraduate Degree | 4.2% | (n=1) |  | 29.2% | (n=7) |
| Don’t know | 20.8% | (n=5) |  | 20.8% | (n=5) |
| Father – Highest level of Education | | | | | |
| Primary School | 25% | (n=6) |  | 0% |  |
| Secondary School | 20.8% | (n=5) |  | 45.8% | (n=11) |
| Undergraduate Degree | 12.5% | (n=3) |  | 8.3% | (n=2) |
| Postgraduate Degree | 4.2% | (n=1) |  | 20.8% | (n=5) |
| Don’t know | 33.3% | (n=8) |  | 25% | (n=6) |
| Mental Health | | | | |  |
| Contact with a mental health practitioner | | | | |  |
| Current | 25% | (n=4) |  | 12.5% | (n=3) |
| Past | 58.3% | (n=14) |  | 29.2% | (n=7) |
| Received diagnosis |  |  |  |  |  |
| Taking medication | 8.3% | (n=2) |  | 4.2% | (n=1) |
| SDQ Total Difficulties score |  |  |  |  |  |
| Normal | 12.5% | (n=3) |  | 83.3% | (n=20) |
| Borderline | 33.3% | (n=8) |  | 16.7% | (n=4) |
| Abnormal | 54.2% | (n=13) |  | - |  |

Analyses were run to determine whether there were any significant differences between the externalising and control groups on demographic variables and internalising difficulties.

For age, Levene’s test was non-significant indicating that the assumption of homogeneity of variance had been met (*F*=.357, *p*=.553) and an independent samples t-test found no significant difference between the groups in terms of age (*t* (46) = -.650, *p*=.519).

For gender, Levene’s test was non-significant indicating that the assumption of homogeneity of variance had been met (*F*=.1.41, *p*=.242). and an independent samples t-test found no significant difference between the groups in terms of gender (*t* (46) = -.602, *p*=.550).

Comorbidity is common amongst adolescents (Green et al., 2004). To preserve ecological validity participants were included in the analysis regardless of their level of internalising difficulties. An independent samples t-test was conducted to examine differences between the externalising and control groups in terms of internalising symptoms. Levene’s test was non-significant indicating that the assumption of homogeneity of variance had been met (*F*=3.344, *p*=.074). The t-test was non-significant, (*t* (46) = 1.39, *p*=.170), indicating that there was not a significant difference between the groups in terms of internalising symptoms. Table 4 provides information on the means and standard deviations of SDQ scores across the groups. Internalising difficulties were relatively low across the sample, with the mean score for the high externalising group in the “Slightly raised” range and the mean score for the low externalising group in the “Close to Average” range.

|  |  |  |
| --- | --- | --- |
| Table 4:  *Means and standard deviations of SDQ Total Difficulty Scores, Externalising Subscale Scores and Internalising Subscale Scores for High and Low Externalising Groups* | | |
|  | High Externalising Group | Low Externalising Group |
| SDQ Externalising Subscale | *M*= 12.46 (*SD*=1.59) | *M*=4.79 (*SD*=1.91) |
| Close to Average: 0-8  Slightly Raised: 9-10  High: 11-12  Very High: 13-20 |  |  |
| SDQ Internalising Subscale  Close to Average: 0-6  Slightly Raised: 7-8  High: 9  Very High: 10-20 | *M*= 7.96 (*SD* = 3.76) | *M*=6.64 (*SD*= 2.74) |
|  |  |  |
| SDQ Total Difficulties | *M*= 19.71 (*SD*=4.11) | *M*=12.79 (*SD*=2.57) |
| Close to Average: 0-14  Slightly Raised: 15-17  High: 18-19  Very High: 20-40 |  |  |

**3.4.6 Gender Effects**

To investigate if there were any potential confounding effects of gender on the dependent variables, a series of t-tests were conducted examining if there were differences between males and females on the different biases (see Table 5). All but one of these analyses were non-significant at the 0.05 level, In the low externalising group, females scored significantly higher on the cognitive bias Mindreading (*M*= 11.33, *SD*= 3.91) compared to males (*M*=8.14, *SD*=2.48). However, when a Bonferroni correction was applied this became non-significant.

Table 5:

*T-tests investigating differences between males and females on biases across the externalising and control groups*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | High Externalising Group | | Low Externalising Group | |
|  | *t* | *p* | *t* | *p* |
| CNCEQ-R Biases |  |  |  |  |
| UAC | .600 | .554 | -1.379 | .182 |
| PER | .829 | .416 | .242 | .811 |
| SA | -.240 | .813 | -1.668 | .110 |
| OV | 1.063 | .299 | -.538 | .597 |
| MR | .933 | .361 | -2.391 | .028\* |
| Threat Interpretation | |  |  |  |
| ASQ | -1.256 | .222 | -.470 | .643 |
| HAWT | .780 | .445 | -.917 | .369 |
| Attributional Bias |  |  |  |  |
| CASQ-P | -.388 | .702 | -.092 | .927 |
| CASQ-N | .614 | .546 | -.327 | .746 |

\**p*<.05, \*\* *p*<.005

**3.4.7 Age Effects**

The study aimed to investigate whether there were any age-related effects on cognitive biases by investigating age as a covariate in analyses. An assumption for such analyses is that there is a linear relationship between the covariate and each dependent variable within each group of the independent variable. Therefore, a series of correlations were conducted to investigate whether there were any associations between age and the dependent variables; the different cognitive biases (see Table 6). All but one of these analyses (Personalising without Mind-Reading) were non-significant at the 0.05 level. This became non-significant after a Bonferroni correction was applied. This suggested that there were no statistically significant effects of age on any of these cognitive biases for either group. Consequently, subsequent analyses did not control for age.

Table 6:

*Pearson Correlations between Participant Age and Cognitive Biases across High and Low Externalising groups*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | High Externalising Group | | Low Externalising Group | |
|  | Age | | Age | |
|  | *r* | *p* | *r* | *p* |
| CNCEQ-R biases |  |  |  |  |
| UAC | -.393 | .057 | .112 | .603 |
| PER | -.465 | .022\* | .385 | .064 |
| SA | -.346 | .098 | .274 | .194 |
| OV | -.261 | .217 | .195 | .361 |
| MR | -.216 | .311 | .101 | .640 |
| Threat Interpretation |  |  |  |  |
| ASQ | -.077 | .720 | .235 | .269 |
| HAWT | .401 | .072 | .219 | .304 |
| Attributional Bias |  |  |  |  |
| CASQ-P | .231 | .277 | -.176 | .410 |
| CASQ-N | -.144 | .501 | .175 | .413 |

\* *p*<.05

**3.4.8 Research Question 1:**

Are there significant differences between the independent groups (high and low externalising difficulties) on five dependent variables (scores of cognitive biases as measured by the CNCEQ-R) and does age interact with this effect?

Multivariate analysis of variance (MANOVA) allows for differences to be detected on a combination of variables were differences may not be detected individually. It also allows some protection of alpha levels by restricting conclusions to the results of the analysis on the combined variable (Cramer & Bock, 1966). Therefore, a one-way MANOVA was deemed appropriate to investigate whether there were any differences between the externalising and control groups on the five biases measured by the CNCEQ-R. To ensure the MANOVA assumption that dependent variables are correlated was met, a series of correlations were conducted (see Table 7). These correlations revealed significant relationships between all of the dependent variables, indicating the appropriateness of a MANOVA.

Table 7:

*Pearson Correlations between the CNCEQ-R subscales*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Underestimation of Ability to Cope (UAC) | Personalising without Mind- Reading (PER) | Selective Abstraction (SA) | Overgeneralising (OV) | Mind-Reading (MR) |
| UAC | - | *r*=.398\*\* | *r*=.398\*\* | *r*=.559\*\* | *r*=.519\*\* |
| PER | *r*=.398\*\* | - | *r*=.586\*\* | *r* =.555\*\* | *r* =.565\*\* |
| SA | *r*=.398\*\* | *r*=.586\*\* |  | *r* =.544\*\* | *r* =.463\*\* |
| OV | *r*=.559\*\* | *r*=.555\*\* | *r* =.544\*\* | - | *r* =.544\*\* |
| MR | *r*=.519\*\* | *r*=.565\*\* | *r* =.463\*\* | *r* =.544\*\* | - |

\*\* *p*<.01

Box’s Test of Equality of Covariance matrices was non-significant (*M*=13.476; *p*= .687), indicating that the assumption of homogeneity of covariance matrices was met. The one-way MANOVA did not reveal a statistically significant main effect of group for scores on the CNCEQ-R biases, indicating that levels of cognitive bias did not differ significantly among the groups, *F* (5,42) =.647, *p*=.666, Wilks’ Lambda = 0.929, partial *n2* = .071. Observed power was 20%.

Table 8:

*Means and standard deviations of high and low externalising difficulties groups on the five cognitive biases as measured by the CNCEQ-R*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | High Externalising Group | | Low Externalising Group | |
|  | *M* | *SD* | *M* | *SD* |
| CNCEQ-R Biases |  |  |  |  |
| UAC | 8.71 | 3.90 | 8.83 | 3.60 |
| PER | 9.21 | 3.09 | 9.13 | 2.69 |
| SA | 9.21 | 3.23 | 8.21 | 2.09 |
| OV | 9.25 | 3.08 | 8.38 | 3.56 |
| MR | 11.00 | 4.05 | 10.40 | 3.80 |

**3.4.9 Research Question 2:**

Are there significant differences between the independent groups (high and low externalising difficulties) on the two dependent variables of threat interpretation bias as measured by the ASQ and HAWT?

A significant proportion of respondents were missing more than 5% of data on the HAWT. As such, from the final sample of 48, respondents who were missing more than 25% of the data on the HAWT were excluded from the analysis of threat interpretation bias, in line with the procedure utilised by Eley and colleagues (2008). This resulted in three participants from the externalising group being excluded from this analysis (6.25% of N=48; 12.5% of n=24).

**3.4.9.1 Relationship between the two measures of threat interpretation bias**

Both the ASQ and HAWT were assumed to be theoretically similar as they were developed to measure threat interpretation bias. This was investigated statistically to ensure that both measures were measuring the same construct. A Pearson’s r Correlation revealed a non-significant relationship between scores on the ASQ and HAWT measures (*r*=-.058; *p*=.704).

An assumption of MANOVA is that the dependent variables are correlated with each other (Meyers, Gampst & Guarino, 2006). As the ASQ and HAWT were not correlated, t-tests were deemed to be more appropriate in examining this question. An independent samples t-test was used to investigate the differences between the independent groups on scores on the ASQ. A non-significant Levene’s test indicated that the assumption of homogeneity of variance was met, (*F*=.590, *p*>.05). The t-test was non-significant, indicating no statistically significant difference between the groups on threat interpretation bias as measured by the ASQ (*t* (46) =1.45, *p*=.153). Observed power for this analysis was 52%.

For scores on the HAWT, Levene’s Test indicated that the assumption of homogeneity of variance was met (*F*=.480, *p*>.05). The t-test was non-significant (*t* (43) =.805, *p*=.426) indicating that there was not a statistically significant difference between the groups on levels of interpretation bias as measured by the HAWT. Observed power was 52%.

Table 9:

*Means and standard deviations of high and low externalising difficulties groups on threat attribution bias as measured by the ASQ and HAWT*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | High Externalising Group | | Low Externalising Group | |
|  | *M* | *SD* | *M* | *SD* |
| ASQ | 5.98 | 2.31 | 4.96 | 2.54 |
| HAWT | -2.83 | 21.62 | -7.89 | 20.56 |

**3.4.10 Research Question 3:**

Are there significant differences between the independent groups (high and low externalising difficulties) on the dependent measures of attributional style; positive attributional bias and negative attributional bias?

There was a significant relationship between all the CASQ subscales (see Table 10), suggesting the appropriateness of a MANOVA.

Table 10:

*Pearson Correlations between Participant Age, positive attributional bias and negative attributional bias scores*

|  |  |  |  |
| --- | --- | --- | --- |
|  | Age | CASQ-P | CASQ-N |
| Age | - | *r* =.075 | *r* =-.015 |
| CASQ-P | *r* =.075 | - | *r* =.410\*\* |
| CASQ-N | *r* =-.015 | *r* =-.410\*\* |  |

*Note:* CASQ-P = positive attributional bias as measured by the CASQ, CASQ-N= negative attributional bias as measured by the CASQ, \*\* = *p*<.01

Box’s Test of Equality of Covariance matrices could not be computed as SPSS reported that there were fewer than two non-singular cell covariance matrices. It was determined that was due to the CASQtotal score being formed from scores of the other subscales (CASQ-P minus CASQ-N scores). As such, a MANOVA was conducted which investigated only the CASQ-P and CASQ-N scores.Box’s Test of Equality of Covariance matrices was non-significant (*M*=.899; *p*= .836), indicating that the assumption of homogeneity of covariance matrices was met.

A one-way MANOVA indicated a statistically significant main effect of group, *F* (2.45) =5.815, *p*=.006, Wilks Lambda =.795, partial *n2*=.205. This suggests that 20.5% of the variance in the dependent variable was accounted for by externalising symptoms. Observed power was 30%. Two ANOVAS were conducted to investigate where this difference lay. Levene’s Test was non-significant, indicating that the assumption of homogeneity of variance had been met for both positive attribution scores (*F*=.000, *p*=.985) and negative attributions (*F*=.268, *p*=.607).

A one-way ANOVA revealed a significant difference between the groups on positive attribution scores, *F* (1,46) =11.198, *p*=.002. A statistically significant result was not found for differences between the groups on negative attribution scores, however results did indicate a trend towards significance, *F* (1.46) = 3.643. *p*=.063. Further inspection revealed that the control group reported significantly greater positive attributions (*M*=7.5, *SD*=2.38) than the externalising group (*M*=5.24, *SD*=2.3). Observed power was 80%.

Table 11:  
*Means and standard deviations of high and low externalising difficulties groups on positive and negative attributional bias*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | High Externalising Group | | Low Externalising Group | |
|  | *M* | *SD* | *M* | *SD* |
| CASQ-P | 5.24 | 2.30 | 7.50 | 2.38 |
| CASQ-N | 5.37 | 1.99 | 4.23 | 2.16 |

**3.5 Discussion**

This study aimed to investigate the presence of a variety of cognitive biases in adolescents with externalising difficulties. It examined biases that have largely been investigated across young people with internalising problems, but seldom in externalising populations. The study utilised an experimental measure in addition to self-report measures for a more robust assessment of biases. There was no difference found between adolescents with high and low levels of externalising difficulties on negative biases. However, there were significant findings in relation to attributional style. Adolescents at high risk of an externalising disorder reported significantly fewer positive attributions than those with low levels of externalising difficulties.

This study did not find any significant differences between the high externalising and low externalising groups on their endorsement of the five biases measured by the CNCEQ-R. The results supported previous research that has not found significant relationships between these biases and externalising difficulties (Epkins, 2000; Slavny & Pote, under review). Previous researchers (Leung & Poon, 2001) have questioned whether the CNCEQ-R is a valid measure for this population due to its measurement bias towards internalising disorders; with a number of items referring to concepts related to these symptoms (e.g. loss, failure). However, there are currently no equivalent measures that assess a number of biases simultaneously that have been developed specifically for adolescents with externalising difficulties.

There was no significant difference found between adolescents presenting with high risk of an externalising disorder and those at low risk of an externalising disorder on two measures of threat interpretation bias; a self-report (ASQ) and experimental (HAWT) measure. There has been very little research conducted in this area previously. The results of this study conflict with previous research which found that young people aged 7-14 years with oppositional disorder were more susceptible to threat than non-clinical children (Barrett et al., 1996). These contrasting results emphasise the importance of investigating adolescents separately to children. Various developmental differences exist between these two groups and as such, it cannot be assumed that both populations experience similar levels of biases.

This study attempted to address some of the limitations of cognitive bias measurement in previous studies by employing both a self-report and experimental measure of the same bias for a more robust assessment. Surprisingly, although both the ASQ and HAWT have previously been used to measure threat interpretation bias, this study did not find a significant correlation between scores on the two measures. Previous research has also found inconsistent results when using both measures (Waters et al., 2008). A large body of research investigating cognitive biases has exclusively utilised self-report measures which are subject to response biases. This raises questions about the construct validity of these measures. Experimental measures have also been used to measure biases, however these are less widely used, and the range of available measures have poorer psychometric properties; Waters and colleagues (2008) reported low internal consistency for the HAWT.

Similarly, there were limitations in using the HAWT in this study. The large amount of missing data on this measure may indicate a need to tailor this measure in a way that is less cognitively demanding for adolescents with externalising difficulties. The three participants who were among the highest scorers on the externalising disorder subscale were excluded from the threat interpretation analysis due to missing data which may have skewed results. Students in PRUs have been found to have significantly lower levels of literacy abilities than those in mainstream school (Gill, Quilter-Pinner & Swift, 2017). It is possible that respondents with externalising difficulties may have struggled with the focus on written questionnaires and as such may have influenced their responses and the subsequent results. A previous study investigating experiences of students excluded from school found that many reported both disliking formal writing and finding it difficult (Daniels et al., 2003).

The words utilised in this task were taken from a study investigating the same age range in relation to anxiety (Taghavi et al., 2000). Threat words used may have been more relevant to anxiety and less relevant to externalising difficulties. Physical threat may be more relevant to this population (Bogels & Zigterman, 2000). In light of these limitations, these results should be interpreted with caution. However, it highlights some of the difficulties in accurately investigating cognitive processes.

Attributional bias was measured using the positive attribution and negative attribution subscales of the CASQ. Results indicated that adolescents at high risk of externalising difficulties experience significantly fewer positive attributions than adolescents without these difficulties. Previous research with this group of adolescents has predominantly focused on a negative bias, hostile attribution bias; the tendency to interpret other’s behaviour as having hostile intent. However, these results suggest that adolescents with externalising difficulties may additionally experience lower levels of positive attributions. This finding has clinical implications, both in how interventions (e.g. CBT) could be adapted to maximise benefits for this group, as well as transdiagnostic implications. If, with further research there is an association between lower levels of positive biases and externalising difficulties, it may be beneficial to broaden the focus of cognitive interventions from focusing predominantly on reducing negative biases to increasing positive biases.

Attributional style has also been found to be related to symptoms of internalising difficulties (Joiner & Wagner, 1995, Curry & Craighead, 1990). Understanding whether biases are transdiagnostic across adolescents is particularly important as comorbidity is common in young people (Green et al., 2004). Further research in this area may facilitate the development of transdiagnostic interventions that could be effective in reducing symptoms related to a variety of different difficulties.

Current interventions for externalising difficulties tend to be more focused on behaviour than cognition. For example, social-problem solving skills training is commonly used with adolescents with conduct difficulties (and recommended by NICE, 2013) and involves the therapist intervening through modelling and role-play (Carr, 2016). The results of this study tentatively suggest there is less of a role for negative biases for this population. However, further research investigating positive biases in this population may support the suitability of increased used of cognitive techniques in this group.

Attributional bias is also a target of Cognitive Bias Modification of Interpretation (CBM-I) training. CBM-I training has recently been developed to train individuals to interpret information in a different way in the hope of decreasing distress and symptoms of psychopathology. Although this is a relatively new area of research and there are mixed results around the efficacy of these interventions, some studies have reported that the training increases positive attributions (Lau & Belli, 2013; Le Moult et al., 2017). Thus far, studies with adolescents have predominantly focused on the effect of these trainings on symptoms of internalising difficulties. With further research, it may be interesting to examine the effects of such interventions on externalising difficulties in adolescents.

The results of this study must be interpreted with caution and considered in light of some limitations. Despite vigorous efforts to recruit participants from a variety of PRUs across London and surrounding counties, only two PRUs were able to provide participants for this study. This resulted in a smaller sample size than required for adequate power for analyses (ranging from 20-80%) in addition to a restricted age range of the participants in the sample (13-16 years). A larger sample with a wider age range as in previous studies (Slavny & Pote, under review) may have revealed different results. Correlations were used to investigate any effects of age. However, it is possible that age could have had interactional effects with another variable which could not be revealed through correlational analysis alone. Additionally, although 38 PRUs were contacted, participants were recruited from only two. Consequently, the population in the study is subject to selection biases (staff at these PRUs reported choosing to participate due to being particularly interested in mental health) and may not be truly representative of adolescents in PRUs.

Additionally, it is possible that the results found were influenced by not excluding participants with internalising difficulties. Different patterns of biases may be seen from a design that utilised three independent groups comparing adolescents with externalising difficulties only, internalising difficulties only and a no difficulties group. However, comorbidity is very common among adolescents (Green et al., 2004) therefore to increase external validity, this exclusion criteria was not applied. Additionally, the groups did not vary significantly on levels of internalising difficulties, which were on average in the normal range.

The high and low externalising groups were formed based on participant’s scores on the self-report SDQ. The single informant use of the SDQ is a limitation. Multi-informant use has been found to have greater sensitivity. Interestingly, the sample used was predominantly female despite the prevalence of externalising difficulties being higher amongst males (Sylva et al., 2012). Although the analyses did not reveal any gender effects, it is possible that the sample was less representative of the typical population of adolescents with externalising difficulties.

Future research would benefit from the development of suitable measures for adolescents with externalising disorders, that are not biased towards internalising symptoms and are flexible to adapt to the needs of adolescents with literacy and attentional difficulties. CBM-I studies have incorporated the use of imagery in assessing levels of cognitive bias from pre to post-training (Burnett-Heyes et al., 2017). Such visual methods may be more suitable for this group. Similarly, the use of technology or more creative means of assessment may be more suitable for this population and therefore provide more valid results. For example, the use of video games may facilitate engagement and enable the evaluation of cognitive styles (Ceranoglu, 2010).

Despite the high numbers of adolescents experiencing externalising difficulties, there has been much less research investigating cognitive biases in this group in comparison to adolescents experiencing internalising difficulties. The results did not find any statistically significant difference between adolescents with high levels of externalising difficulties and those with lower levels of externalising difficulties on levels of negative cognitive biases, but there was a significant difference in terms of a positive bias; positive attribution. Previous research on cognitive biases has focused largely on negative biases. The results of this study suggest that positive biases (or a deficit of) may also play a role in psychopathology and may be an important avenue of exploration. Further research in this area may also have clinical implications in terms of the focus of cognitive interventions for externalising difficulties in adolescents. Additionally, this study emphasises the difficulties of using existing measures of cognitive biases with adolescents of behavioural difficulties.

**4. Integration, Impact and Dissemination**

The following section is a critical appraisal and evaluation of the overall research process. It outlines the integration of the systematic review and empirical paper, the impact of this research, plans for dissemination and includes the researcher’s own personal reflections throughout the process.

**4.1 Integration**

Reflections of each paper are discussed, followed by the rationale of how these studies are integrated. Subsequently, common, linking themes are discussed.

**4.1.1 Systematic review.**

***4.1.1.2 Reflections on aims.***

The systematic review aimed to analyse and synthesise existing quantitative research investigating the clinical efficacy of CBM-I training for adolescents. The researcher had initially intended to investigate whether such an intervention could be useful for adolescents with externalising difficulties. However, initial searches revealed that no studies had been conducted using CBM-I with this population. Conduct disorders are the most common form of psychopathology amongst adolescents, with 6.6% of 11-16-year olds in the UK meeting criteria for this (Green et al., 2004). Despite the prevalence of these difficulties amongst adolescents, research investigating the use of CBM-I training with this age group has predominantly focused on adolescents experiencing internalising difficulties such as anxiety and depression. Consequently, the research question was expanded to include studies investigating CBM-I with any group of adolescents. This allowed for a broader inclusion of studies, investigating different paradigms such as the use of imagery. As this research is in its infancy, this strategy allowed for the inclusion of the majority of studies that had been conducted with adolescents thus far. The synthesis of these studies, with varying methodologies, emphasised specific limitations that could be addressed in future research. However, including such a wide variety of populations means that a number of variables were not controlled for and make it difficult to ascertain which factors may have contributed to the carrying results across studies.

***4.1.1.3 Reflections on Methodology***

As this is a new field of research, studies with adolescents specifically were limited. Across these studies, there is a lot of heterogeneity in samples, design and measurement of outcome variables. To accommodate this a narrative review was chosen over a meta-analysis. Meta-analyses have the advantage of using statistical techniques to synthesise the data in a simplified way into a single estimate. However, this is likely to be less appropriate when synthesising studies that have great degree of heterogeneity. Consequently, the results of the systematic review were focused largely on improvements required for future studies rather than definitive conclusions about the efficacy of CBM-I interventions with adolescents.

***4.1.1.4 Reflections on Results***

The results highlighted the mixed findings that have been reported across CBM-I studies. The majority (78.6%) reported a significant difference in the biases endorsed by participants from pre to post-training. Some studies reported an increase in positive attributions, others a decrease in negative attributions and some studies both (see p.35). However, these changes were not always exclusive to the intervention group. Additionally, some studies (50%) reported beneficial changes in mood.

Due to the heterogeneity across studies, it was difficult to draw a firm conclusion about the clinical efficacy of CBM-I training for adolescents. The results revealed that is was too premature to be able to fully address this aim given the current available body of research. However, the review importantly highlighted a number of areas where research could be improved, particularly by enhancing the measurement of outcome variables. Concerns were raised about the validity of a commonly used measure of interpretation bias, the Recognition Test (Mathews & Macintosh, 2000), which had limitations due to the similarity between the content of the training and the measure itself. Additionally, it was noted that the majority of studies did not used a standardised, reliable measure of psychopathology symptoms which compromised the reliability and validity of results and ability to compare to population normative scores.

**4.1.2 Empirical Study**

***4.1.2.1 Reflections on Aims***

The initial aims of this study were to investigate the presence of cognitive biases in adolescents with externalising difficulties and to explore any developmental patterns of these biases using a cross-sectional. Due to recruitment difficulties (discussed below) the age range of the sample was restricted to participants between 13 and 16 years. This impacted on the ability to address the study’s aim of investigating developmental differences as the participants represented only a subsection of adolescence (10-19 years as defined by the World Health Organisation). Although age was considered in the analysis, the main focus of the study was adapted to focus more specifically on the presence and pattern of biases. A longitudinal design, assessing biases of youth throughout their adolescence would have been a more effective way of achieving the study’s aim as it controls for more confounds such as cohort effects.

***4.1.2.2 Reflections on Methodology***

Several ethical issues were considered such as consent, confidentiality and providing support for students who could become distressed during testing. Students were assured that participation was voluntary and their schooling would not be affected by non-participation. Risk was assessed with teachers prior to testing to ensure a suitable location and the safety of both students and staff.

Recruitment of the sample was an area of difficulty. In pre-empting this, an opt-out consent proceudre was utilised to maximise numbers recruited. However, there are ethical considerations associated with this. The researcher reflected on the possiblity that some caregivers may not have fully read this form and therefore informed consent could be compromised. However, to account for this, in PRUs on the day of data collection, teachers phoned caregivers to gain verbal consent.

Rigorous efforts were made to recruit participants for the study, from PRUs in particular. Thirty-eight different PRUs were contacted but only two participated in data collection. Seven different psychologist-led workshops/ sessions were provided to schools. Several data collection sessions were held across PRUs due to the smaller ratio of pupils per class than mainstream schools. Typically, these sessions consisted of 2-8 students and often consisted of fewer participants than anticipated. This was largely due to students being absent from school or students being emotionally aroused and being supported by staff outside of class. As these students were unable to partake, it is possible that the study was susceptible to sampling bias and was not truly representative of the target population. To preserve ecological validity, the study included adolescents with literacy difficulties as this is common amongst students in PRUs (Gill, Quilter-Pinner & Swift, 2017). It also included participants with externalising difficulties; both behavioural and attentional as they are commonly co-morbid (Green et al., 2004). However, this compromised internal validity. Future studies would benefit from controlling for literacy ability and comparing a three separate groups to account for this; conduct only, attentional difficulties only and combined group.

Many of the students in PRUs experienced literacy, attention and concentration difficulties and required one-on-one support to complete the measure. The researcher reflected on the limitations of long battery testing with adolescents with potential attention, reading and writing difficulties. It is likely that this population could have difficulties concentrating for prolonged periods of time and this may negatively impact on their mood and reinforce negative beliefs around their ability. Additionally, it is likely that the quality of the data could be compromised due to respondent fatigue. To account for this, data collection sessions were held over longer periods of time than in the mainstream classes to allow participants ample time for completion. Respondents were able to have breaks throughout and were supported by teachers. However, respondents who received one-to-one support may have been subject to social desirability bias as their answers could be seen at times by the individual supporting them.. The researcher

Teachers made important contributions to the data collection process. In addition to supporting students and organising practical elements (such as a suitable room), they also supported the researchers in assessing the suitability of students for the study. However, this may have increased the possibility of some confounding variables. For example, teachers judged whether a student would struggle with some measures and recommended that some students did not partake in the study, to avoid any negative impact on them. Consequently, the sample may have been less representative of adolescents with externalising difficulties and teacher’s impressions of students may have been a confoudning variable.

Teachers in PRUs felt that students may initially be suspicious of partaking in research and this may reinforce negative self-perceptions i.e. that they are different and need to be examined. They recommended meeting students and facilitating workshops with them prior to data collection. The researcher felt that this was a beneficial approach, it gave students an opportunity to gain a broader understanding of psychology, the way in which psychological research can be used and allowed the researcher to gain rapport with students. The researcher felt that building this rapport allowed students to feel more comfortable during the data collection session to ask for support when completing the measures. However, it is also possible that participants who received extra support with some questions may have been subject to social desirability bias. Priming of answers may have also occurred due to prior discussions regarding psychological research.

Participants were recruited from PRUs with the intention of obtaining a sample with high levels of externalising difficulties. This sampling strategy was subject to bias as participants may not have been truly representative of the population of adolescents experiencing externalising difficulties. The study may have omitted older adolescents who had dropped out of school, those who were regularly absent from school. Those who declined to partake or those were deemed unsuitable to partake by teachers. Prior to data collection, the researcher had anticipated that the majority of students at PRUs would meet criteria for risk of an externalising disorder (as measured by the SDQ) and thus form the high externalising group. The researcher was surprised to discover that this was not the case. From the final sample, only 50% of the externalising group was formed of students from PRUs, whereas the other 50% attended mainstream school. The researcher reflected on whether attending the PRU had resulted in improvements in symptoms for some students, such as those who scored in the “Slightly Raised” range and were excluded from analyses. The researcher also reflected on the high numbers of students in mainstream schools who were presenting with high levels of externalising difficulties but did not appear to be accessing specialist support, either through a PRU or mental health professional. The researcher felt that this highlighted the importance of providing more accessible support to adolescents experiencing these difficulties.

A limitation of the study was the use of a single informant approach to measuring psychopathology. Multi-informant approaches, including the use of teacher and/or parent reports of symptoms is a more sensitive method of assessment. Due to the transient population of the PRUs, this was difficult to obtain in the projects time frame. Consequently, there is a risk that the high and low externalising groups were less representative of the population of adolescents experiencing externalising difficulties.

***4.1.2.3 Reflections on Results***

The results of the study indicated that adolescents at high risk of an externalising disorder experience significantly fewer positive attributions than adolescents at low risk of an externalising disorder. However, analyses revealed that adolescents with externalising difficulties did not differ significantly from their peers on a number of negative cognitive biases including threat interpretation and the five biases measured by the CNCEQ-R. There were no effects of age found, although this is likely related to the restricted age range of the sample.

The results must be interpreted in light of some of the aforementioned limitations including the single-informant approach to measurement of psychopathology, the inclusion of participants with attentional and literacy difficulties, the limitations of the measures of bias and the sampling strategy. A key limitation of the study is the low observed power due to the small sample size. Therefore, results must be interpreted with caution.

The results support some of the previous literature that has not found a significant relationship between externalising difficulties and threat interpretation (Bogels & Zigterman, 2000) and the five biases of the CNCEQ-R (Slavny & Pote, under review). They also support research which has indicated a relationship between externalising difficulties and attributional style (Schepman et al., 2014). Previous research has predominantly explored negative biases. Further research is required investigating positive biases before conclusions can be drawn.

The results may have implications for interventions. Cognitive techniques, such as cognitive restructuring are commonly used with adolescents with internalizing difficulties (Sudhir, 2015). The rationale for using such techniques with this group has been supported by links found between cognitive biases and internalising difficulties. For externalising difficulties, interventions are predominantly effective when they are multimodal (including caregivers and other significant figures) and focus on developing specific skills (Lochman et al, 2011). This emphasis on behavioural training strategies is reflected in NICE guidelines which recommend a focus on a social learning model (NICE, 2013). The results of the current study do not suggest the presence of significantly different patterns of negative cognitive biases between adolescents with high and low levels of externalizing difficulties. However, the differences between the groups in terms of positive attributional bias suggest further explorations of positive biases in this group could be warranted. Further research may have implications for an increase in the use of cognitive techniques with this population. Should similar results be replicated, this may provide a rationale for extending typically employed skills training interventions for externalising difficulties to include cognitive techniques.

**4.1.3 Integration of both studies.**

CBM-I training, as investigated in the systematic review, involves altering cognitive biases of interpretation. The empirical study explored a number of cognitive biases of interpretation in adolescents of high risk of an externalising disorder. Understanding the presence of cognitive biases among adolescents experiencing different symptoms can allow for treatment such as CBM-I and CBT to be appropriately tailored to meet this groups specific needs. However, despite the common use of CBT with adolescents, much of the research of cognitive biases has been conducted with adults. The researcher was surprised by this, as adolescence is a unique period of developmental change and as such, it cannot be assumed that the cognitive biases that are relevant to adults are also prevalent in adolescents presenting with similar symptoms. The researcher was struck by how much less attention had been given to adolescents in the literature in terms of cognitive biases in comparison to adults, given that this is a period where psychopathology appears to become evident and thus may be a particular beneficial time for intervention. This may be related to views held regarding the cognitive maturity of adolescence. It has been argued that youth may not have the ability to engage with cognitive techniques due to lower levels of cognitive maturity than adults (Grave & Blissett, 2004).

Gaining a fuller understanding of the presence of cognitive biases amongst adolescents has implications for CBM-I training. Typically, CBM-I paradigms have focused on altering attributional bias amongst participants. These interventions have reported increasing positive attributions as well as decreasing negative attributions. The empirical study revealed that adolescents with externalising difficulties reported significantly fewer positive interpretations than their peers. This could implications for the use of CBM-I training for this population.

Across both the systematic review and empirical paper, difficulties were highlighted in the measures used to assess cognitive biases. Assessing an individual’s internal cognitions is no easy feat and self-report measures rely on their ability to understand and reflect on their own thought process. Experimental measures attempt to overcome this (Mathews and Macleod, 1994). However, these measures have been less widely used with adolescents and psychometric properties are weaker. The empirical study attempted to overcome these difficulties by employing both a self-report and experimental measure of threat interpretation bias. Surprisingly, there was no correlation found between this self-report and experimental measure of the same bias. This raised questions about the validity of these measures. Similarly, in the adult literature, there have been concerns around the use of the homophone task. Although scores on this measure have been found to be related to anxiety symptoms, researchers have queried whether it is subject to response bias than a true interpretive effect (Mathews and Macleod, 1994). Participants may not accurately report that first word that comes to mind. Future research may benefit from utilising a lexical priming paradigm where participant’s response to words is timed, as has been employed in the adult literature (Richards and French, 1992). Another study that employed a different experimental measure (the Scrambled Sentences Task), reported that although higher bias scores using this were associated with depression, it made a unique contribution to depression independent to the scores on a self-report measure of bias (Rude et al., 2010). The authors query whether the measures assess separate aspects of cognitive vulnerability to depression. Similarly, the results from this study may indicate that the HAWT may be assessing a separate aspect or mechanism of threat interpretation. Further research comparing multiple measures of the same bias is required to gain a better understanding of this.

In the systematic review, the majority of studies that reported beneficial changes in biases post-training, employed the Recognition Test. The content of this test is very similar to the CBM-I training and may be subject to response bias. Studies that employed additional measures of biases reported mixed results. The alternative measures used also varied across studies. This combined with the heterogeneity across studies (e.g. the use of different paradigms), made it difficult to compare and understand likely reasons for inconsistent results.

The empirical paper emphasised the need for measures to be suitably adapted specifically for young people with externalising difficulties. Through facilitating data collection sessions, the researcher observed the impact of the cognitive demand placed on respondents through the use of written self-report questionnaires and the listening task. Participants commented on the difficulty of this and some required much reassurance that there are no “correct” answers. The researcher reflected whether collecting data in this way mirrored school exam procedures which many participants may have had negative experiences of. This may have evoked fear or distress in students and impacted on their ability to answer. Assessing biases in a more engaging or creative way (e.g. using computer games or individual interviews) may reduce cognitive demand and allow participants to have a more positive experience which in turn may reduce response bias and in turn yield more accurate results.

Across both papers, the researcher was struck by the sparse amount of research that has been undertaken in this area with adolescents with externalising difficulties. Conduct disorder is the most common difficulty facing adolescents (Green et al., 2004). However, the majority of the research investigating both cognitive biases and CBM-I training has predominantly focused on adolescents with internalising difficulties. The researcher reflected whether this bias in the research is due to the difficulties in recruiting from this population, as outlined earlier. The researcher also reflected on how such bias may reinforce stigma around these difficulties and the already excluded individuals experiencing them.

**4.2 Impact**

Impact is defined by the Research Excellence Framework (2014) as “An effect on change or benefit to the economy, society, culture, public policy or services, health, the environment or quality of life beyond academia” (Penfield et al, 2014). Both the empirical paper and systematic review discussed treatment implications which could impact across individuals, services and the economy.

Externalising difficulties, such as conduct disorder can have serious detrimental effects on the life of both the individual and their families as well society as a whole. In comparison to their peers, youth with conduct disorder are twice as likely to leave school without qualifications, four times more likely to become drug dependent, six times more likely to die before the age of 30, eight times more likely to be placed on a child protection register and 20 times more likely to be imprisoned (Khan, Parsonage & Stubbs, 2015). It has been estimated that the life time cost of these difficulties on society as a whole is approximately £260,000 per child (Parsonage, Khan & Saunders, 2014). Improving current treatments such as CBT or developing newer, cost-effective, accessible treatments such as CBM-I training, could greatly reduce these costs on the economy.

In terms of health and quality of life, this research could impact both service-users (adolescents with externalising difficulties and their families) as well as practitioners. Understanding the presence of cognitive biases can inform evidence-based practice, optimising the service practitioners deliver and service-users receive. Understanding thinking styles may aid psycho-education for both adolescents and their families. This could enable the development of collaborative formulations which would inform interventions. Feedback from service-users and their families could evidence this impact.

Systematic reviews are an important means for synthesising previous research by identifying, evaluating and summarising findings. They allow available evidence to be more accessible to decision makers (Gopalakrishnan & Geneshkumar, 2013). The study conducted in this paper allows practitioners and researchers to gain an understanding of the clinical implications of CBM-I for adolescents from the research conducted thus far. The study highlights key areas of necessary improvements in this research. This research can aid decision-makers in verdicts around funding future research.

CBT is currently commonly employed with youth and has been found to have a medium effect size in reducing externalising symptoms (Battagliese et al., 2015). Further insight into the pattern of cognitive biases in this group across treatment may inform a greater understanding of the model of change for CBT for this group (Kazdin, 2001). Research has predominantly focused on pre and post treatment outcomes, yet non-linear patterns of change have been found across treatment (Hayes, Hope & Hayes, 2007). Assessing biases across the course of therapy could enable a greater understanding of the mechanisms of change of CBT. Additionally, using the current research to tailor such interventions more suitably to this population by increasing positive attributions among this population could improve these interventions.

Unfortunately, not all adolescents experiencing externalising difficulties will have access to a multi-modal intervention for various reasons, including lack of resources. Despite the majority of parents with a child who meets criteria for an externalising disorder seeking help, only about a quarter of these receive support (Green et al., 2005). Developing a cost-effective, accessible intervention such as CBM-I training could enable greater numbers of adolescents to receive support. The systematic review highlights some difficulties with current studies of CBM-I training with adolescents but does reveal that some interventions have been successful in increasing positive attributions. Further, more rigorous research could allow for the investigation of the efficacy of such interventions for adolescents with externalising disorders which may have an impact on increased accessibility of treatment for this group.

Additionally, adolescents with externalising difficulties may be wary of accessing current treatments. NICE guidelines note that many adolescents with externalising disorders may have had punitive experiences of care and be wary of offers of help. For those experiencing externalising symptoms, stigma is likely to be contributing factor to this. Stigma is known to act as a barrier to help-seeking and treatment adherence (Leaf, Bruce & Tischler, 1986; Sirey et al., 2001). Adolescents have been found to be less tolerant of externalising difficulties than internalising (Lau et al., 2016). CBM-I training may offer a less explicit means of help-seeking. Training sessions are typically conducted using a computer and work through implicit learning, rather than overtly discussing difficulties and learning specific emotion regulation strategies. As such, CBM-I may offer a less stigmatising, more accessible means for accessing support.

As such, the research conducted across the systematic review and empirical paper may contribute to a body of research that could increase accessibility, improve wellbeing for service-users and lower economic costs.

**4.3 Dissemination**

Dissemination of research is an important process that allows for findings to be communicated to others. Ethically, it is important that the contribution of study participants is purposeful and utilised. To maximise accessibility of the research findings, the dissemination strategy for the study is three-fold.

**4.3.1 Publication.**

Publication allows research to be shared with a wider audience and facilitates improvements to evidence-based practice. The research will be submitted for publication to notable relevant academic journals which have published similar research. These include the Journal of Child Psychology and Psychiatry which is highly ranked amongst Psychology Developmental journals and had an impact factor of 4.40 in 2016 (ResearchGate, 2017), Developmental Psychology which had an impact factor of 2.591 in 2016 and Cognitive Therapy and Research which has an impact factor of 1.293 in 2016 (SCImago, 2017).

**4.3.2 Conferences.**

Conferences provide an additional opportunity to share research. The research conducted will be submitted to be presented as relevant conferences. Research is being prepared to be submitted as an oral presentation to the Faculty for Children, Young People and their Families Annual Conference in Liverpool in October 2018. This will propose presenting the research orally, focusing on the findings from the empirical study and directions for future research.

**4.3.3 Co-producing a dissemination strategy with service-users**

The publication of research in academic journals limits its accessibility to a select group. As such, the researcher has extended the dissemination strategy beyond publications. The researcher aims to work with service-users to develop an appropriate strategy for dissemination of the research to these audiences. Obtaining their insight would allow for the research to be disseminated to appropriate audiences in an accessible way. They will be consulted about what information is relevant to know, how this can be explained and the most effective ways of sharing this information, for example through leaflets, presentations, video or visual media.

The researcher will work alongside service-users in developing this strategy which will allow for the research to be shared with all PRUs and mainstream schools who partook in the study. Additionally, service-users will be consulted regarding the optimal way to share the research to a wider audience of service-users. This strategy will allow for research to be consumed by all individuals who will benefit from this; both practitioners and service-users.

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***\*Citations in bold refer to studies analysed as part of the systematic review***

**Appendices**

**Appendix A: Demographic Questionnaire**

PLEASE TELL ME A BIT ABOUT YOU…

1. **What is your date of birth?**

Day\_\_\_\_\_ Month\_\_\_\_\_ Year\_\_\_\_\_\_\_

2. **What is your gender?** Please circle

Male Female

3. **How would you describe your ethnic background?** Please circle

|  |  |  |  |
| --- | --- | --- | --- |
| **White:** | **Black or Black British:** | **Mixed:** | **Asian or Asian British:** |
| White British | African | Mixed White and Black Caribbean | Indian |
| White Irish | Caribbean | Mixed White and Black African | Pakistani |
| White Other | Other Black | Mixed White and Asian | Bangladeshi |
|  |  | Other Mixed | Chinese |
|  |  |  | Other Asian |

**Any other ethnic group** Please state: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



4. **What level of education did your father/carer complete?** Circle the highest level that was completed

Primary school  
High school/Secondary school  
Undergraduate university degree  
Postgraduate university degree (MA, Ph.D, M.D, law degree etc.)

Don’t know

5. **What level of education did your mother/carer complete?** Circle the highest level that was completed

Primary school  
High school/Secondary School  
Undergraduate university degree  
Postgraduate university degree (MA, Ph.D, M.D, law degree etc.)

Don’t know

6. I**f your father/carer works, what does he do for a job?**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

7. **If your mother/carer works, what does she do for a job?**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

8. **Are you currently having counselling?** Please circle your answer   
Yes No

9. **Have you seen a counsellor or mental health worker in the past?** Please circle your answer

Yes No

10. **If you circled ‘Yes’ for Question 8 or 9, were any of the following terms used to describe your difficulties?** Please circle all that are relevant to you.

Depression  
Anorexia  
Panic Obsessive-Compulsive

Anxiety

Phobia

Bulimia

Post-Traumatic Stress

Attention Deficit/ Hyperactivity

Conduct Disorder

Other (please state) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

11. **Are you currently on any medication to help with any of the difficulties mentioned above?** Please circle your answer.

Yes No

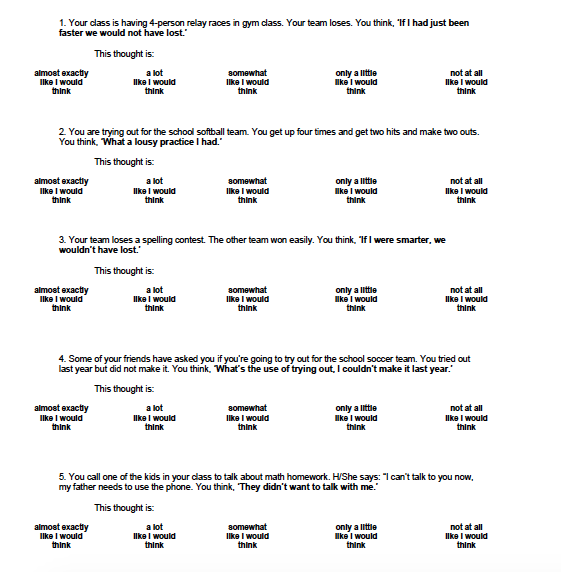
12. **In the last 12 months have you experienced any of the following?** Please circle your answer. You can circle more than one.

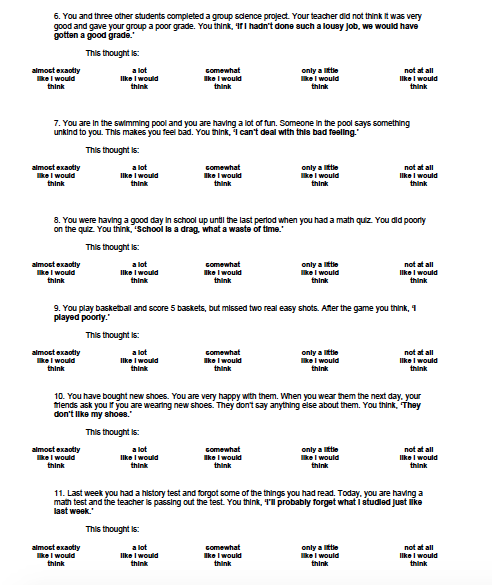
|  |  |
| --- | --- |
| Moved house | Been seriously ill |
| Moved school | Parent or sibling been seriously ill |
| Separation/divorce of parents/carers | Death of friend or family member |

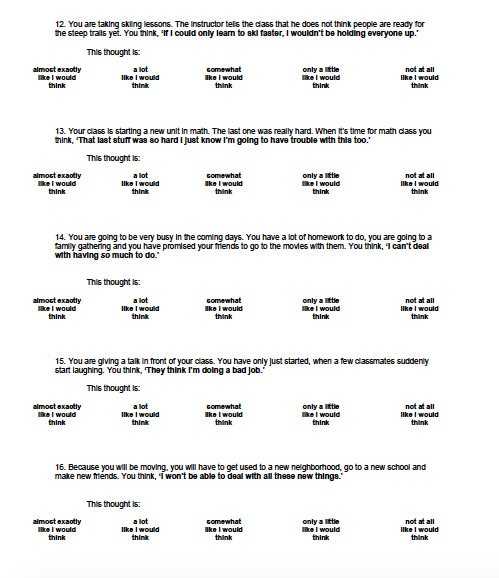
Thank you!

**Appendix B: CNCEQ-R**









**Appendix C: CASQ-R**

**Children’s Attributional Style Questionnaire – Revised**

**INSTRUCTIONS**

Here are some situations, I want you to try really hard to imagine that these situations just happened to you. After each situation is presented, two possible reasons for why the situation might have happened are given. I want you to choose the most likely reason to explain why the situation happened to you.

Sometimes both of the reasons may sound true, and sometimes both may sound false, and, you may never have been in some of these situations. But even so, I wat you to pick the reason that seems to explain why the situation happened to you.

There are no right answers and no wrong answers, so always pick the reason that seems most likely to you.

Circle either “a” or “b” for each question.

1. **You get an “A” on a test.**  
   a. I am smart.  
   b. I am good in the subject that the test was in.
2. **Some kids that you know say that they do not like you.**  
   a. Once in a while people are mean to me.  
   b. Once in a while I am mean to other people.
3. **A good friend tells you that he or she hates you.**  
   a. My friend was in a bad mood that day.  
   b. I wasn’t nice to my friend that day.
4. **A person steals money from you.**  
   a. That person is not honest.  
   b. Many people are not honest.
5. **Your parents/carers tell you something that you make is very good.**  
   a. I am good at making some things.  
   b. My parents like some things I make.
6. **You break a glass.**  
   a. I am not careful enough.  
   b. Sometimes I am not careful enough.
7. **You do a project with a group of kids and it turns out badly.**  
   a. I don’t work well with people in that particular group.  
   b. I never work well with groups.
8. **You make a new friend.**  
   a. I am a nice person.  
   b. The people that I meet are nice.
9. **You have been getting along well with your family.**  
   a. I am usually easy to get along with when I am with my family.  
   b. Once in a while I am easy to get along with when I am with my family.
10. **You get a bad grade in school.**  
    a. I am not a good student.   
    b. Teachers give hard tests.
11. **You walk into a door and you get a bloody nose.**  
    a. I wasn’t looking where I was going.  
    b. I have been careless lately.
12. **You have a messy room.**  
    a. I did not clean my room that day.  
    b. I usually do not clean my room.
13. **You parent/carer makes you your favourite dinner.**  
    a. There are a few things that my parent/carer will do to please me.  
    b. My parent/carer usually likes to please me.
14. **A team that you are on loses a game.**  
    a. The team members don’t help each other when they play together.  
    b. That day the team members didn’t help each other.
15. **You do not get your chores done at home.**  
    a. I was lazy that day.  
    b. Many days I am lazy.
16. **You go to an amusement park and you have a good time.**  
      
    a. I usually enjoy myself at amusement parks.  
    b. I usually enjoy myself in many activities.
17. **You go to a friend’s party and you have fun.**  
    a. Your friend usually gives good parties.   
    b. Your friend gave a good party that day.
18. **You have a substitute teacher and she likes you.**  
    a. I am well behaved during class that day.  
    b. I am almost always well behaved during class.
19. **You make your friends happy.**  
    a. I am usually a fun person to be with.  
    b. Sometimes I am a fun person to be with.
20. **You put a hard puzzle together.**  
    a. I am good at putting puzzles together.   
    b. I am good at many things.
21. **You try out for a sports team and do not make it.**  
    a. I am not very good at sports.  
    b. The other kids who tried out were very good at sports.
22. **You fail a test.**  
    a. All tests are hard.  
    b. Only some tests are hard.
23. **You hit a home run in a ball game.**  
    a. I swing the bat just right.  
    b. The pitcher threw an easy pitch.
24. **You do the best in your class on a paper.**  
    a. The other kids in my class did not work hard on their papers.  
    b. I worked hard on the paper.

**Appendix D: ASQ**

**Ambiguous Situations Questionnaire - Child**

Situations and Interpretations

You will be given a set of 12 different situations – and then two possible ways in which you might explain the situation. Please circle a) or b) and indicate which explanation you would most likely think about in this situation.

**1) You notice at school one day that a favourite book of yours is missing. Where would you think the book might be?**

a) Someone has stolen the book.

b) You left your book at home.

**2) You see the School Principal walking around the playground and s/he has been asking other children where you are. Why would you think the principal would be looking for you?**

a) S/he has a message from your mother for you.

b) S/he thinks you have done something wrong.

**3) You are staying over at a friend's place and his/her parents seem to be very angry. Why would you think the parents would be angry?**

a) They had an argument and are upset with each other.

b) They don't want you to be there and are angry at you.

**4) You see a group of students from another class playing a great game. When you walk over to join in they are laughing. Why would you think they are laughing?**

a) One of them has told a nasty joke about you.

b) They are laughing about something in the game.

**5) You are having a party which starts at 3.00 and a little after 3.00, no one is there. Why would you think no one has turned up?**

a) No one wants to come to the party.

b) They are running a little late.

**6) You are showing your school project in front of the class and two kids at the back are giggling. What would you think they are giggling at?**

a) They are laughing at something stupid that you said.

b) One of them has told a joke and they are laughing at that.

**7) Do you have a dog? If not, pretend that you do.**

**You are playing inside and your dog runs to the door and starts to bark and growl. What would you think it is barking at?**

a) There is another dog walking past outside.

b) There is someone you don't know trying to get into your house.

**8) On the way to school, you start to feel sick in the tummy. What would you think has made you feel sick?**

a) You ate some bad food and are going to be really sick.

b) You didn't eat enough breakfast and are just feeling hungry.

**9) You are lying in bed at night when you hear a big crash in the house. What would you think it is?**

a) Someone has dropped something on the floor.

b) One of your parents has fallen and is hurt.

**10) You are at a friend's house and the phone rings in the middle of the night. Why would you think someone is calling so late?**

a) There is an emergency at home.

b) It is a wrong number. **11) You are walking to a friend's house and a big dog comes toward you. What would you think the dog is going to do?**

a) The dog wants to sniff you and have a pat.

b) The dog is going to bite you.

**12) You are reading and cannot see the words properly. Why would you think you can't see properly?**

a) Your eyes are tired.

b) There is something wrong with your eyes.

**Appendix E: List of homophones used in HAWT**

|  |
| --- |
| COMPUTER |
| **BREAK** |
| **HIT** |
| **PATIENTS** |
| MOTHER |
| **HANG** |
| **WILL** |
| **PARTING** |
| OFFICE |
| **BARK** |
| **WHIP** |
| **GROWTH** |
| FINGER |
| **STROKE** |
| **ODD** |
| **SINK** |
| BELL |
| **FINE** |
| **CHOP** |
| **BEAT** |
| BULB |
| **BATTER** |
| **TANK** |
| **STUB** |
| WATER |
| **STRAIN** |

\*Words in bold are threat homophones

**Appendix F: SDQ****Appendix G: Letter for Caregivers**

**Information letter to carers with opt out form**

Dear Parent/Carer,

We are Trainee Clinical Psychologists at Royal Holloway, University of London, and have partnered up with (name of school) in order to carry out a research project.

**What does the project involve?**

We will be asking the students to complete some questionnaires during PSHE lessons. These questionnaires will be asking them about helpful and unhelpful ways of thinking as well as asking them questions about their peer relationships and how their family deals with difficult situations.Your child’s answers will be used to help with the project. All information will be kept confidential. Your child’s ***answers will be kept anonymous*** and will be stored securely.

**Why are we doing this?**

We know that particular ways of thinking can affect a young person’s well-being. We are interested in understanding this better so that we ***can help to improve the well-being of young people***.

**What happens next?**

Your child’s answers will be used to help with the project. We will be giving feedback about our findings to the school.

If, in the unlikely case that your child’s answers were to raise any concern, we will make sure that the relevant member of staff in the school is made aware to ensure that your son/daughter receives the appropriate support.

Your decision to have your child participate in this project is ***entirely voluntar****y*. If you would NOT like your child to participate in the research project, please complete the form below and hand it back to your child’s form tutor. Your child will also be given the opportunity to back out of participating at any time during the project.

If you would like to discuss the project further and have any questions regarding your child’s participation, please do not hesitate to contact us at:

[Angharad.Ormond.2015@live.rhul.ac.uk](mailto:Angharad.Ormond.2015@live.rhul.ac.uk) or [Jennifer.Kelly.2015@live.rhul.ac.uk](mailto:Jennifer.Kelly.2015@live.rhul.ac.uk)

Yours Sincerely,

Annie Ormond & Jennifer Kelly, Trainee Clinical Psychologists

Supervised by Dr. Helen Pote, Clinical Psychologist, Royal Holloway, University of London

I would NOT like (student’s name) ……………………………… of (student’s form class) ………. to participate in the research project. Please arrange for my child to complete alternative work during this lesson.

Name ………………………Signature …………………………….Date…………………

**Appendix H: Information sheet**

**Participant information and consent form**

Hi our names are Jen and Annie. We are research students and would like to ask for your help with our projects.

What’s the project about?

**We are trying to understand how young people think and feel**, especially when they are faced with different situations.

Today’s session: Finding out about how you think

Please read each question carefully and then you can decide on your answer, marking your choice in your pack. It is important to keep your answers to yourself and to not copy anyone else as we are interested only in what YOU think and feel.

What happens next?

Your answers will be used to help with the project but **no-one will know what you have said** as your name will not be written in my project.

If, from your answers we think you might need support with anything, we will let your teacher know. If this is the case your teacher will speak to your parents too. Please try and tell us how you really feel or think on the questions. **Getting your true answers is very important to us** and will affect the project and how helpful it might be to other young people. Try to answer as many questions as possible, but if there is a question you are not comfortable answering then you can skip that item.

Please tick boxes if you agree to the following statements

|  |  |
| --- | --- |
| I understand the information sheet and have had the opportunity to ask Jen/Annie questions. |  |
| I understand that I can stop taking part at any time without giving a reason and that this will not affect my school work. |  |
| I agree to take part in the project. |  |

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Your Name Class Today’s Date

**Appendix I: Confirmation of ethical approval**

