# University of Southampton

Faculty of Environmental and Life Sciences

School of Psychology

Effects of Cognitive Behavioural Therapy, Dialectical Behavioural Therapy, and Paternal Anxiety on Youth Emotional and Behavioural Dysregulation: A Systematic Review, Meta-Analysis, and Longitudinal Study.

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by

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Thesis for the degree of Doctorate of Clinical Psychology

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# University of Southampton

## Abstract

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### Background

Emotional dysregulation (ED) is a prominent feature across a range of psychiatric and neurodevelopmental disorders in childhood and adolescence. ED is also implicated in systemic risk factors, such as paternal anxiety. The body of knowledge around ED is growing, but despite this, little is known around interventions to treat ED and intergenerational influences on ED including emotional and behavioural problems.

### Aims

This thesis aimed to (1) synthesis existing evidence, through systematic review and meta-analysis, on the effectiveness of cognitive behavioural therapy (CBT) and dialectical behavioural therapy (DBT) for reducing ED in children and young people, and (2) examine the bidirectional associations between paternal anxiety and child emotional and behavioural problems using a pre-existing longitudinal dataset.

### Methods

Chapter 1: By conducting a systematic review and meta-analysis, existing evidence was synthesised evaluating randomised control trials for CBT/DBT- based interventions on ED in children and young people. Chapter 2: By employing logistic regression models to the Avon Longitudinal Study of Parents and Children (ALSPAC) dataset, a population-based longitudinal analysis was conducted, examining the impact of paternal anxiety on child outcomes.

## Results

The meta-analysis (k = 3) showed a small-to-moderate reduction in ED for CBT compared to control (Hedge's g = -0.43, 95% CI = [-0.63, -0.23]). The longitudinal analysis found that paternal anxiety at 18 weeks gestation and 8 weeks postnatally was significantly associated with increased risk of emotional and behavioural difficulties in children at 7-8 years.

## Conclusion

Chapter 1's findings suggest that both CBT and DBT are interventions which reduces ED outcomes for children and young people, compared to a control. Chapter 2's findings suggest that paternal anxiety plays an important role in developmental child mental health outcomes. To conclude, clinicians should consider early intervention for ED with therapeutic intervention and the role of paternal mental health and it's impact on child mental health.

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# Research Thesis: Declaration of Authorship

Print name: James Robert Swanton

Title of thesis: **Effects of Cognitive Behavioural Therapy, Dialectical Behavioural Therapy, and Paternal Anxiety on Youth Emotional and Behavioural Dysregulation: A Systematic Review, Meta-Analysis, and Longitudinal Study.**

I declare that this thesis and the work presented in it are my own and has been generated by me as the result of my own original research.

I confirm that:

1. This work was done wholly or mainly while in candidature for a research degree at this University;
2. Where any part of this thesis has previously been submitted for a degree or any other qualification at this University or any other institution, this has been clearly stated;
3. Where I have consulted the published work of others, this is always clearly attributed;
4. Where I have quoted from the work of others, the source is always given. With the exception of such quotations, this thesis is entirely my own work;
5. I have acknowledged all main sources of help;
6. Where the thesis is based on work done by myself jointly with others, I have made clear exactly what was done by others and what I have contributed myself;
7. None of this work has been published before submission.

Signature:..... Date: 27/06/2025.....

# Definitions and Abbreviations

Avon Longitudinal Study of Parents and Children (ALSPAC)- A large-scale, prospective birth cohort study based in the Avon region of the United Kingdom.

Behavioural Problems- A description of disruptive or challenging behaviours that can interfere with learning, social interactions, and overall functioning.

Binary Logistic Regression- A statistical technique used to model the relationship between one or more independent variables and a binary outcome.

Cognitive Behavioural Therapy (CBT)- A therapeutic modality that focuses on the interaction between thoughts, emotions, and behaviours.

Dialectical Behavioural Therapy (DBT)- A therapeutic modality that blends cognitive behavioural techniques with mindfulness and acceptance strategies.

Emotional Dysregulation (ED)- Describes interpersonal difficulties with managing and responding to emotional experiences in a controlled and accepted manner.

Emotional Problems- Describes interpersonal difficulties in managing, processing, and expressing emotions in a way that is adaptive and healthy.

Meta-Analysis- A quantitative research method that combines and synthesizes results from multiple independent studies addressing a research question.

Neurodevelopmental Disorder- Describes a group of conditions that emerge during the early developmental period in childhood involving atypical brain development, which can impair various cognitive, communication, behavioural, and motor skills.

Paternal Anxiety- Refers to the experience of anxiety symptoms among fathers, often related to the challenges and responsibilities of parenthood.

Psychiatric Disorder- Describes a condition characterised by significant disturbances in an individual's thoughts, emotions, or behaviours, which can lead to distress or impairment in all or some areas of functioning.

Randomised Controlled Trial (RCT)- An experimental study design used to evaluate the effectiveness of interventions.

Systematic Review- A research method that synthesises findings from multiple studies to address a specific research question.

# Chapter 1 Effects of Cognitive Behaviour Therapy and Dialectical Behaviour Therapy on Emotional Dysregulation in Children and Adolescents with Psychiatric Disorders: A Systematic Review and Meta-Analysis

## 1.1 Abstract

Objective

We examined the effects of Cognitive Behavioural Therapy (CBT) and Dialectical Behaviour Therapy (DBT) on emotional dysregulation in children and young people with psychological, psychiatric, and neurodevelopmental disorders.

Method

Following a pre-registered protocol (PROSPERO CRD42024501675), we conducted a systematic search (until 22nd February 2024) on PubMed, Web of Science and Embase, for empirical papers examining the effects of CBT and DBT on emotion dysregulation (measured via a validated scale) in children and young people (up to 18 years) with DSM/ICD diagnoses of psychological, psychiatric, and neurodevelopmental disorders. Study quality was assessed with the National Heart, Lung, and Blood Institute (NHLBI) quality assessment tool. A narrative synthesis of the literature examined the effectiveness of intervention on emotional dysregulation. Pooled effect sizes (Hedge's G) were estimated through meta-analysis.

Results

The narrative synthesis summarised the findings of 15 journal articles, which explored the relationships of emotional dysregulation, intervention, environment, and treatment outcomes. Our meta-analysis of three studies (591 participants) showed a statistically significant effect of CBT on reducing emotional dysregulation compared to treatment as usual (Hedge's G = -0.43, SE = 0.10, 95% CI = [-0.63; -0.23])

Conclusion

The present study highlights CBT and DBT as promising treatments for emotional dysregulation in children and young people with psychological, psychiatric, and neurodevelopmental disorders. However, the small number of studies included in our review, makes cross-cultural and transdiagnostic comparisons difficult. The findings highlight a clear need for further RCTs examining the effect of DBT and CBT on emotional dysregulation.

Keywords: Emotional Dysregulation, Cognitive Behavioural Therapy, Dialectical Behaviour Therapy, Children and Young People, Meta-Analysis

**Word Count:** 4,569 (excluding Tables and Figure captions)

### 1.1.1 Acknowledgments and additional information

The protocol for the systematic review was registered on Prospero (CRD42024501675) on 12th February 2024. There was no significant change or amendments to the initial protocol throughout the study. All data, R code and supplementary materials are provided within the study and can be accessed here: https://osf.io/cyvrn/. There were no sources of financial or non-financial support received for this work. Dr Bellato declares honoraria as Joint Editor of JCPP Advances. Dr Lawrence and Mr Swanton declare no competing interests.

### 1.1.2 Key points

- CBT and DBT are widely used therapies in treating emotional dysregulation in clinical practice. This systematic review and meta-analysis provide support for these modalities as appropriate treatment options.
- Emotional Dysregulation presents across multiple psychiatric and neurodevelopmental disorders, and this review found that as an outcome, emotional dysregulation is responsive to therapeutic interventions.
- These findings can help influence practice and policy in how to treat emotional dysregulation in children and young people, but further research is needed to provide conclusive support for each treatment modality.

## 1.2 Introduction

Emotional dysregulation (ED) refers to an individual's inflexibility to regulate and manage the intensity and quality of emotions (such as, sadness, anger, fear), with an absence of healthy strategies that diffuse or moderate negative and intense emotions; subsequently inhibiting

appropriate goal directed behaviour (Carpenter & Trull, 2013). ED is evident within multiple mental health and neurodevelopmental disorders including, but not limited to, borderline personality disorder (BPD), schizophrenia, bipolar disorder (BD), autism spectrum disorder (ASD) and Attention-Deficit/Hyperactivity Disorder (ADHD) (Cludius, Mennin, & Ehring, 2020) (Bemmouna & Weiner, 2023).

Within their narrative review of ED in children and adolescents with psychiatric disorders, Paulus and colleagues (2021) highlighted the transdiagnostic nature of ED and its role in maintaining features of internalisation and externalisation across various psychiatric and neurodevelopmental conditions. The origins and perpetuation of ED can be partially allocated to various harmful experiences within formative years, namely childhood trauma (significantly physical and sexual), childhood emotional neglect, self-injurious ideation and behaviour, substance misuse, personal stress, genetic predisposition and difficulties engaging with goal/task-orientated behaviour (Paulus, Ohmann, Mohler, Plener, & Popow, 2021) (Easdale-Cheele, Parlatini, Cortese, & Bellato, 2024)

ED can significantly impact the development of children and young people, because the cognitive and behavioural processes, social relationships and functioning, emotional literacy and self-worth, emergent within typical development are often interfered with or compromised through the negative effects of ED (Dugal, Godbout, Belanger, Herbert, & Goulet, 2018). Interventions for reducing ED and improving emotion regulation (ER) comprise both pharmacological and non-pharmacological interventions but, due to limited RCTs and methodological differences across studies, the evidence base is insufficient to provide clear paths for treatment of ED (Easdale-Cheele, Parlatini, Cortese, & Bellato, 2024).

The National Institute for Health and Care Excellence (NICE) recognised the relationships between ED and psychiatric and neurodevelopmental disorders and deferred to Children and Adolescent Mental Health Services (CAMHS) for the assessment and treatment of ED (NICE, 2024). NICE recommended investigating the effectiveness of existing long-term psychological interventions that integrate an explicit theoretical approach, monitor risks, assess a broad range of outcomes, and aim to improve ED through practical strategies. Cognitive behavioural therapy (CBT) and dialectical behavioural therapy (DBT) are such interventions.

Understanding the origins and manifestations of emotional and behavioural difficulties in childhood and adolescence may prove critical in identifying risk factors and profiles which can inform intervention strategies to manage and mitigate the trajectory of these early difficulties, which can manifest and negatively impact functioning through childhood and adulthood. Attachment theory (Bowlby, 1969) highlights the significant role of parent and child relationships, and how these relationships shape children's abilities to regulate their emotions and their vulnerability to psychopathology. Cognitive models of anxiety (Beck, 1976) spotlight maladaptive cognitive patterns in adults, such as rumination and sensitivity to threat, which are

evident across multiple psychopathological disorders. The cognitive models have since been applied to child to adolescent populations, which supports the emergence of cognitive vulnerabilities within the early developmental period, as factors which may share underlying mechanisms across multiple disorders (Meyer, 2017)

A trans-diagnostic approach to examining psychopathology in childhood has a focus on commonalities and vulnerabilities across multiple disorders and provides a flexible framework, which is conducive to understanding the emergence and development of psychopathology (Schweizer, Snyder, Young, & Hankin, 2020). Traditional diagnostic frameworks look to categorise mental health difficulties into clear disorders; however, there is a developing evidence base, which suggests emotional and behavioural problems share underlying mechanisms and frequently co-occur within presentations (Pearl & Norton, 2017).

The integration of perspectives from both child and adult evidence-based literature provides for a trans-diagnostic approach which shapes the understanding of the origins and manifestations of emotional and behavioural difficulties in childhood and adolescence and may prove critical in identifying risk factors and profiles which can inform intervention strategies to manage and mitigate the trajectory of these early difficulties, which manifest and negatively impact mental health outcomes through childhood and adulthood (Dalgleish, Black, Johnston, & Bevan, 2020).

This study applies such an approach to examine the role of CBT and DBT on emotional dysregulation in children and young people. By doing so, we aimed to contribute to the body of research which supports a dimensional and process-orientated perspective within developmental psychology.

### 1.2.1 Cognitive Behaviour Therapy (CBT) and treatment of emotional dysregulation

CBT originated through the idea that our thoughts, feelings, and behaviours are interwoven with cyclical associations and are reactive to specific situations. This intervention is based upon principles of learning theory and holds that modification to thinking and/or behavioural patterns can influence and change mental health (Hofmann, Asnaani, Vonk, Sawyer, & Fang, 2012). Within their systematic review, Sloan and colleagues (2017) found evidence of the effectiveness of different psychological interventions (including CBT), compared to control interventions, for the treatment and reduction of ED symptoms, and improvements of general psychopathology, across multiple psychiatric disorders (including anxiety, depression, substance use, eating pathology and BPD) in samples including adults (individual sample means ranged from15.4 – 72.9 years).

The focus on skill training and changes in patterns of thinking and behaviours within CBT might provide a platform to improve ER skills - consequently reducing ED symptoms. Indeed, CBT aims to break vicious cycles of negative thoughts and behaviour patterns, which maintain negative emotions and their presentation. The techniques learnt through CBT focus on interrupting negative thought and behaviour patterns and supporting individuals with new strategies that are developed through practice and application when experiencing difficult situations that require emotional regulation. Therefore, CBT with a focus on skills training might be a suitable intervention to improve ED symptoms and the functioning of individuals who experience ED (Dumornay, et al., 2022).

### 1.2.2 Dialectical Behaviour Therapy (DBT) and treatment of emotional dysregulation

DBT origins aimed to apply standardised behavioural and social learning theory principles to help individuals who experienced substantial suicidal ideation and behaviours, to ameliorate the severity of symptoms (Linehan, 1981). DBT bio-psycho-social theory contextualises ED as an influence of an individual's interaction with an invalidating environment, coupled with a high degree of emotional vulnerability and a biological predisposition (Panos, Jackson, Hassan, & Panos, 2014).

DBT often focuses on ED during treatment and is a transdiagnostic intervention for clinical presentations where ED is a prominent feature of psychiatric and neurodevelopmental disorders, such as: Borderline Personality Disorder (BPD), Schizophrenia, Bipolar Disorder (BD), autism spectrum disorder (ASD), Attention-Deficit/Hyperactivity Disorder (ADHD). DBT also focuses on dysfunctional behavioural responses to emotional experiences, such as self-injury or suicidal attempts (McMain, Korman, & Dimeff, 2001). DBT encompasses the promotion of learning and application of effective responses during intense emotional experiences, which differ from previous maladaptive responses (Reilly, et al., 2020).

## 1.3 Study Objectives

Easdale-Cheele et al. (2024) report promising evidence in support of the effectiveness of CBT and DBT for reducing ED and improving ER trans diagnostically in children, young people and adults. However, as of today, no quantitative synthesis of studies focused exclusively on children and young people exists. Hence, we conducted a systematic review with meta-analysis to quantify the effect of CBT and DBT for reducing ED in children and young people with psychiatric, psychological, and neurodevelopmental disorders.

# 1.4 Methods

The 2020 PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines (Page, et al., 2021) were followed to conduct the systematic review and meta-analysis (See Table 1.3). The protocol for the study was pre-registered on PROSPERO (CRD42024501675).

## 1.4.1 Search strategy and study selection

We systematically searched PubMed, Web of Science and Embase until 26th February 2024 for studies reporting the effects of CBT and DBT on emotional dysregulation in children and young people. The search strategy for each database included key words associated with emotional dysregulation and DBT and CBT. The focus of the search was on the clinical construct of emotional dysregulation, which indirectly included emotion regulation and stability, even though it is not mentioned in the search terms. The full search strategy is reported:

((emotion* dysregulation) OR (emotion* instability) OR (emotion* lability) OR (emotion* reactivity) OR (emotion* swing*) OR (affect* dysregulation) OR (affect* instability) OR (affect* lability) OR (affect* reactivity) OR (affect* swing*) OR (mood dysregulation) OR (mood instability) OR (mood lability) OR (mood reactivity) OR (mood swing*) OR (irritability)) AND ((CBT) OR (cognitive behaviour therapy) OR (cognitive behavioural therapy) OR (DBT) OR (dialectical behaviour therapy) OR (dialectical behavioural therapy) OR (DBT-A))

Studies met eligibility criteria for inclusion if:

(a) the participants were children and adolescents (mean age of the sample <18 years) with a DSM/ICD diagnosis of any psychological, psychiatric and/or neurodevelopmental disorder. This inclusion criterion was selected to support the application of the findings to childhood and adolescent development. Using the average age approach, allowed for the inclusion of a wider age range within childhood and adolescent populations, whilst maintaining the focus on early developmental trajectories. If inclusion criteria for age range had strict cut-offs, such as only including participants aged 10 to 14 years of age, this potentially would have excluded important data from child populations at differing stages of development and would not have captured the variability in emotional dysregulation symptom emergence, over different periods of childhood. Using this approach, we aim to provide a broader understanding of emotional dysregulation across a range of childhood periods, focusing on early developmental trajectories and early risk factors that are relevant to mental health outcomes.

(b) they compared effects of CBT or DBT to control conditions e.g., waiting list, treatment as usual or medication, and

(c) they reported pre- and post-intervention emotional dysregulation data, measured with a validated clinical scale such as Children's Emotion Management Scales (CEMS).

Studies that were not peer-reviewed or primary studies e.g., dissertations, conference abstracts, narrative reviews, were excluded, together with studies without a control group and studies which compared a CBT or DBT to an adjunct therapy e.g., CBT compared to DBT.

Titles and abstracts of retrieved records were exported to Covidence, a reference management software (Covidence, 2024), and screened by two authors independently (J.S and A.B). Covidence uses artificial intelligence to read and sort studies by relevance, which could have influenced decision making around inclusion criteria; however, studies were only included within the study which met inclusion criteria (reported above). The studies that met inclusion criteria at the title/abstract screening were progressed to full text screening, which was doubled screened by J.S and A.B.

### 1.4.2 Data selection, extraction and quality rating

Data from each study included in the review was extracted by one author (J.S) using standardised forms (presented in Table 1), and cross-checked by A.B. The data extracted included: study design, intervention and control type, age, sample size, location, race/ethnicity, and intellectual disability or neurodevelopmental/psychiatric diagnosis. The data also included pre- and post-intervention outcome measures used for emotional dysregulation (through a validated tool e.g., Children's Emotion Management Scales (CEMS)). Mean (M), Standard Deviation (SD), Confidence Intervals (CI), which measured ED as a primary or secondary outcome within respective studies. Main results not available from the study e.g., pre- and post-intervention and control M and SD, resulted in the study being excluded. To evaluate study quality, we used National Heart, Lung and Blood Institute (NHLBI) quality assessment tool for controlled trials, which focuses on concepts key to a study's internal validity within medical and health research (National Heart, Lung and Blood Institute , 2021) (see Table 1.2).

### 1.4.3 Data synthesis and analysis

The substantial theoretical and procedural differences between CBT and DBT, means a singular meta-analysis would not be appropriate and violate the assumptions of the meta-analytical models, leading to incorrect and invalid results. To navigate this and produce meaningful insight into the standardised mean difference between interventions and control groups measuring ED, separate meta-analyses were planned and conducted for each modality: CBT and DBT.

The studies were grouped by intervention type to ensure conceptual and theoretical clarity was evident and to prevent heterogeneity. Studies were only included if they reported pre- and post-intervention outcomes measured by a valid ED measure were included in the results. Follow-up measures and mixed timepoint data was not included in the pooled analyses to ensure comparability.

A description of eligible studies was produced for the systematic review before meta-analysis was conducted in R Statistical Software (R Core Team, 2021) to estimate the pooled effect size for each reported outcome across studies which reported pre-and post-intervention data. Meta-analyses were performed using *R Statistical Software* (R Core Team, 2021). For data used in the meta-analysis (i.e., individual studies' effect sizes), see https://osf.io/cyvrn/. For a summary of studies included in the systematic review, see Table 1.

For RCTs which were eligible for inclusion in the meta-analysis, we calculated Hedge's g as the standardised mean difference in emotional dysregulation (ED) symptom change between intervention and control arms. Calculated Hedge's G scores represented one effect size for each study to be included in meta-analysis model, with a positive g score indicating superiority of intervention vs control in reducing emotional dysregulation.

However, studies which reported multiple separate effect sizes, which was only Afshari, et al., (2014) had a composite effect size calculated by averaging the reported effects. A moderate correlation (p=0.5) between outcomes was assumed to calculate the pooled variance, as recommended by Borenstein et al., (2009) when direct estimates are unavailable. The composite effect size produces a single, statistically valid estimate which is suitable for inclusion in the meta-analysis, allowing for the study to be represented appropriately without inflating precision or biasing the pooled effect (Higgins, et al., 2024).

The composite effect size is per meta-analytic best practice when multiple related outcomes are reported within a single sample and reflect theoretical and conceptual aspects of the same construct e.g., anger and sadness dysregulation are both core dimensions of the transdiagnostic construct of emotional dysregulation. It is appropriate to calculate a composite effect size, as this promotes statistical independence by avoiding multiple non-independent outcomes from same sample of participants and allows for the model to align with the assumptions of meta-analysis and reduce the risk of underestimating standard errors.

Effect sizes were nested within studies in multilevel models for those studies that reported multiple effect sizes (e.g., anger and sadness dysregulation), using the Restricted Maximum-Likelihood Estimator. Multilevel Random Effects meta-analytical model was fitted to the imported data using the *metafor* R package (Viechtbauer, 2010).

Cochran's Q test was planned to be used to assess the presence of variation and significant heterogeneity across the studies. However, as the meta-analysis needed at least 10 separate

effect sizes to be meaningful, without violating the assumptions of Cochran's Q test, this test was not used and funnel plots were used to assess heterogeneity instead (Higgins, et al., 2024)

## 1.5 Results

Described below are the characteristics of the studies included in the systematic review, with a narrative synthesis of the included studies, and the results of the meta-analysis.

We retrieved 3645 papers in total, and screened 2832 after duplicates were removed. After title and abstract screening, 2705 studies were excluded with 127 full-texts articles assessed. After full-text screening, 111 articles were excluded , with a total of 15 articles being included in the systematic review which met inclusion criteria and were RCTs. The studies evaluated CBT or DBT interventions which aimed at reducing emotional dysregulation scores in children and adolescents across multiple clinical populations Figure 1.3 displays a PRISMA flowchart which shows the screening and inclusion process, and Table 1.1 presents a comprehensive overview of the study characteristics.

Four studies provided sufficient data for being included in the meta-analysis (as they reported pre- and post-intervention data). With the additional 11 articles being excluded from the meta-analysis due to methodological limitations within the design. See Table 1.1 for Study Characteristics.

The four studies that provided sufficient data for meta-analysis were Afshari, et al., (2014), Goldstein, et al., (2015), Klim-Conforti, et al., (2021), and Stadler, et al., (2023). However, Goldstein, et al., were excluded from the meta-analysis, as it was the only DBT study eligible for inclusion. Goldstein's modality for therapeutic intervention within their RCT was DBT. Afshari, et al, Klim-Conforti, et al., and Stadler, et al., all applied the modality of CBT for their therapeutic intervention, which would have invalidated the findings of the meta-analysis if included, as the studies would not have conceptual and structurally comparable interventions. As planned, CBT and DBT studies were analysed separately, therefore, Goldstein, et al., was excluded from the quantitative synthesis, and a meta-analysis of DBT interventions could not be conducted due to insufficient data ($k < 2$), but the findings are reported narratively in the review to highlight the potential of DBT for treating ED.

These two distinctively different modalities and the low number of DBT studies compared to CBT studies means only a meta-analysis of the CBT studies was theoretically and conceptually possible. This sparsity of DBT studies also precluded the possibility of conducting a separate meta-analysis of DBT studies, as meta-analysis techniques require a minimum of two studies.

Additional to the meta-analysis, a narrative synthesis of the findings of the studies that met inclusion criteria, but could not be included in the meta-analysis for methodological limitations

e.g., no pre- and post- intervention outcomes, non-valid ED measure etc., was conducted and the findings are contextualised in the narrative review. The studies were grouped thematically by intervention type and the findings are reported based on features of the study such as study design, ED outcomes, content of the intervention and population. This approach was completed in conjunction with the best practice recommendations for integration of study designs and outcome measure, which are not amenable to meta-analysis (Rodgers, et al., 2009).

## 1.6 Narrative synthesis of included studies

### 1.6.1 CBT interventions

Six studies used CBT as their primary intervention (Afshari, et al, (2014), Derella, et al., (2017), Evans, et al., (2020), Klim-Conforti, et al., (2021), Scarpa & Reyes (2011), and Stadler, et al., (2023)). Across all six studies, comparing pre- and post-intervention outcomes, CBT was a beneficial intervention for pre-adolescents, adolescents, and children across both male and female genders in reducing symptoms of ED across varying primary psychiatric disorders: self-reported suicidality, conduct disorder (CD) and oppositional defiant disorder (ODD), severe irritability mood disorder (SIMD) and separation anxiety disorder (SAD).

The variation within the CBT protocols was of note, Afshari, et al., utilised a structured protocol in Coping Cat to target ED in children with SAD, while Derella, et al., applied the SNAP program, which is a group based intervention suited for boys with CD/ODD. Evans, et al., targeted mood dysregulation in youths with the modular CBT protocol MATCH, where as Klim-Conforti, et al., implemented a novel, curriculum based CBT programme designed around the theme of Harry Potter, which addresses suicidality in middle schoolers. The variation in protocol demonstrates a high degree of flexibility and adaptability for the application of CBT.

Scarpa & Reyes (2011) also found a brief group-based CBT program, compared to delayed treatment, improved emotion regulation and decreased episodes of behavioural outbursts, whilst reducing symptoms of ED in children diagnosed with neurodevelopmental disorder, high functioning autism spectrum disorder. Similarly, Stadler, et al., reported delayed but clinically meaningful effects of CBT on ED and irritability in adolescent girls with CD/ODD.

Schuppert, et al., (2009) used Emotion Regulation Training (ERT) as their primary intervention for adolescents with symptoms of BPD. The intervention consisted mainly of CBT skills and ethos, however, there were methodological limitations within the study that made the outcomes difficult to interpret. Lastly, Kennedy, et al., (2019) used Unified Protocol-Children (UP-C) a transdiagnostic CBT program, compared to Cool Kids (CBT) and found no

significance in UP-C compared to CBT for parent-rated Anger and Worry dysregulation, but significant effects on parent rated sadness dysregulation, which might imply parental regulation of sadness as a mediator to reducing symptoms of ED in children with emotional disorders.

### 1.6.2 DBT interventions

Seven of the studies used Dialectical Behaviour Therapy/ Dialectical Behaviour Therapy for Adolescents/ Dialectical Behaviour Therapy for Children (DBT/DBT-A/DBT-C) as their primary intervention (Adrian, et al., (2019), Dibaj, et al., (2023), Goldstein, et al., (2015), Goldstein, et al., (2023), Meyer, et al., (2022), Perpletchikova, et al., (2017) and Wood, et al., (2023)). Across all seven studies, DBT was found to be a beneficial intervention for pre-adolescents, adolescents, and children across both male and female genders in reducing symptoms of ED across varying primary psychiatric disorders: BPD/BPD traits, BP, CD and ODD, self-harm and suicidal ideation.

Meyer, et al., (2023) also found DBT to reduce difficulties associated with hyperactivity/impulsivity, conduct problems, and ED in adolescents diagnosed with neurodevelopmental disorder, ADHD.

Goldstein, et al. (2015) reported DBT intervention leading to significant reductions in emotional dysregulation, observed among adolescents with high baseline levels of dysregulation. The improvements in ED were found to have a mediating effect on the reduction of suicide attempts within the sample, which is suggestive of a meaningful clinical impact of DBT on ED in adolescents with severe affective disorders.

### 1.6.3 Intervention facilitators

All 15 studies reported the intervention and control group facilitators as being trained to post-graduate degree level in either psychology, psychological therapies or medicine and psychiatry. Klim-Conforti, et al., (2021) trained educational professionals to deliver their intervention, which highlights the possibility of adapting psychological interventions to be delivered by suitably educated and trained core professionals, which produced viable outcomes. However, much further research is warranted to explore the feasibility of educational professionals delivering psychological interventions and the validity of the research findings.

### 1.6.4 Gender differences

Within the studies reviewed, there was no clear examination of differences in gender. Thirteen studies reported mixed gender participants, with Derella, et al., (2017) focused exclusively on

pre-adolescent boys with clinically significant rates of conduct problems and Stadler, et al., (2023) focused exclusively on adolescent girls with CD or ODD differing from the other studies. Derella, et al., (2017) reported an improvement in emotion regulation skills and a reduction of irritability symptoms in their sample through CBT protocol (SNAP) compared to their control arm: standard services. Stadler, et al., (2023) reported no difference in CD/ODD symptoms but a clinically meaningful delayed treatment effect on aggression, irritability, and ED compared to their control arm: treatment as usual.

### 1.6.5 Group based interventions.

Group based therapy and skills training are a key feature within DBT and are used to train skills in emotional regulation, interpersonal effectiveness, and mindfulness (Linehan, 1993). Six studies' primary intervention was a group-based therapy, which was inclusive of both CBT and DBT, and varied between intervention length (9-24 weekly sessions) and group sizes (which were inconsistently reported throughout). Klim-Conforti, et al., (2021) reported the intervention occurring over a 3-month period, which makes generating a mean average of sessions inviable.

### 1.6.6 Individual intervention

Nine of the interventions consisted of individual therapy, seven using DBT and two using CBT, which varied between length of 10-32 weeks, with Adrian, et al., (2019) reporting duration of intervention as 6 months, which is ambiguous and does not provide clarity or opportunity in generating a mean number of sessions across studies.

### 1.6.7 Environment

All but one study, Klim-Conforti, et al., (2021), reported sampling, recruitment and intervention to occur in clinical environments, e.g., inpatient, outpatient services, mental health facilities. Klim-Conforti, et al., (2021) recruited middle schoolers in Canada who self-reported suicidality. They trained educational staff to deliver CBT based curriculum (based on an adapted Harry Potter) within the school environment. Children who received CBT based curriculum, compared to those who received waitlist/no intervention, showed a reduction in suicidality, ED, interpersonal difficulties and mental health: anxiety and depression. This study shows promise in adapting clinical interventions, training non-clinical staff and delivering intervention in a non-clinical setting and achieving positive psychological outcomes. Replication of this study design within different cultures and school-based environments may further validate the findings and is a promising alternative to clinic-based interventions.

### 1.6.8 Treatment outcomes

All 15 studies reported positive outcomes following CBT or DBT intervention, compared to TAU, EUC, UC, waitlist/no intervention, and standard services, for reducing ED symptoms across their intervention, the consistency of reduced ED symptoms from engaging in an intervention (CBT/DBT) is promising for clinicians working with children and young people who experience ED across a varying degree of psychiatric and neurodevelopmental disorders. Although the studies provide consistent support for CBT and DBT in treating ED in children and young people, there are varying methodological designs across the studies, and it would be important for clinicians to appreciate the scope and limitations of each individual study when considering their treatment options for their patients.

### 1.6.9 Emotional dysregulation

Five of the studies included did not use a validated ED measure; Schuppert, et al., (2009), Perpletchikova, et al., (2017), Meyer, et al., (2022), Evans, et al., (2020), and Dibaj, et al., (2023). Without a validated measure of ED (such as: CGI-S or self-reported reduction in ADHD symptoms), due to complexity of the nature and presentation of ED, it is hard to know if the construct of ED and its symptoms are accurately captured, which dissolves the validity, regarding ED, of the studies for this review.

Six studies included did use a validated ED measure: Adrian, et al, (2019), Derella, et al., (2017), Goldstein, et al., (2023), Kennedy, et al., (2019), Scrapa & Reyes, (2011), Wood, et al, (2023). However, their control arms consisted of delayed treatment and an alternative psychotherapy e.g., CBT, which violated the criteria of eligibility for inclusion. Four studies reported pre- and post-intervention data that was measured with a validated ED measure; Afshari, et al., (2014), Goldstein, et al., (2015), Klim-Conforti, et al., (2021), and Stadler, et al., (2023), and were included within the meta-analysis.

### 1.6.10 Self-harm and suicidality

Five studies' primary outcome was self-harm and suicidality, with ED as a secondary outcome. Emotional dysregulation and suicidality have a positive association, although ED is not predictive of suicidal ideation and attempts. Turton, et al., (2021), found in their systematic review that targeting ED interventions alone would not be enough to reduce suicidal ideation and behaviour.

However, Adrian, et al., (2019), Dibaj, et al., (2023), Goldstein, et al., (2023), Klim-Conforti, et al., (2021) and Wood, et al., (2023) all provide support in treating self-harm and suicidality

through CBT or DBT interventions, IGST, EUC, waitlist/no intervention, and S & S (CBT), which has a positive effect in ED symptom reduction and reduction in severity of suicidal ideation and behaviours. The role of ED needs to be explored further through research to explore possible bidirectional associations and or moderating effect of treating ED within populations who experience self-harm and suicidal ideation.

## 1.7 Meta-analysis

Afshari, et al., (2014) reported two separate measures of ED for anger dysregulation and sadness dysregulation, following CBT-based intervention for children with separation anxiety disorder. The outcomes of both anger and sadness dysregulation represent key components of emotional dysregulation and share the difficulties in monitoring, modulating and responding appropriately to emotional experiences, highlighting their conceptual and theoretical alignment. Therefore, to maintain meta-analytical practice and maintain methodological integrity, a composite effect size for this study was calculated and is the representative effect size from Afshari, et al., in the meta-analysis.

The three studies included in the meta-analysis, Afshari, et al., (2014), Klim-Conforti, et al., (2021) and Stadler, et al., (2023) had their effect sizes calculated through pre- and post-intervention outcomes only. This decision was made to ensure the comparability of treatment effects across the trials was consistent and to avoid outcomes being derived from different time points, which may have been reflective of other psychological processes as contributors to the overall differences in treatment effects observed. For example, Afshari, et al., (2014) is the only study to include pre-post and pre-follow-up outcomes, combining or using the pre-follow-up outcomes within the meta-analytical model, would violate the assumptions of comparability, add heterogeneity and also misrepresent the result of the meta-analysis on a conceptual and theoretical basis significantly.

Additionally, within the Afshari, et al., (2014) reported conditions, Emotion-Centred Cognitive Behavioural Therapy (ECBT) was excluded from the quantitative synthesis, as ECBT represents a distinctly lesser established therapeutic approach, and deviates from standardised and manualised CBT protocols, which are a key feature of the other included studies. The inclusion of ECBT outcomes would compromise the interpretability of the pooled effect estimates due to the fundamental differences and theoretical orientation. For these reasons, only the CBT arm from Afshari, et al., was used within the meta-analysis.

Three studies (total participants, N = 591) were included in the multilevel random-effects meta-analysis. The studies investigated the effects of CBT-based interventions on emotional dysregulation in children and adolescents. The studies included participants with Separation Anxiety Disorder (n = 34, M = 10.57 years, SD = 2.28; Afshari, et al., 2014), adolescent girls

with Conduct/Oppositional Defiant Disorder (n = 127, M = 15.60 years, SD = 1.50; Stadler, et al., 2023) and a large sample of middle schoolers with self-reported suicidality (n = 430, aged 11-14 years; Klim-Conforti, et al., 2021).

A multilevel random-effects meta-analysis model was used to evaluate the overall effectiveness of CBT-based interventions on emotional dysregulation in children and adolescents with psychological, psychiatric and neurodevelopmental disorders. Overall, CBT-based interventions revealed a statistically significant small-to-moderate reduction in emotional dysregulation in the intervention groups compared to control groups (no treatment, treatment as usual, or waitlist) (Hedge's g = -0.43, SE = 0.10, 95% CI = [-0.63; -0.23], z = -4.27, p < .001)(See Figure 1.1).

Heterogeneity was not statistically significant (Q(2) = 1.29, p = .53), and the estimated between-study variance was $\tau^2 = 0$, which would suggest a consistent effect of CBT across the included studies. However, given the small number of studies included in the meta-analysis, the results should be interpreted with caution as there are clear limits in the power of the analysis to detect heterogeneity. It is also possible, that the absence of variability being detected also reflects insufficient statistical sensitivity, rather than a lack of between-study differences.

To visually assess any potential publication bias, a funnel plot was produced (See Figure 1.2). However, whilst some asymmetry is observed, the interpretation of this is limited due to the small number of included studies (n=3). The small number of studies invalidates the strength of the output, as standard guidelines require 10 studies or more to produce a reliable funnel plot asymmetry analysis (See Figure 2 and Figure 3).

## 1.8 Discussion

### 1.8.1 Interpretation of the results

We conducted a systematic review and meta-analysis to evaluate the effects of CBT and DBT on ED – measured using validated scales – in children and young people with psychiatric, psychological, and neurodevelopmental disorders. The narrative review examined a total of fifteen studies, with three studies being used in the meta-analysis with the key findings reporting CBT, compared to waitlist/no intervention, TAU, and no treatment, as effective interventions for reducing ED symptoms across multiple presentations. Our meta-analysis showed a small-to-medium-sized effect of CBT on reducing symptoms of ED in children and adolescents. Observations of the funnel plot suggest that some asymmetry is present, which may indicate potential publication bias. However, given the limited number of included studies

(n = 3), this observation should be interpreted with caution, as it may be due to chance rather than a true bias (Montori, Smieja, & Guyatt, 2000).

The meta-analysis results tentatively support the use of CBT for reducing ED symptoms in children and young people who experience ED across various psychiatric and neurodevelopmental disorders. The analysis results show support for using CBT modalities as an individual treatment and/or as an adjunct to pharmacological intervention, as recommended by NICE guidelines (NICE, 2024). However, as there are clear limitations within the study e.g., small sample size and methodical constraints, the strength of the analysis lies in the primary findings that CBT/DBT has been shown to reduce ED symptoms within the specific populations; which adds to the growing body of knowledge and evidence of treating ED as a transdiagnostic construct, can have positive results in terms of clinical outcomes.

### 1.8.2 Discussion of theoretical underpinnings

*How* CBT/DBT had their effects on ED is, however, unclear. Individuals' re-appraisal of thoughts, their distress tolerance to strong negative emotions and emotional experiences, and the development of positive adaptive coping strategies, through CBT and DBT, could be key factors that contribute to the reduction in ED symptoms (Dumornay, et al., 2022) (Reilly, et al., 2020). However, more research is required regarding the specific mechanisms underlying intervention-related changes in ED symptoms. Indeed, there is little reported about which factor(s) of CBT/DBT correlate(s) with reductions in ED symptoms, which makes it hard to distinguish what element of the therapeutic process influences change and what could be recommended as a focus/adaption towards CBT/DBT interventions. Trials evaluating the relationship between emotion regulation and cognitive and behavioural strategies are needed to understand the mechanisms of change and investigate what specific elements of each intervention (and combinations) promote improvements in emotion regulation and reductions in ED.

Individual and group-based CBT/DBT interventions, compared to waitlist/no intervention, TAU, UC, EUC, support reductions in ED symptoms. Research is needed to examine possible differences between different modalities for delivering the interventions. Within the studies included, there was no measure of therapeutic alliance, group dynamics or individual motivation to change, which are all consistently researched and implicated as positive factors that contribute to successful therapy outcomes (Taylor, Simic, & Schmidt, 2015). Future research accounting for these variables might contribute to developing tailored interventions which look at addressing and treating ED as a transdiagnostic construct.

The scarce number of studies included in our review did not allow us to compare the effects on ED of CBT to DBT. Linehan (1993) proposed that biological differences and invalidating environments, experienced in childhood, all create a dysfunctional emotional regulation

system, which is targeted by DBT (Linehan, 1993). While DBT and CBT are conceptually similar, DBT includes elements that CBT does not to address ED, such as mindfulness, distress tolerance increase, emotional regulation techniques, and interpersonal effectiveness, whereas CBT applies emotion regulation training and interpersonal effectiveness to address ED. While these components are all conducive and directed towards shaping how an individual regulates their emotions and navigate invalidating environments (Linehan, 1981; 1993; Panos, et al., 2014; Reilly, et al., 2020), it is unclear whether DBT is a more effective intervention for treating ED, compared to CBT. Furthermore, as therapy is an active and engaging cognitive process, it is difficult to discern how influential the individual and combined features of both cognitive and behavioural aspects are, for positively impacting ED. Exploration of the loading effect of cognitive and behavioural aspects of DBT within ED would help further the body of knowledge on applying this treatment protocol within clinical practice.

### 1.8.3 Limitations and future research

A standout limitation to the study was the exclusion of DBT-based interventions in the meta-analysis, due to methodological limitations. As only CBT-based interventions were included in the meta-analysis due to DBT trials not meeting the criteria for inclusion and there only being one eligible study, the pooled effect size reflects only CBT-based intervention outcomes and does not generalize to DBT approaches for treating ED in children and young people.

There are clear limitations of our study, including a small number of primary studies included in the review and meta-analyses, as well as a small overall sample size, which makes cross-cultural and transdiagnostic comparisons difficult. The small number of studies also limits the statistical power to detect heterogeneity or publication bias and does not allow for the generalisability of the findings. Future research exploring the mechanisms of change and factors implicated within CBT/DBT interventions, and their relationship with ED would be of benefit for clinical decision-making.

The small number of included studies also prevents any additional exploration of moderators such as sociodemographic factors and intervention duration. This means it remains unclear which populations or applications of CBT-based intervention are the most effective for reducing ED.

As Afshari et al., (2014) reported multiple outcomes, a composite effect size was calculated through averaging the effect estimates for Anger and Sadness Dysregulation. Whilst best practice, due to the absence of specific correlations, this estimated pooled variance introduces some estimation uncertainty which limits the confidence in reporting the statistical output and overall findings of the meta-analysis.

The systematic review was conducted following PRISMA guidelines and used the NHLBI quality assessment tool for RCT's, which accounted for the included control trails internal validity and efforts to reduce bias. There was no grey literature search, as the review focused on RCT's, which may have also contributed to the potential publication bias associated (Franco, Malhotra, & Simonovits, 2014). The reported results should be interpreted with caution following publication bias reporting; however, the protocol and outcomes of the review and analysis have been conducted soundly.

There was no inclusion of single gender-only designs, which may have been beneficial for shaping clinicians' decision-making in treating and understanding complex presentations across genders. This aspect provides limitations in the transdiagnostic treatment of ED across presentations.

Our study explored the effects of CBT/DBT on ED in children and young people compared to different control arms, including treatment as usual, waiting lists or no intervention. Moreover, we had to exclude several studies which did not compare CBT/DBT to a control arm.

Our findings highlight the need for future RCTs and rigorous studies exploring the effects of psychological interventions on different outcomes (including ED), which would certainly provide a greater depth of knowledge around ED as a transdiagnostic construct in children and young people with emotional challenges and neurodevelopmental disorders.

### 1.8.4 Applications to clinical practice

The findings of our meta-analysis offer a potential association between CBT-based intervention and improved ED scores as measured by a validated outcome measure, across diverse clinical populations including children with separation anxiety, adolescents with conduct problems, and youth with suicidality. The findings of the analysis support the use of CBT-based interventions as a transdiagnostic intervention for treating emotional dysregulation across significant psychiatric presentations.

However, the findings of the analysis should be viewed as preliminary and interpreted with caution. The difficulties with interpreting the observations around heterogeneity and asymmetry spark concerns regarding potential publication bias and the influence of differing factors within the studies included which all limit the validity and reliability of the findings.

The study does not fully capture the complexity of clinical settings and clinical work. Thus, clinicians should consider these results as part of a wider evidence base, which is maturing, and consider the findings in line with relevant clinical factors, previously established research base, and individual circumstances when applying the findings to their clinical work. Well-designed future studies are needed to validate these findings, which would inform clinical decision-making.

## 1.9 Conclusion

Our systematic review and meta-analysis are an up-to-date analysis of the effects of CBT/DBT on ED in children and young people with psychiatric and neurodevelopmental disorders. Our findings tentatively support preliminary evidence of CBT as a beneficial intervention for children and young people experiencing ED, as there is a reported reduction in ED symptoms through CBT interventions. However, the study findings must be considered within the limitations discussed and with much consideration to clinical applicability and utilization of the findings relevant to real-world clinical settings.

The study emphasises the need for further rigorous research to be established, which would allow for a better understanding of the underlying mechanisms that influence intervention-related changes in ED and other clinical outcomes.

## 1.10 Tables

**Table Effects of Cognitive Behaviour Therapy and Dialectical Behaviour Therapy on Emotional Dysregulation in Children and Adolescents with Psychiatric Disorders: A Systematic Review and Meta-Analysis.1 Summary of studies included in the systematic review.**

| First Author, Year | Sample characteristics | Intervention | Control | Emotion Dysregulation Measure | Main Findings |
|---|---|---|---|---|---|
| Adrian, 2019 | Adolescents with borderline personality disorder characteristics and clinically significant suicidal ideation.<br>N= 173, Mage= 14.89, SD= 1.47 years | DBT (n= 86)<br>6 months of individual treatment | IGST (n= 87)<br>6 months of treatment | DERS | DBT treatment was found to be more beneficial for individuals with higher levels of family conflict, externalising of problems and self-harm behaviours. DBT was more beneficial for individuals with higher levels of emotional dysregulation and parent psychopathology. |
| Afshari, 2014 | Children diagnosed with | ECBT (n= 10) | No treatment (n=10) | CEMS | ECBT can be an effective |

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| | separation anxiety disorder.<br>N= 30, Mage= 10.57, SD= 2.27 years | 12 weekly sessions<br><br>CBT (Coping Cat, n=10)<br><br>10 weekly sessions | | | treatment for children diagnosed with separation anxiety, as the modality focuses on difficulty in managing the negative emotions rather than their anxious presentation. Low numbers within the study, makes the findings hard to generalise and further research is needed to distinguish the difference in ECBT and CBT in having significant effect on SAD children. |
| Derella, 2017 | Pre-adolescent boys who demonstrate clinically significant rates of conduct problems.<br>N= 252, Age range= 6 to 11 years | CBT (SNAP) (n= 130)<br><br>3 months of weekly small group sessions | Standard Services (n= 122)<br><br>3 months | SCS | The study explored secondary RCT data and found that SNAP intervention improved emotion regulation skills function, whilst also reducing irritability |

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| | | | | | symptoms. This analysis provides support for using CBT based treatments for pre-adolescent boys with CD/ODD to target irritability symptom reduction. |
| Dibaj, 2023 | Adolescents with borderline traits.<br>N=77, Mage= 15.9, SD= 1.4 years | DBT-A (n=39)<br>19 weekly sessions | EUC (n=38)<br>19 weekly sessions | No validated ED measure reported | DBT-A predicts more favourable outcomes for adolescents with borderline traits, with a reported reduction in self-harm and improved emotion regulation. |
| Evans, 2020 | Youth with severe irritability mood disorder.<br>N= 174, Mage= 10.6, SD= 1.8 years | MATCH (CBT) (n= 62)<br>16 fortnightly sessions | UC (n= 53)<br>SMT (n= 59)<br>16 fortnightly sessions | No validated ED measure reported | MATCH (CBT) are supportive interventions options for treating SIMD. In treating SIMD in youths with mood dysregulation, MATCH may add an additional advantage in treatment |

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| | | | | | options. |
| Goldstein, 2015 | Adolescents diagnosed with bipolar disorder.<br>N= 20, Mage= 15.82, SD= 2.1 years | DBT (n=14)<br>36 sessions (18 individual, 18 family skills training) | TAU (n=6)<br>1 year period | CALS-C<br>CALS-P | DBT associated with greater treatment engagement and accepted as feasible to adolescents with BP and their families. DBT showed reduced in ED symptoms and depressive symptoms over follow up. DBT promising adjunct to pharmacotherapy for individuals who exhibit suicidality, self-injury and ED. |
| Goldstein, 2023 | Adolescents with Bipolar Disorder.<br>N= 100 | DBT (n= 47)<br>36 sessions over 1 year | SOC psychotherapy (n=53)<br>Schedule clinically determined for each participant. | DERS | DBT demonstrated efficacy in decreasing suicide attempts among the high-risk population of adolescents with bipolar spectrum disorder and was mediated |

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| | | | | | through improvement in emotional dysregulation skills. Individuals who displayed high baseline emotion dysregulation, benefited further from DBT as an intervention. |
| Kennedy, 2019 | Children with primary anxiety disorder.<br>N= 47, Age range= 7 to 13 years | UP-C (n= 24)<br>15 Weekly group sessions | Cool Kids (n= 23)<br>10 Family sessions | CEMS<br>ERQ-CA | UP-C observed to be efficacious in treating anxiety and producing gains in emotion reactivity and regulation skills. Sadness dysregulation responded favourable to UP-C. |
| Klim-Conforti, 2021 | Middle-schoolers with self-reported suicidality.<br>N= 430, Age range= 11 to 14 years | CBT (n= 200)<br>3-month curriculum | Wait List/No intervention. (n=230)<br>3 months | LPI | The Harry Potter based CBT curriculum demonstrated improvement in suicidality, emotional dysregulation, interpersonal difficulties and mental health: |

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| | | | | | anxiety and depression in middle-school population. Further larger studies need to replicate to validate the findings further. |
| Meyer, 2022 | Adolescents with diagnosed ADHD.<br>N= 128, Age range= 15 to 18 years | SSTG (DBT) (n= 71)<br>14 weekly sessions | SKILLS (psychoeducation about ADHD (n= 57) | No validated Ed measure reported | SSTG appears beneficial for adolescents with ADHD who perceive their difficulties as significant, namely: hyperactivity/impulsivity, conduct problems and emotional dysregulation. These three outcomes have a moderating effect on their self-reported ADHD symptoms. |
| Perepletchikova, 2017 | Children with Disruptive Mood Dysregulation Disorder.<br>N= 43, Mage= 9.19, SD= 1.86 years | DBT-C (n= 21)<br>32 weekly sessions | TAU (n= 22)<br>32 weekly sessions | No validated ED measure reported | DBT-C demonstrated feasibility and preliminary efficacy for children with DMDD. DBT-C compared to TAU highlighted |

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| | | | | | positive improvements on Clinical Global Impression Scale-Severity (CGI-S) over treatment. However, further research is needed to validate the findings. |
| Schuppert, 2009 | Adolescents with symptoms of borderline personality disorder and emotional dysregulation. N= 63, Age range= 14 to 19 years | ERT (n= 43)<br><br>19 weekly sessions | TAU (n= 23)<br><br>19 weekly sessions | No validated ED measure reported | The findings of the study are complicated to interpret due to the high attrition rate throughout, resulting in less powerful results. ERT can be implemented as an adjunctive intervention in a stepped care model for treating BPD symptoms in adolescents, however, there isn't significant evidence to support this. |
| Scarpa, 2011 | Children with high functioning autism | CBT (n=5) | Delayed treatment (n=6) | ERC | Study highlights improvement in emotion |

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| | spectrum disorder.<br>N= 11, Age range= 5 to 7 | 9 weekly group sessions | 9 weekly group session | | regulation and decreasing behavioural outbursts, mood intensity and an increase in mood regulation. CBT groups can be a positive treatment young child with high functioning ASD for reducing ED symptoms. Further research is needed to validate the findings. |
| Stadler, 2023 | Adolescent girls with conduct or oppositional defiant disorder.<br>N= 127 | START NOW (n= 72)<br>12 weekly group sessions and 12 individual sessions | TAU (n= 55)<br>TAU across 12 weeks | DERS | START NOW for female youths with CD or ODD within mental health institutions, did not show difference in CD/ODD symptoms compared to TAU from baseline to post treatment, but there was a clinically meaningful delayed treatment effect on |

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| | | | | | aggression, irritability and emotional dysregulation. |
| Wood, 2023 | Self-Harming and suicidal youth.<br>N= 22, Age range= 16 to 18 years | DBT-A (n= 13)<br>21-24 weekly group sessions | CBT (S&S) (n= 9)<br>10 weekly group sessions | DERS-SF | Group-based interventions display potential in reducing severity of emotional dysregulation difficulties for youth who self-harm, have suicidal ideation, and display traits of borderline personality disorder. |

*Note*: Children's Affective Lability Scale, Child Self-Report (CALS-C), Children's Affective Lability Scale, Parent Report (CALS-P), Children's Emotion Management Scales (CEMS), Clinical Global Impression Scale (CGI-S), Cognitive Behavioural Therapy (CBT), Dialectical Behavioural Therapy (DBT), Difficulties in Emotion Regulation Scale (DERS), Disorder of Emotion Regulation Scale-Short Form (DERS-SF) Disorder of Emotion Regulation Scale-Short Form (DERS-SF), Emotion Regulation Checklist (ERC), Emotion Regulation Questionnaire for Children and Adolescents (ERQ-CA), Enhanced Usual Care (EUC), Individual/Group Supportive Therapy (IGST), Life Problems Inventory (LPI), Modular, Transdiagnostic, Behavioural/Cognitive Behavioural Intervention (MATCH), Social Competence Scale-Parent Version (SCS), Standardised Manualised Treatment (SMT), Stop Now And Plan (SNAP), Treatment as Usual (TAU), Usual Care (UC).

**Table Effects of Cognitive Behaviour Therapy and Dialectical Behaviour Therapy on Emotional Dysregulation in Children and Adolescents with Psychiatric Disorders: A Systematic Review and Meta-Analysis.2 National Heart, Lung and Blood Institute (NHLBI) quality assessment tool for controlled trials**

| Study | Adrian 2019 | Afshari 2014 | Derella 2019 | Dibaj 2023 | Evans 2020 | Goldstein 2015 | Goldstein 2023 | Kennedy 2019 | Klim-Conforti 2021 | Meyer 2022 | Perepletchikova 2017 | Scarpa 2011 | Schuppert 2009 | Stadler 2023 | Wood 2023 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Randomized? | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | CD | Yes | Yes | Yes |
| Randomization method adequate? | CD | NR | Yes | NR | Yes | CD | Yes | CD | CD | NR | NR | NR | NR | Yes | NR |
| Treatment allocation concealed? | NR | No | NR | NR | NR | NR | Yes | NR | NR | NR | NR | No | NR | NR | NR |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Participants blinded? | No | No | No | No | No | No | No | No | No | No | No | No | No | No | No |
| Outcome assessors blinded? | Yes | NR | NR | NR | Yes | NR | Yes | NR | NR | NR | NR | NR | NR | NR | NR |
| Groups similar at baseline? | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Dropout rate <20%? | Yes | Yes | Yes | CD | Yes | CD | Yes | CD | Yes | CD | Yes | Yes | No | Yes | CD |
| Differential dropout rate | Yes | Yes | Yes | CD | Yes | CD | Yes | CD | Yes | CD | Yes | Yes | CD | Yes | CD |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| <15%? | | | | | | | | | | | | | | | |
| Adherence to interventi on protocols ? | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Other interventi ons avoided or similar? | | | | | | | | | | | | | | | |
| Prespecif ied outcome s clearly defined? | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Outcome | Yes | Yes | Yes | No | No | Yes | Yes | Yes | No | No | No | Yes | CD | Yes | Yes |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| measures valid/reliable? | | | | | | | | | | | | | | | |
| Outcome assessors blinded (again)? | Yes | NR | NR | NR | Yes | NR | Yes | NR | NR | NR | NR | NR | NR | NR | NR |
| Sample size sufficient? | Yes | No | Yes | No | Yes | No | Yes | No | Yes | Yes | No | No | No | Yes | N0 |
| Overall quality rating | Good | Fair | Fair | Fair | Good | Fair | Good | Fair | Good | Poor | Fair | Poor | Poor | Good | Fair |

Scoring criteria: Yes, No, Cannot Determine (CD), Not Reported (NR), Not Applicable (NA).
Scoring Approach: There are no formal numerical scores, instead reviewers agree upon a global judgement rating based on the number and seriousness of limitations and the risk of bias in each domain.
Overall Quality Ratings
Good: Few or no risks of bias; study results are considered valid
Fair: Some risk of bias; not enough to invalidate the results, but caution is needed.

Poor: Significant risk of bias that may seriously affect the validity of the results

**Table Effects of Cognitive Behaviour Therapy and Dialectical Behaviour Therapy on Emotional Dysregulation in Children and Adolescents with Psychiatric Disorders: A Systematic Review and Meta-Analysis.3 PRISMA Checklist**

| Section and Topic | Item # | Checklist item | Location where item is reported |
|---|---|---|---|
| **TITLE** | | | |
| Title | 1 | Identify the report as a systematic review. | |
| **ABSTRACT** | | | |
| Abstract | 2 | See the PRISMA 2020 for Abstracts checklist. | |
| **INTRODUCTION** | | | |
| Rationale | 3 | Describe the rationale for the review in the context of existing knowledge. | |
| Objectives | 4 | Provide an explicit statement of the objective(s) or question(s) the review addresses. | |
| **METHODS** | | | |
| Eligibility | 5 | Specify the inclusion and exclusion criteria for the review and how studies were grouped for | |

| Section and Topic | Item # | Checklist item | Location where item is reported |
|---|---|---|---|
| criteria | | the syntheses. | |
| Information sources | 6 | Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted. | |
| Search strategy | 7 | Present the full search strategies for all databases, registers and websites, including any filters and limits used. | |
| Selection process | 8 | Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process. | |
| Data collection process | 9 | Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process. | |

| Section and Topic | Item # | Checklist item | Location where item is reported |
|---|---|---|---|
| Data items | 10a | List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect. | |
| | 10b | List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information. | |
| Study risk of bias assessment | 11 | Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process. | |
| Effect measures | 12 | Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results. | |
| Synthesis | 13a | Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups | |

| Section and Topic | Item # | Checklist item | Location where item is reported |
|---|---|---|---|
| methods | | for each synthesis (item #5)). | |
| | 13b | Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions. | |
| | 13c | Describe any methods used to tabulate or visually display results of individual studies and syntheses. | |
| | 13d | Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used. | |
| | 13e | Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression). | |
| | 13f | Describe any sensitivity analyses conducted to assess robustness of the synthesized results. | |
| Reporting bias | 14 | Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases). | |

| Section and Topic | Item # | Checklist item | Location where item is reported |
|---|---|---|---|
| assessment | | | |
| Certainty assessment | 15 | Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome. | |
| **RESULTS** | | | |
| Study selection | 16a | Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram. | |
| | 16b | Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded. | |
| Study characteristics | 17 | Cite each included study and present its characteristics. | |
| Risk of bias | 18 | Present assessments of risk of bias for each included study. | |

| Section and Topic | Item # | Checklist item | Location where item is reported |
|---|---|---|---|
| in studies | | | |
| Results of individual studies | 19 | For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots. | |
| Results of syntheses | 20a | For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies. | |
| | 20b | Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect. | |
| | 20c | Present results of all investigations of possible causes of heterogeneity among study results. | |
| | 20d | Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results. | |
| Reporting | 21 | Present assessments of risk of bias due to missing results (arising from reporting biases) for | |

| Section and Topic | Item # | Checklist item | Location where item is reported |
|---|---|---|---|
| biases | | each synthesis assessed. | |
| Certainty of evidence | 22 | Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed. | |
| **DISCUSSION** | | | |
| Discussion | 23a | Provide a general interpretation of the results in the context of other evidence. | |
| | 23b | Discuss any limitations of the evidence included in the review. | |
| | 23c | Discuss any limitations of the review processes used. | |
| | 23d | Discuss implications of the results for practice, policy, and future research. | |
| **OTHER INFORMATION** | | | |
| Registration and protocol | 24a | Provide registration information for the review, including register name and registration number, or state that the review was not registered. | |
| | 24b | Indicate where the review protocol can be accessed, or state that a protocol was not | |

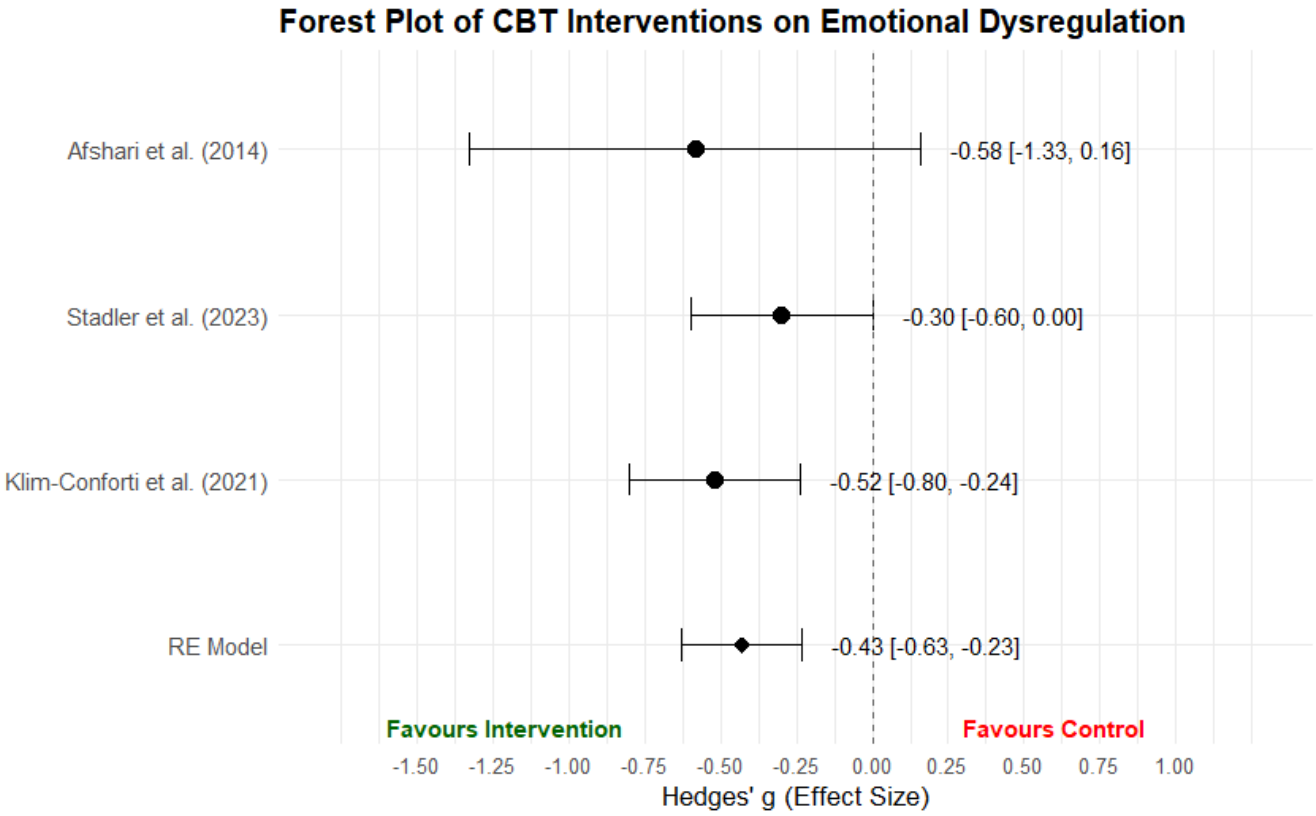
| Section and Topic | Item # | Checklist item | Location where item is reported |
|---|---|---|---|
| | | **prepared.** | |
| | **24c** | **Describe and explain any amendments to information provided at registration or in the protocol.** | |
| **Support** | **25** | **Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.** | |
| **Competing interests** | **26** | **Declare any competing interests of review authors.** | |
| **Availability of data, code and other materials** | **27** | **Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.** | |

# 1.11 Figures

## 1.11.1 Forest Plot

Forest plot of individual and overall effect sizes for studies evaluating CBT interventions on emotional dysregulation in children and young people with diagnosed psychological, psychiatric and neurodevelopmental disorders. The overall random-effects estimate was Hedges' g = -0.43 (95% CI = [-0.63; -0.23]).

**.1 Forest Plot of CBT Interventions on Emotional Dysregulation**




Key:

Afshari (CEMS AD/SD) = Children's Emotion Management Scales (CEMS), Anger Dysregulation Subscale (AD), Sadness Dysregulation. Composite Score

Stadler (DERS) = Difficulties in Emotion Regulation Scale (DERS)

Klim-Conforti = Life Problems Inventory (LPI) Emotional Dysregulation Subscale (ED)

### 1.11.2 Funnel Plot

Funnel Plot assessing publication bias for studies investigating the effects of CBT on emotional dysregulation in children and young people with diagnosed psychological, psychiatric and neurodevelopmental disorders.

### .2 Funnel Plot of CBT Interventions on Emotional Dysregulation

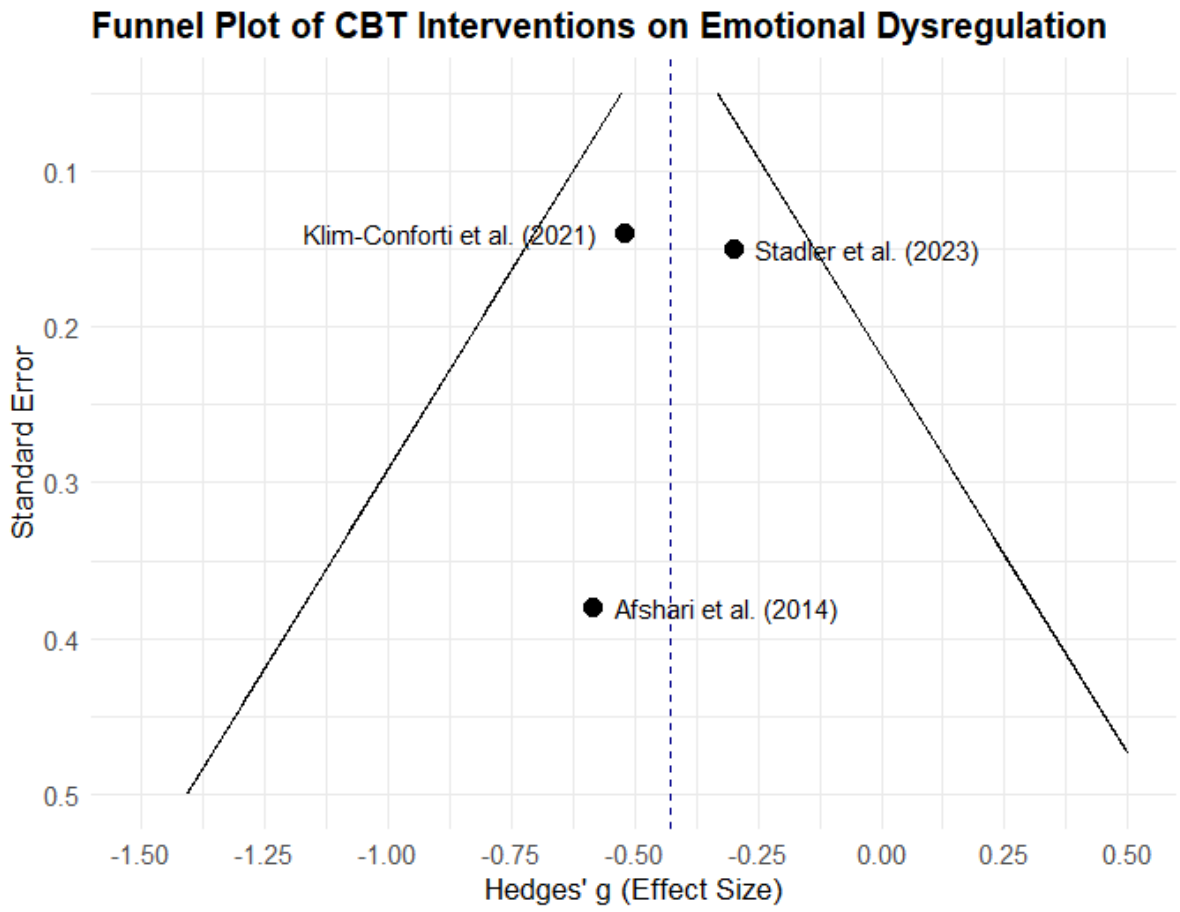
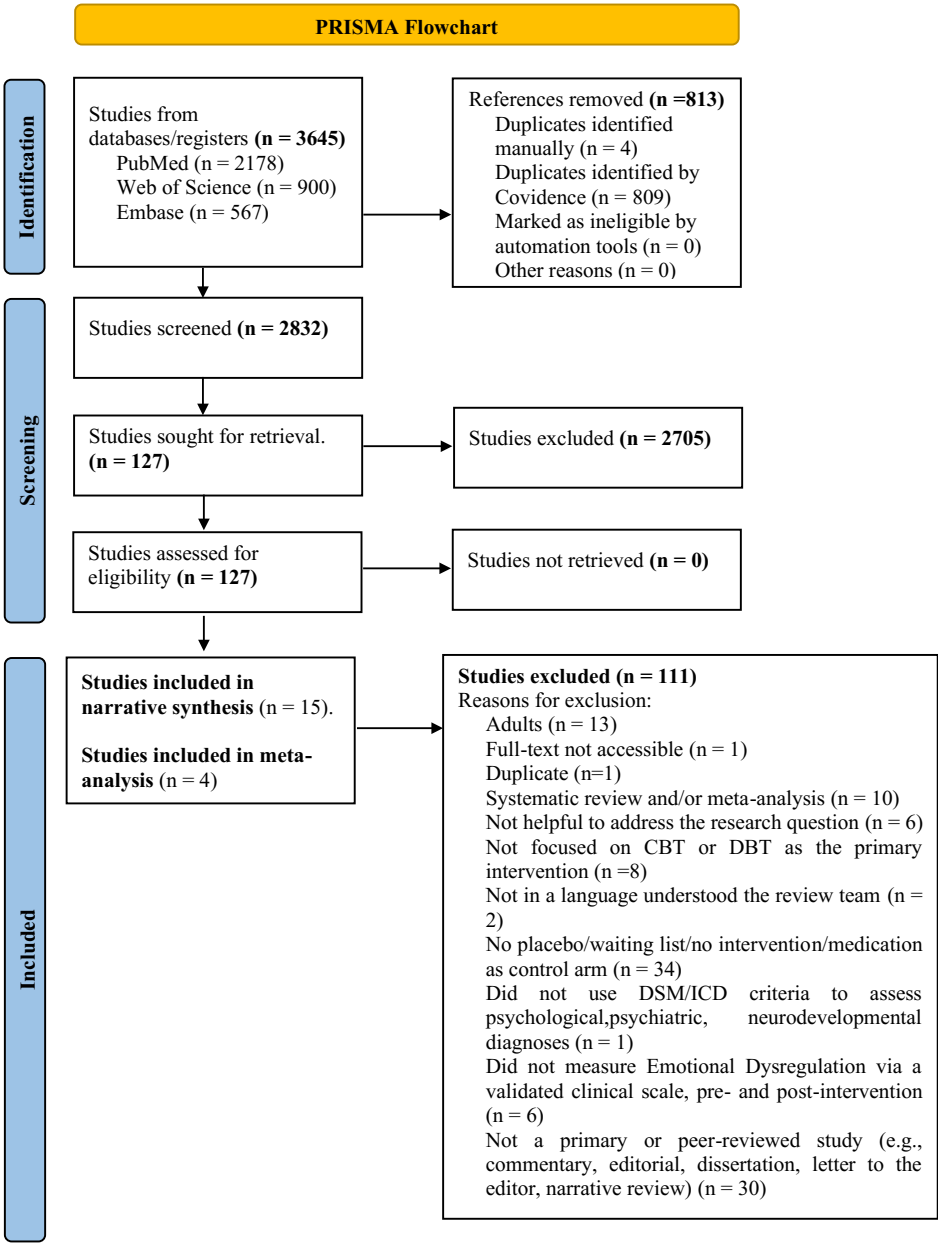


**Figure Effects of Cognitive Behaviour Therapy and Dialectical Behaviour Therapy on Emotional Dysregulation in Children and Adolescents with Psychiatric Disorders: A Systematic Review and Meta-Analysis.3 PRISMA Flowchart**

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# Chapter 2 The Effects of Exposure to Paternal Anxiety on Offspring

## 2.1 Abstract

Objective

Anxiety in fathers during the perinatal period is associated with an increased risk of emotional and behavioural problems in their offspring, particularly males. The aim of the study was to examine differential effects of exposure to paternal anxiety on children's psychological functioning and development, comparing non-anxious and anxious paternal groups.

Methods

In a longitudinal population cohort study (the Avon Longitudinal Study of Parents and Children (ALSPAC)) we examined the associations of exposure to paternal anxiety and no exposure to paternal anxiety in children, and later behavioural/emotional and psychiatric problems in their children, assessed at ages 42- and 91-months.

Results

Children who were exposed to paternal anxiety had the highest risk of psychopathology trajectory, measured by emotional and behavioural outcomes at 42-months. Male children had higher risk of developing emotional problems (OR:6.45, 95% CI: 5.25 – 7.91, $p < 0.001$), and females had higher risk of developing behavioural problems (OR: 4.10, 95% CI: 3.15 – 5.33, $p < 0.001$). The associations change little when controlling for confounding variables: sociodemographic, child temperament, maternal and paternal mental health.

Conclusion

The findings of the study suggest male and female children both appeared to have significant associations with paternal anxiety, and there was variety in gender, with male's more at risk to emotional problems and females with behavioural problems. The output of this study provides clear evidence regarding the importance of perinatal mental health interventions for fathers, as well as mothers.

Keywords: Anxiety, child behavioural problems, child emotional problems, perinatal, fathers, ALSPAC.

Word Count: 4,100 (excluding Table 1 & 2)

## 2.2 Introduction

The interaction and transmission of paternal anxiety to children have been established within multiple theoretical frameworks. Bandura's (1977) social learning theory suggests that children learn, and display behaviours based on observation of their parent's behaviour in different situations and contexts, primarily through imitation. If a parent displays anxious behaviours, then these behaviours are modelled by their children, which can lead to the establishment and manifestation of anxiety and/or emotional and behavioural problems.

Bowlby's (1969) attachment theory stresses the importance of parent-child interactions in how a child develop their internalisation and sense of self and how they make sense of relationships and understand others, who make up their social world. Through their interactions, an anxious parent may display behaviours and attitudes towards caregiving that could be linked to an insecure attachment style, which is associated with a greater vulnerability to anxiety and emotional and behavioural problems.

Bogels and Perotti (2011) posited an intergenerational transmission model that addresses both environmental and genetic predispositions as factors that contribute to the transmission of anxiety from parent to child. A parent's predisposition to anxiety and environmental features such as caregiving, expression of emotion, and maintenance and formation of relationships would all be located within the intergenerational transmission model and would have substantiated effects on the origin of a child's propensity towards anxiety and emotional and behavioural problems.

Within adult male populations in Western societies, Anxiety Disorders (AD) are highly prevalent and have a significant impact on adaptive behaviour and emotional wellbeing; with the effects being disabling to the individual and their system (Craske, et al., 2017). Adult male parents have a prominent role in rearing offspring; their role within a family unit can be pivotal and contribute to general offspring development, and specifically, the development of offspring AD (Bogels & Phares, 2008).

In the UK, the prevalence of mental disorders in children and young people had a stark rise over the past decade. In 2023, 1 in 5 children and young people aged 8-25 years old had a probable mental disorder, with 20.3% being attributed towards children aged 8 to 16 years old (Newlove-Delgado, et al., 2023). Socioeconomic factors, such as maternal postpartum depression and low economic social status have been identified as a risk factors for internalising and externalising problems within children, which can lead to the optimisation of persistent and enduring mental health difficulties for children and young people (Clement, et al., 2024).

Lawrence, Murayama, & Creswell (2019) found in their meta-analysis of AD in offspring of parents with AD, that parental AD poses risk of development and co-occurring ADs for offspring. Crucially, studies of mothers with anxiety disorders comprise the largest portion of evidence exploring the role of parental AD and risk to offspring and show a positive association of offspring emotional and behavioural difficulties with maternal mental health problems (Rogers, et al., 2020). Less attention has been placed on exploring paternal mental health problems and their association with offspring emotional and behavioural difficulties.

Moller, Majdandzic, & Bogels (2015) explored paternal and maternal anxiety and behaviours and infant anxiety, and found that paternal behaviour, namely overinvolvement, was positively associated with infant anxiety, highlighting the role of paternal behaviours in the origins of AD in offspring. In a meta-analysis of paternal anxiety disorders and offspring development, Zecchinato, Ahmadzadeh, Kreppner, & Lawrence (2024) found offspring of anxious fathers, compared to offspring of non-anxious fathers, are at an increased risk of negative emotional and behavioural outcomes, both attributed to environmental and genetic factors.

Parental perinatal mental health has been established as an important risk factor for offspring psychological development (Stein et al., 2014). As at other times later in development, much of this research has focused on mothers' perinatal mental health; both perinatal depression (e.g., Stein et al., 2018), and perinatal anxiety (e.g., Lawrence et al., 2020; Murray et al., 2008). Perinatally, the importance of paternal *depression* has been examined, and Ramchandani et al. (2006) found that children whose fathers experienced perinatal depression, compared to infants whose fathers did not, were at risk of adverse emotional and behavioural outcomes at 42 months, and more likely to have a psychiatric disorder at 91 months.

The importance of paternal perinatal anxiety for offspring development has, to our knowledge, not been reported in the literature. There is a growing body of evidence exploring the importance of paternal AD for offspring development and manifestation of AD (Clement, et al., 2024), but the phenomena are still under-researched. To our knowledge, while the role of maternal perinatal anxiety in offspring development has been examined, this has not been examined in fathers. The objective of this study is to examine differences in psychological outcomes in two groups of children – those whose fathers experienced perinatal anxiety and those whose fathers did not.

## 2.3 Methods

The Avon Longitudinal Study of Parents and Children (ALSPAC) (Golding, Pembrey, & Jones, 2001) is a large, population-based, longitudinal study located within the city of Bristol, UK and is a world-leading birth cohort study. From April 1991 to December 1992, 14,000 pregnant women were recruited into the study, some of whom had had single and multiple births during

the recruitment period. The children and their parents were followed up extensively over a two-decade period and make up the sample used within this study.

The initial sample consisted of 14,541 pregnant women and questionnaires were sent to both mothers and fathers during and after their pregnancy; of the 13, 586 responding to the first questionnaire, 13,228 had partners. The mean age of fathers was 28.8 years (SD= 9.75) with 96% being white in ethnic origin. 18.2% of fathers were educated to degree level and 55.5% had at least one other child in the household (Ramchandani, et al., 2008).

Data was requested and obtained following the procedures detailed on the ALSPAC website (https://www.bristol.ac.uk/alspac/researchers/access/).

The project proposal was registered and is accessible on the ALSPAC proposals database https://proposals.epi.bristol.ac.uk/?q=proposalSummaries

All participants provided informed consent, and ethical approval was obtained from the ALSPAC Law and Ethics Committee and The University of Southampton Research Governance and Ethics Committee for this project.

### 2.3.1 Paternal anxiety

Fathers' anxiety was measured at 18 weeks gestation and at 8 weeks postnatal, using the 8-item anxiety subscale of the Crown-Crisp Experiential Index (CCEI). The CCEI is a well-validated and widely used self-report measure of psychoneurotic illness and was used to assess symptoms of anxiety (Crown & Crisp, 1970; Golding, Pembrey, & Jones, 2001). The sample provided ALSPAC pro-rated test scores for missing items, unless all items were missing and considered a cut-off of ≥8 was used to identify the top 15% of scorers to define high anxiety levels of ADs (Capron, et al., 2015).

The individuals who scored below the top 15% mark were classified as the non-anxious group within this study and the individuals who scored within the top 15% at pre-, post-natal or both were defined as the anxious group.

### 2.3.2 Offspring outcomes

The primary outcomes of the secondary analysis of a longitudinal data set (ALSPAC) were child mental health problems at 42 and 91 months. Offspring emotional and behavioural outcomes at 42 months were assessed with the Revised Rutter Parent Scale for Preschool Children (RRPSPC), maternal reporting (Elander & Rutter, 1996). Items from the RRPSPC combine and measure three problem scales: emotional problems, conduct problems and hyperactivity, and a prosocial behaviours scale. All problem scales combine to provide a total

problem scale. We used a cut-off of the top 10% of scorers to define high scorers in the sample (Ramchandani, et al., 2008).

The RRPSPC does not provide individual subscale scores, in this study we replicated using a cut-off score of the top 10% of scores on the emotional problems scale to define high scorers, as this cut-off has been used in previous research (Plomin, Price, Eley, Dale, & Stevenson, 2002). The top 10% of scores on the emotional problems scale represent higher levels of dysfunction and greater clinical significance.

At 91 months, parents and teachers completed the Development and Well-Being Assessment (DAWBA) questionnaire to assess emotional and behavioural psychiatric outcomes (Goodman, Ford, Richards, Gatward, & Meltzer, 2000). The DAWBA requires parents and teachers to provide details of the nature and impact on functioning of their child's psychiatric symptoms. The information is then computed from the two sources and provides a likely diagnosis based on the relevant information, where appropriate, by experienced clinician raters following DSM-IV guidelines (Ford, Goodman, & Meltzer, 2003). Within our study, we will report if children met the diagnostic criteria and classification from the DAWBA assessment tool, which assess anxiety and behavioural disorders.

### 2.3.3 Confounding factors

### 2.3.4 Paternal and maternal mental health

Information regarding paternal and maternal self-reported current and historical mental illness was also included.

At 18-weeks' gestation and at 8-weeks postnatally mothers' anxiety was measured using the CCEI, and at 73-months for both parents. We also included a history of severe depression and or other psychiatric disorders/problems were self-reported (yes/no) at 12-weeks' gestation for both mothers and fathers.

Depression was measured using the Edinburgh Postnatal Depression Scale, a self-reported 10 item questionnaire that identifies patients at risk for perinatal depression (Cox, Holden, & Sagovsky, 1987), at 18-weeks' gestation, 8-weeks postnatally, and 73 months for both parents; using a cut-off score of >12 to identify high depression (Cox et al., 1987).

Accounting for both maternal and paternal mental health, we aimed to reduce the influence of shared genetic factors that could have influenced the relationship between paternal anxiety and offspring outcomes. The inclusion of both variables allows for stronger assumptions that associations can be attributed to paternal anxiety rather than broader interactions of family history of mental health.

### 2.3.5 Sociodemographic variables

Information was obtained regarding the following potential confounding variables: 1) Father's age at the time of child's birth, 2) Number of children in the family at the time of the child's birth, 3) Paternal education level, 4) Father's ethnicity, 5) Social class status, 6) Marital status.

The sociodemographic variables included can all influence child development and parental anxiety. The sociodemographic factors can all be stressors and can contribute to paternal anxiety levels being increased, whilst also affecting the child's environment, which increases the risk of emotional and behavioural problems. Controlling for these factors within the study reduces the likelihood of the observed association's origins being underlying social or economic disadvantages.

### 2.3.6 Offspring temperament

Information was included of assessed child temperament scores, obtained using the Carey Infant Temperament Scale (CTS), a measure which includes 88-items and 9 separate subscales (activity, approach, adaptability, distractibility, intensity, mood, persistence, and threshold scale) (Carey & McDevitt, 1978), which was completed by the mother of the child at 24-months.

Offspring temperament was included as a confounder due to the differences in temperament such as difficulty in emotional regulation, and as these differences can predispose children to emotional and behavioural problems. A child's temperament can also influence parental anxiety through a bidirectional association. In adjusting the models for temperament, we hoped to separate the effect of paternal anxiety from offspring predispositions.

### 2.3.7 Sub-groups

The sub-group analyses are for boys and girls separately at both 42- and 91 months to explore gender differences in offspring. A separate analysis is to be conducted for only those whose biological father living at home at 36-months to explore and prevent stepfather compounds.

### 2.3.8 Data analysis

The analysis was completed in six stages:

The sample was separated into two groups by paternal anxiety status: no perinatal anxiety at any time point (group 1) and anxiety at any time (whether pre-natal/post-natal or both) (group

2). The two groups were then compared on a range of sociodemographic variables, which may have contributed as potential confounding variables: 1) Father's age at the time of child's birth, 2) Number of children in the family at the time of the child's birth, 3) Paternal education level, 4) Father's ethnicity, 5) Social class status, 6) Marital status, 7) past history of severe (self-reported) depression (yes/no response).

Binary logistic regression models were used, with a series of planned contrasts to evaluate any effects on children who were exposed to paternal anxiety within the peri-natal periods. The top 10% of scorers of emotional and behavioural symptoms in children aged 42-months, measured using the RRPSPC, in the first series of contrasts, were the "high" levels. We then contrasted risk in the using the non-anxious group as the reference group and completed planned analysis comparing the anxious group to the non-anxious group, which examined the specificity of contrasts outlined in the design.

We then repeated the same analyses controlling for any potential confounding effect of child temperament, maternal anxiety and depression and paternal depression (EPDS score >12) in the peri-natal period. We also controlled for any covariates which may have differed between the anxious and non-anxious group ((1) Father's age at the time of child's birth, 2) Number of children in the family at the time of the child's birth, 3) Paternal education level, 4) Father's ethnicity, 5) Social class status, 6) Marital status, 7) past history of severe (self-reported) depression (yes/no response)).

The analyses for Rutter Scale scores were repeated for boys and girls separately.

The analyses were repeated excluding families whose biological father was no longer living with the family, to alleviate any stepfather confounds.

The same analyses were repeated using psychiatric status of children at age 91-months, using the DAWBA questionnaire as the outcome measure, which examined the persistence and developmental importance of any association. Including the confounding variables mentioned.

### 2.3.9 Statistical analysis

Details of the steps followed to perform binary logistic regression, unadjusted and adjusted models 1-4 for the emotional and behavioural outcomes at 42 months and the anxiety and behavioural disorders at 91-months are reported in (Supplement 1).

Listwise deletion was the method applied to account for and handling missing data within the dataset. Any records that were missing values within the variables being analysed were removed to promote accuracy and consistency across the data and reduce bias of the results (Graham, 2009). By utilising listwise deletion the data also fit the assumptions of the regression

models applied, which improved the integrity of the model and the outcomes (Little & Rubin, 2002).

## 2.4 Results

Descriptive statistic of sociodemographic factors for the 1,945 participants (n=1,519 non-anxious paternal group and n=425 anxious paternal group) are provide in Table 1. Paternal average age at the child's birth was similar between groups, the non-anxious group reported a mean age of 32.98 (SD = 5.23) and compared to the anxious group's mean age 32.68 (SD = 5.29). The number of children in the family was similar between the groups, with a mean of 0.86 (SD = 0.94) for the non-anxious group and 0.89 (SD = 0.97) for the anxious group. A greater percentage of fathers in the non-anxious group had a degree (36.28%) compared to the anxious group (33.73%), and most participants across both groups were White in their ethnic origins (non-anxious: 91.69%, anxious: 91.94%). A larger percentage of the non-anxious group were married (82.02%) compared to the anxious group (80.00%). A past history of depression was more common in the anxious group (8.21%) compared to the non-anxious group (2.04%).

### 2.4.1 Paternal anxiety and child emotional and behavioural problems at 42-months

Results presented in Table 2, show the association between paternal anxiety and child emotional and behavioural problems at 42 months, measured by Rutter scores. In unadjusted models, children of anxious fathers had significantly higher odds of displaying emotional problems (OR = 1.72, 95% CI: 1.17 – 2.52, p = 0.006) compared to the children of non-anxious fathers. However, the behavioural problems measured at 42 months via the Rutters score, showed no statistical significance (OR = 1.31, 95% CI: 0.96 – 1.79, p = 0.087).

In adjusted models, controlling for sociodemographic variables (Model 1), child temperament (Model 2), maternal mental health (Model 3), and both maternal and paternal mental health (Model 4), the association between paternal anxiety and child emotional problems retained significance in the first two models (Model 1: OR = 1.65, 95% CI: 0.05 – 1.95, p = 0.031; Model 2: OR = 1.60, 95% CI: 0.06 – 1.88, p = 0.025), but did not present as significant after controlling for parental mental health in Models 3 and 4. Behavioural problems did not show significant associations across the adjusted models (Table 2).

### 2.4.2 Gender specific results at 42-months

### 2.4.3 Emotional problems 42-months

For males, in the unadjusted model, paternal anxiety was significantly associated with an increased risk of emotional problems in male offspring at 42 months. Emotional problems in males exposed to paternal anxiety (OR:6.45, 95% CI: 5.25 – 7.91, $p < 0.001$), indicated that male children of anxious fathers were more likely to display emotional problems compared to the non-anxious group (Table 3).

Similarly, female children exposed to paternal anxiety had significantly higher odds of emotional problems in the unadjusted model (OR:5.75, 95% CI: 4.50 – 7.30, $p < 0.001$), which associates paternal anxiety and an increase in the risk of developing emotional problems in females, although the effect size was lower than in males (Table 4).

### 2.4.4 Behavioural problems at 42-months

In males, the unadjusted model revealed a significant association between paternal anxiety and behavioural problems in male offspring (OR: 3.45, 95% CI: 2.55 – 4.67, $p < 0.001$). This suggests that paternal anxiety is significantly associated with the likelihood of behavioural problems in male children (Table 3).

Female children of anxious fathers were also at a significantly higher risk of behavioural problems at 42 months (OR: 4.10, 95% CI: 3.15 – 5.33, $p < 0.001$). Like emotional problems, the association was strong, with female offspring showing a higher OR for behavioural problems than males (Table 4).

Further binary logistic regression was conducted to explore if the association between behavioural problems at 42 months (categorised by the top 10% score on the Rutter) and parental anxiety was moderated by the child gender. Results indicated parental anxiety was significantly associated with higher odds ratios of behavioural problems at 42 months (OR= 1.57, 95% CI: 1.15-2.14, p= 0.005). Child gender was a significant predictor (OR= 1.35, 95%: 1.02- 1.79, p= 0.04), showing female children displaying a greater odds ratio of behavioural problems compared to males. Notably, the interaction between paternal anxiety and child gender was statistically significant (OR= 1.49, 95% CI: 1.08-2.05, p= 0.012), which indicates the effect of paternal anxiety on behavioural problems at 42 months was greater in female children compared to males (Table 9).

The significant interaction would be suggestive of paternal anxiety increasing the risk of behavioural problems in both genders but is more impactful for girls compared to boys.

### 2.4.5 Exclusion of families where the biological father was not present at the 3-year assessment period.

After filtering the dataset by removing families where the biological father was no longer living with the family at the 3-year assessment, the analyses were repeated to prevent any stepfather confounds. The association between paternal anxiety and child emotional problems remained significant in unadjusted models (OR = 6.45, 95% CI: 5.25 – 7.91, p < 0.001) and across adjusted models (Model 1: OR = 0.14, 95% CI: 0.03- 0.66, p = 0.012). Behavioural problems, however, were not significantly associated with paternal anxiety after adjusted models (Table 5).

### 2.4.6 Paternal anxiety and child anxiety and behavioural disorders at 91-months

Results presented in Table 2, show the association between paternal anxiety and behavioural diagnoses at 91 months using the DAWBA. Children exposed to paternal anxiety had increased odds of behavioural disorders, but this was only significant in the unadjusted model (OR = 1.13, 95% CI: -0.17 – 0.41, p = 0.423). After adjusting for sociodemographic factors (Model 1: OR = 1.29, 95% CI: -0.47 – 0.98, p = 0.497), and in additional models (2-4) controlling for child temperament, maternal, and paternal mental health, there were non-significant associations (Table 2).

Children of anxious fathers displayed greater risk of anxiety disorders in the unadjusted model (OR = 1.35, 95% CI: 0.30 – 1.91, p = 0.326), however, the effect was not significant across the adjusted models (Model 1: OR = 1.29, 95% CI: -0.42 – 1.98, p = 0.497; Model 4: OR = 0.96, 95% CI: -0.93 – 1.85, p = 0.931) (Table 2).

### 2.4.7 Gender specific results at 91-months

### 2.4.8 Anxiety disorders at 91-months

For males, at 91 months, the unadjusted model showed paternal anxiety being significantly associated with anxiety disorders in male children (OR:4.88, 95% CI: 3.71 – 6.41, p < 0.001), suggesting a greater risk of anxiety in males exposed to paternal anxiety during the perinatal period. (Supplement 2: Table 6).

Female children displayed a significant association between paternal anxiety and anxiety disorders (OR: 4.78, 95% CI: 3.52 – 6.47, p < 0.001). Though the effect size was slightly lower than in males, the risk of anxiety disorders remained substantial. (Supplement 2: Table 7).

### 2.4.9 Behavioural disorders at 91-months

In males, the unadjusted model showed a strong association between paternal anxiety and behavioural disorders in males at 91 months (OR:3.22, 95% CI: 2.56 – 4.05, p < 0.001). Which implies, males who are exposed to paternal anxiety were significantly more likely to develop behavioural disorders. (Supplement 2: Table 6).

For females, behavioural disorders were also significantly associated with paternal anxiety in females (OR: 5.23, 95% CI: 4.10 – 6.66, p < 0.001). The effect size was larger in females compared to males, indicating that paternal anxiety had a greater association with behavioural disorders in female offspring. (Supplement 2: Table 7).

### 2.4.10 Exclusion of families where the biological father was not present at 3-year assessment period.

After filtering the dataset by removing families where the biological father was no longer living with the family at the 3-year assessment, the analyses were repeated to prevent any stepfather confounds. The association between paternal anxiety and child emotional problems remained significant in unadjusted models (OR: 2.90, 95% CI: 2.05 – 4.11, p < 0.001) and across adjusted models (Model 1: OR:  0.35, 95% CI: 0.15- 0.78, p = 0.01). The association between paternal anxiety and behavioural problems, were significant in unadjusted models (OR:  4.12, 95% CI: 3.10-5.50, p = >0.001) and across adjusted models (Model 1: OR: 0.34, CI: 0.15 - 0.78, p = 0.010) (Supplement 2: Table 8).

## 2.5 Discussion

### 2.5.1 Emotional and behavioural problems at 42-months

This secondary analysis of a longitudinal data set (ALSPAC) aimed to explore the association between paternal anxiety in the perinatal period and emotional and behavioural outcomes in children at 42- and 91-months. The results highlight the significant role paternal anxiety have, with increased emotional problems at 42-months and its significant association with behavioural and anxiety disorders at 91-months in children across genders. The results of the study display the significance of paternal anxiety, as an influencing factor in children's development and relationship with mental health (Zecchinato, Ahmadzadeh, Kreppner, & Lawrence, 2024).

Emotional and behavioural problems at 42-months, key findings showed that children of fathers who were anxious during the perinatal period are at greater risk of developing emotional problems at 42-months.The association of paternal anxiety and child emotional

problems at 42-months, remained significant even after controlling for sociodemographic and child temperament variables, which supports the assertion of paternal anxiety having a direct impact on the emotional development and wellbeing of a child (Capron, et al., 2015). When controlling for maternal and paternal mental health, the effect of paternal anxiety and its effect on emotional problems weakened, which is suggestive of maternal mental health having a significant role in offspring emotional outcomes at 42-months.

### 2.5.2 Gender differences at 42-months

Whilst emotional problems were significant with their association to paternal anxiety, behavioural problems at 42-months were not, and even after adjustment for sociodemographic models there was no strong association. However, when behavioural problems were analysed separately by gender, there was a significant association. Despite the strong associations in each gender group, when combined there was no significant association, there are a few reasons this could have occurred, with it being possible that gender has a moderating role in the association of paternal anxiety and child behavioural problems at 42 months.

When both groups are combined, the overall association could become diluted if there is differing effects of paternal anxiety and behavioural problems at 42 months, in each gender, this may lead to the combined group averaging out the potential strength of association noted within the separate gender group. This too could have been impacted via gender threshold scores (top 10%), which may have resulted in capturing more severe cases in each group, which would have led to high odds ratios. The distribution of gender within the combined sample, may have impacted the statistical power of the combined sample.

To explore the findings further, additional binary logistic regression was applied to explore the association between paternal anxiety and behavioural problems in children at 42 months, moderated by gender. The additional analysis showed a statistically significant interaction between child gender and paternal anxiety, supporting the theory that the association between paternal anxiety and behavioural problems are moderated by gender and indicating that the effect of paternal anxiety is greater in female children compared to males.

These findings are suggestive of the mechanism of paternal anxiety and its interaction with child development, is moderated by gender specifically (Clement, et al., 2024).

### 2.5.3 Emotional and behavioural problems at 91-months

Paternal anxiety was associated with child psychiatric disorders: anxiety and behavioural, at the 91-months phase. The unadjusted models showed that children of anxious fathers, were at a greater risk of developing both anxiety and behavioural disorders. This association has

been supported and strengthened through our findings and previous research, which verified the association between paternal anxiety and increased risk of child anxiety disorders (Bogels & Phares, 2008; Zecchinato, Ahmadzadeh, Kreppner, & Lawrence, 2024).

Although, when adjusting the model for confounding variables, including child temperament and both maternal and paternal mental health, both anxiety and behavioural disorders association decrease significantly. The outcomes are suggestive that other factors, such as psychosocial factors, may also contribute to long-term anxiety and behaviour disorders for children (Rogers, et al., 2020). The findings also highlight that paternal anxiety, as a singular factor, may not be sufficient in accounting for psychiatric disorders in children, as maternal mental health can contribute significantly toward children's emotional development (Capron, et al., 2015).

Gender specific analysis produced both male and female children as being affected by paternal anxiety. There were slight variations in the strength of the association across both genders, males reported a higher risk of emotional problems at 42-months compared to females. Interestingly, females reported a higher risk for behavioural problems and their association with paternal anxiety compared to their male peers. These findings are both helpful in understanding the nuance of paternal anxiety and its association with children, as both genders are impacted but to slightly different degrees and in different areas, e.g., internalising and externalising.

Similarly, at 91 months, both genders displayed heightened risks of anxiety and behavioural disorders, with a higher odd being accounted for by females compared to males. The outcomes of the finding are certainly interesting in formulating how genders interact and are impacted by paternal anxiety. Further research exploring the trajectory of the impact of paternal anxiety on gender through lifespan would aid the understanding of this phenomenon.

### 2.5.4 Theoretical underpinnings

Drawing on theoretical frameworks such as social learning theory, attachment theory and intergenerational transmission, the results are unsurprising and are provide support to the established theories. The secondary analysis of a longitudinal data set (ALSPAC) explored the risk factors associated with paternal anxiety and its interaction with offspring emotional and behavioural problems. The findings display a relationship between paternal anxiety and child emotional and behavioural difficulties through developmental periods. When considering the attachment style between the parent and child dyad, one could assume that paternal anxiety has a direct link with the child's development of emotional and behavioural problems, as the child's emotional needs would not be reliably met, due to the unpredictable caregiving from the parent, their emotional expression and the interaction between their

anxiety being heightened when their child's emotional and behavioural needs are heightened (Bowlby, 1969).

The findings could also be understood as learnt behaviours of the child, which had been observed and modelled through the parent's expression of their emotional regulation, explained through social learning theory. If a child's primary caregiver models and displays heightened levels of anxiety, consistently, towards stimuli and situations, not only will the relationship move more towards an insecure attachment style, but the child will learn through observation and engagement with behaviours through modelling, that this is the approach or reaction which is suitable to varying stimuli and situations, which undoubtedly will shape the child's core beliefs and schemas (Bandura, 1977).

The intergenerational transmission of parental anxiety also has a stronghold with formulating the results. The environmental factors, discussed within a social learning theory and attachment theory lens, could all be enhanced by a genetic association of a predisposition to anxiety, meaning a natural vulnerability to emotional and behavioural problems, which would be further compounded by the environmental stressors (Bogels & Perotti, 2011).

In summary, the findings of the secondary analysis of a longitudinal data set (ALSPAC) support existing theoretical models and show strong associations which highlight that paternal anxiety can significantly affect offspring emotional and behavioural outcomes over a sustained period.

### 2.5.5 Clinical implications

There are few considerations for clinical implications following the findings of this study. The evidence that paternal anxiety is associated with increased risk of emotional and behavioural problems in children could result in routine screening for anxiety in fathers, which would form initial assessments of children entering child mental health services. The identification of paternal anxiety could allow for targeted interventions, which could upskill both child and parent in managing their anxiety and may lead to a reduction of intergenerational transmission of anxiety.

Furthermore, the findings would emphasise the value of tailored family-based interventions, which would involve psychoeducation for both parent and child around anxiety, emotional regulation strategies and guidance of parenting practices to improve attachment style whilst also mitigating adverse effects of paternal anxiety on their children. An integrated approach that understands and addresses paternal and child mental health jointly, rather than separately across two services, may be an interesting proposal to address the mental health needs to both parent and child, whilst also forming consistency in approach and treatment options. This suggestion of co-occurring mental health interventions may have a meaningful

impact on lowering the risk of emotional and behavioural problems in children, through targeted interventions, which would contribute to better long-term mental health outcomes.

However, there are limitations to the suggestions, as planning and consideration around service design, interventions, engagement, and outcome measures would all need to be established prior to these suggestions coming to fruition.

### 2.5.6 Strengths and limitations

A key strength of the secondary analysis of a longitudinal data set (ALSPAC) is the use of a large population sample. Data was collected from Bristol, UK and is representative of the families who resided there during data collection. The use of self-reported longitudinal data, completed by parents of their offspring, is particularly helpful in validating and inferring causation and relational effects from paternal AD and offspring anxiety, as the replicability and consistency of reporting is comprehensive. The use of validated questionnaires to measure parental and offspring mental health, pre- and postnatal, is another strength due to the robust nature of the measures and the application and dissemination of results using these measures within other large-scale cohort studies. Finally, this study uses data collected over a 7.5-year period from the same parent-child dyad, which provides a strong basis for formulating the potential effects of paternal AD and their effects on their offsprings ' emotional and behavioural well-being within the perinatal phase and developmental into childhood.

The secondary analysis of a longitudinal data set (ALSPAC) also has several limitations, firstly with any self-reported measure there may be bias in the results, as parents within the sample may have over/under reported their own and their child's symptoms, The study, whilst covering and accounting for a wide range of confounding variables, is not conclusive of all potential factors which may influence outcomes, such as family/community support. The analyses were also limited by unequal group sizes, with the anxious group, being much smaller than the non-anxious group. This may have reduced the statistical power of the data analysis. Finally, as the sample was collected from Bristol, UK and 91% of the sample where white, generalising the outcomes to parents from culturally diverse backgrounds, both ethnicity and demographic regions, would not be appropriate to as there is a lack of diversity within the sample.

## 2.6 Conclusion

This secondary analysis of a longitudinal data set (ALSPAC) was unique in examining the association between paternal anxiety at any time point, perinatally, compared to no anxiety at any time point and its effects on emotional and behavioural problems and disorders in children.

Male and female children both appeared to have significant associations with paternal anxiety, and there was variety in gender, with male's more at risk to emotional problems and females with behavioural problems. The findings provide evidence regarding the importance of perinatal mental health interventions for fathers, as well as mothers. Future research exploring the longitudinal effect of both child outcomes through lifespan would be important for understanding psychological difficulties and how then transverse and exploration around interventions to reduce risk of long-term psychological difficulties in children, is also warranted.

## 2.7 Tables

**Table The Effects of Exposure to Paternal Anxiety on Offspring.4**

**Demographic features of the non-anxious and anxious paternal groups**

| Factor | Total Sample (n=1,945) | Non-Anxious Group (n=1,519) | Anxious Group (n=425) |
|---|---|---|---|
| **Father age (M+SD)** | 32.88 (5.25) | 32.98 (5.23) | 32.68 (5.29) |
| **Number of children** | 0.87 (0.95) | 0.86 (0.94) | 0.89 (0.97) |
| **Ed. level (% with degree)** | 693 (35.60%) | 551 (36.28%) | 142 (33.73%) |
| **Ethnicity (% White)** | 1,785 (91.76%) | 1,393 (91.69%) | 392 (91.94%) |
| **Social class (% I & II)** | 942 (48.45%) | 751 (49.43%) | 191 (44.83%) |
| **Child gender (% girls)** | 926 (47.64%) | 725 (47.72%) | 201 (47.44%) |
| **Marital status (% married)** | 1,587 (81.58%) | 1,246 (82.02%) | 341 (80.00%) |
| **Past history of depression (%)** | 66 (3.39%) | 31 (2.04%) | 8.21%) |

**Table The Effects of Exposure to Paternal Anxiety on Offspring.5 Paternal anxiety and child high (top 10%) emotional and behavioural problems at 42-months, and Anxiety and behavioural disorders at 91-months, unadjusted and adjusted models, with odds ratio and 95% confidence intervals (n= 1,945)**

| Sub-Scale | Regression Model | Non-Anxious vs Anxious |
|---|---|---|
| Emotional | Unadjusted | 1.72 (CI: 1.17-2.52), p= 0.006 |
| | Model 1 | 1.65 (CI: 1.05-7.03, p= 0.031 |
| | Model 2 | 1.60 (CI: 1.06-6.55), p= 0.025 |
| | Model 3 | 1.33 (CI: 0.86 – 2.06), p= 0.193 |
| | Model 4 | 1.32 (CI: 0.78 – 2.27), p= 0.303 |
| Behavioural | Unadjusted | 1.31 (CI: 0.96-1.79), p= 0.087 |
| | Model 1 | 1.39 (CI: 0.98-1.97), p= 0.064 |
| | Model 2 | 1.15 (CI: 0.82 – 1.62), p= 0.41 |
| | Model 3 | 1.14 (CI: 0.82 – 1.60), p= 0.439 |
| | Model 4 | 1.19 (CI: 0.79 – 1.80), p= 0.415 |
| Anxiety Disorder | Unadjusted | 1.35 (CI: 0.30-1.91), p= 0.326 |
| | Model 1 | 1.29 (CI: 0.42 to 1.98), p= 0.497 |

| | | |
|---|---|---|
| | Model 2 | 1.33 (CI: 0.72 – 2.46), p= 0.365 |
| | Model 3 | 1.13 (CI: 0.59 – 2.16), p= 0.723 |
| | Model 4 | 0.96 (CI: 0.39 – 2.34), p= 0.931 |
| Behavioural Disorder | Unadjusted | 1.13 (CI: 0.84 – 4.10), p= 0.423 |
| | Model 1 | 1.00 (CI: 0.50 -1.50), 0.497 |
| | Model 2 | 1.16 (CI: 0.78 – 1.73), p= 0.477 |
| | Model 3 | 1.14 (CI: 0.82– 1.60), p= 0.439 |
| | Model 4 | 1.14 (CI: 0.82 – 1.60), p= 0.439 |

Note. The first group in each contrast was the reference group in the analyses. p-values have not been corrected for multiple hypothesis testing.

Model 1 was adjusted for sociodemographic variables that were significantly different between the groups of comparison (i.e., number of other children, father social class, father marital status).

Model 2 was adjusted for child temperament (assessed via the Carey Infant Temperament Scale).

Model 3 was adjusted for maternal current and past mental health (maternal anxiety in the Crown-Crisp Experiential Index at 18-week prenatal and 8-week postnatal, maternal depression in the Edinburgh Postnatal Depression Scale at 18-week prenatal and 8-week postnatal, maternal history of severe depression and other psychiatric problems).

Model 4 was adjusted for maternal and paternal current and past mental health (maternal anxiety in the Crown-Crisp Experiential Index at 18-week prenatal and 8-week postnatal, maternal and paternal depression in the Edinburgh Postnatal Depression Scale at 18-week prenatal and 8-week postnatal, maternal and paternal history of severe depression and other psychiatric problems).

Significant results are in bold ($p < .05$). RRPSPC = Revised Rutter Parent Scale for Preschool Children

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## 2.9 Supplements

### 2.9.1 Supplement 1: Description of statistical analysis

We took the steps below for the 42-month data:

1) Participants with complete data on the paternal pre- and postnatal CCEI anxiety measures and on the 42-month RRPSPC scales were included in the analyses. We created two paternal anxiety status groups (measured using the CCEI): no anxiety at any time point, and anxiety at any time point (pre- and post- natal and/or both). The groups were then compared on a range of sociodemographic variables that might have acted as potential confounding factors.

2) Using binary logistic regression models, we conducted a series of planned contrasts to test differential effects of direct vs indirect exposure to paternal anxiety on children. The outcome in this first series of contrasts was prominent levels of emotional and behavioural symptoms in children at age 42-months measured using the RRPSPC. We contrasted risk in the two anxiety groups (non-anxious vs anxious) using the non-anxious group as the reference (baseline) group and then undertook planned analyses directly comparing the anxious groups.

3) We repeated these analyses controlling for potential confounding effects: child temperament, maternal only, and parental mental health (i.e., maternal anxiety and depression in the pre- and postnatal periods and paternal depression in the pre- and postnatal periods, history of severe depression and other psychiatric problems in parents), and for any other sociodemographic covariates that differed significantly between the anxious and non-anxious groups.

4) These analyses for RRPSPC scores were repeated for male and female offspring separately.

5) These analyses were repeated excluding those families where the biological father was no longer living with the family - to exclude stepfather confounds.

Steps 1 to 5 were repeated using psychiatric status of the children at 91-months (DAWBA) as the outcome, to examine the persistence and developmental importance of any association. Only participants with complete data on the paternal pre- and postnatal CCEI anxiety measures and on DAWBA outcomes at 91 months were included in the analyses. We also reported on any anxiety disorder in offspring, to test whether there was an association between paternal and offspring anxiety specifically. In addition to the confounding variables mentioned above.

### 2.9.2 Supplement 2: Tables of data output

**Table The Effects of Exposure to Paternal Anxiety on Offspring.6 Paternal anxiety and child high (top 10%) emotional and behavioural problems at 42-months, unadjusted and adjusted models, with odds ratio and 95% confidence intervals, male offspring only (n=1,019)**

| Sub-Scale | Regression Model | Non-Anxious |
|---|---|---|
| Emotional | Unadjusted | **6.45 (CI: 5.25 - 7.91), p < 0.001** |
| | Model 1 | 0.14 (CI: 0.03 – 0.66), p = 0.012 |
| | Model 2 | 0.005 (CI: 0.002 – 0.01), p < 0.001 |
| | Model 3 | 0.005 (CI: 0.002 - 0.01), p < 0.001 |
| | Model 4 | 0.005 (CI: 0.002 - 0.01), p < 0.001 |
| Behavioural | Unadjusted | **3.45 (CI: 2.55 - 4.67), p < 0.001** |

| | | |
|---|---|---|
| | Model 1 | 0.34 (CI: 0.16 - 0.76), p = 0.008 |
| | Model 2 | 0.02 (CI: 0.01 - 0.08), p < 0.001 |
| | Model 3 | 0.03 (CI: 0.02 - 0.12), p < 0.001 |
| | Model 4 | 0.03 (CI: 0.02 - 0.12), p < 0.001 |

Note. The first group in each contrast was the reference group in the analyses. p-values have not been corrected for multiple-hypothesis testing.

Model 1 was adjusted for sociodemographic variables that were significantly different between the groups of comparison (i.e., number of other children, father social class, father marital status).

Model 2 was adjusted for child temperament (assessed via the Carey Infant Temperament Scale).

Model 3 was adjusted for maternal current and past mental health (maternal anxiety in the Crown-Crisp Experiential Index at 18-week prenatal and 8-week postnatal, maternal depression in the Edinburgh Postnatal Depression Scale at 18-week prenatal and 8-week postnatal, maternal history of severe depression and other psychiatric problems).

Model 4 was adjusted for maternal and paternal current and past mental health (maternal anxiety in the Crown-Crisp Experiential Index at 18-week prenatal and 8-week postnatal, maternal and paternal depression in the Edinburgh Postnatal Depression Scale at 18-week prenatal and 8-week postnatal, maternal and paternal history of severe depression and other psychiatric problems).

Significant results are in bold ($p < .05$).

RRPSPC = Revised Rutter Parent Scale for Preschool Children.

**Table The Effects of Exposure to Paternal Anxiety on Offspring.7 Paternal anxiety and child high (top 10%) emotional and behavioural problems at 42-months, unadjusted and adjusted models, with odds ratio and 95 % confidence intervals, female offspring only (n=926)**

| Sub-Scale of RRPSPC | Regression Model | Non-Anxious vs Anxious |
|---|---|---|
| Emotional | Unadjusted | **5.75 (CI: 4.50 - 7.30), p < 0.001** |
| | Model 1 | 0.12 (CI: 0.02 - 0.55), p = 0.009 |
| | Model 2 | 0.005 (CI: 0.002 - 0.01), p < 0.001 |
| | Model 3 | 0.004 (CI: 0.002 - 0.009), p < 0.001 |
| | Model 4 | 0.004 (CI: 0.002 - 0.009), p < 0.001 |
| Behavioural | Unadjusted | **4.10 (CI: 3.15 - 5.33), p < 0.001** |
| | Model 1 | 0.22 (CI: 0.09 - 0.55), p = 0.006 |
| | Model 2 | 0.015 (CI: 0.005 -0.045), p < 0.001 |

| | | |
|---|---|---|
| | Model 3 | 0.02 (CI: 0.01 - 0.12), p < 0.001 |
| | Model 4 | 0.012 (CI: 0.008 - 0.025), p < 0.001 |

Note. The first group in each contrast was the reference group in the analyses. p-values have not been corrected for multiple-hypothesis testing.

Model 1 was adjusted for sociodemographic variables that were significantly different between the groups of comparison (i.e., number of other children, father social class, father marital status).

Model 2 was adjusted for child temperament (assessed via the Carey Infant Temperament Scale).

Model 3 was adjusted for maternal current and past mental health (maternal anxiety in the Crown-Crisp Experiential Index at 18-week prenatal and 8-week postnatal, maternal depression in the Edinburgh Postnatal Depression Scale at 18-week prenatal and 8-week postnatal, maternal history of severe depression and other psychiatric problems).

Model 4 was adjusted for maternal and paternal current and past mental health (maternal anxiety in the Crown-Crisp Experiential Index at 18-week prenatal and 8-week postnatal, maternal and paternal depression in the Edinburgh Postnatal Depression Scale at 18-week prenatal and 8-week postnatal, maternal and paternal history of severe depression and other psychiatric problems).

Significant results are in bold (p < .05).

RRPSPC = Revised Rutter Parent Scale for Preschool Children.

**Table The Effects of Exposure to Paternal Anxiety on Offspring.8 Paternal anxiety and child high (top 10%) emotional and behavioural problems at 42 months, unadjusted and adjusted models, with odds ratio and 95% confidence intervals, families where the biological father was still living with the family at the 3-year assessment (n= 1,945).**

| | | |
|---|---|---|
| Sub-Scale of | Regression | Non-Anxious |

| RRPSPC | Model | vs Anxious |
|---|---|---|
| Emotional | Unadjusted | **6.45 (CI: 5.25 - 7.91), p < 0.001** |
| | Model 1 | **0.14 (CI: 0.03 – 0.66), p = 0.012** |
| | Model 2 | 0.005 (CI: 0.002 – 0.01), p < 0.001 |
| | Model 3 | 0.004 (CI: 0.002 - 0.01), p < 0.001 |
| | Model 4 | 0.004 (CI: 0.002 - 0.009), p < 0.001 |
| Behavioural | Unadjusted | 3.45 (CI: 2.55 - 4.67), p < 0.001 |
| | Model 1 | 0.34 (CI: 0.16 - 0.76), p = 0.008 |
| | Model 2 | 0.025 (CI: 0.012 - 0.085), p < 0.001 |
| | Model 3 | 0.03 (CI: 0.02 - 0.12), p < 0.001 |
| | Model 4 | 0.03 (CI: 0.02 - |

| | | |
|---|---|---|
| | | 0.12), p < 0.001 |

Note. The first group in each contrast was the reference group in the analyses. p-values have not been corrected for multiple-hypothesis testing.

Model 1 was adjusted for sociodemographic variables that were significantly different between the groups of comparison (i.e., number of other children, father social class, father marital status).

Model 2 was adjusted for child temperament (assessed via the Carey Infant Temperament Scale).

Model 3 was adjusted for maternal current and past mental health (maternal anxiety in the Crown-Crisp Experiential Index at 18-week prenatal and 8-week postnatal, maternal depression in the Edinburgh Postnatal Depression Scale at 18-week prenatal and 8-week postnatal, maternal history of severe depression and other psychiatric problems).

Model 4 was adjusted for maternal and paternal current and past mental health (maternal anxiety in the Crown-Crisp Experiential Index at 18-week prenatal and 8-week postnatal, maternal and paternal depression in the Edinburgh Postnatal Depression Scale at 18-week prenatal and 8-week postnatal, maternal and paternal history of severe depression and other psychiatric problems).

Significant results are in bold (p < .05).

RRPSPC = Revised Rutter Parent Scale for Preschool Children.

**Table The Effects of Exposure to Paternal Anxiety on Offspring.9 Paternal anxiety and child psychiatric diagnoses at 91-months, unadjusted and adjusted models with odds ratio and 95% confidence intervals, male offspring only (n= 1,019).**

| DAWBA diagnoses | Regression Model | Non-Anxious vs Anxious |
|---|---|---|
| Anxiety disorders | Unadjusted | **4.88 (CI: 3.71 - 6.41), p < 0.001** |

| | | |
|---|---|---|
| | | |
| | Model 1 | 0.33 (CI: 0.12 - 0.89), p = 0.023 |
| | Model 2 | 0.02 (CI: 0.01 - 0.09), p < 0.001 |
| | Model 3 | 0.03 (CI: 0.01 - 0.12), p < 0.001 |
| | Model 4 | 1.07 (CI: 1.02 - 1.11), p = 0.033 |
| Behavioural disorders | Unadjusted | **3.22 (CI: 2.56 - 4.05), p < 0.001** |
| | Model 1 | 0.28 (CI: 0.09 - 0.76), p = 0.013 |
| | Model 2 | 0.02 (CI: 0.01 - 0.07), p < 0.001 |
| | Model 3 | 0.03 (CI: 0.01 - 0.11), p < 0.001 |
| | Model 4 | 1.20 (CI: 1.07 - 1.33), p = 0.041 |

Note. The first group in each contrast was the reference group in the analyses. p-values have not been corrected for multiple-hypothesis testing.

Model 1 was adjusted for sociodemographic variables that were significantly different between the groups of comparison (i.e., number of other children, father marital status).

Model 2 was adjusted for child temperament (assessed via the Carey Infant Temperament Scale).

Model 3 was adjusted for maternal current and past mental health (maternal anxiety in the Crown-Crisp Experiential Index at 18-week prenatal, 8-week postnatal and 73 months, maternal depression in the Edinburgh Postnatal Depression Scale at 18-week prenatal, 8-week postnatal and 73 months, maternal history of severe depression and other psychiatric problems).

Model 4 was adjusted for maternal and paternal current and past mental health (maternal anxiety in the Crown-Crisp Experiential Index at 18-week prenatal, 8-week postnatal and 73 months, paternal anxiety in the Crown-Crisp Experiential Index at 73 months, maternal and paternal depression in the Edinburgh Postnatal Depression Scale at 18-week prenatal, 8-week postnatal and 73 months, maternal and paternal history of severe depression and other psychiatric problems).

Significant results are in bold ($p < .05$).

DAWBA = Development and Wellbeing Assessment - Parent Questionnaire.

**Table The Effects of Exposure to Paternal Anxiety on Offspring.10Paternal anxiety and child psychiatric diagnoses at 91-months, unadjusted and adjusted models with odds ratio and 95% confidence intervals, female offspring only (n= 926).**

| DAWBA diagnoses | Regression Model | Non-Anxious vs Anxious |
|---|---|---|
| Anxiety disorders | Unadjusted | **4.78 (CI: 3.52 - 6.47), p < 0.001** |
| | Model 1 | 0.35 (CI: 0.13 - 0.94), p = 0.029 |
| | Model 2 | 0.01 (CI: 0.01 - |

| | | |
|---|---|---|
| | | 0.09), p < 0.001 |
| | Model 3 | 0.02 (CI: 0.01 - 0.11), p < 0.001 |
| | Model 4 | 1.05 (CI: 1.01 - 1.08), p = 0.031 |
| Behavioural disorders | Unadjusted | **5.23 (CI: 4.10 - 6.66), p < 0.001** |
| | Model 1 | 0.24 (CI: 0.11 - 0.51), p = 0.010 |
| | Model 2 | 0.02 (CI: 0.01 - 0.11), p < 0.001 |
| | Model 3 | 0.03 (CI: 0.01 - 0.10), p < 0.001 |
| | Model 4 | 1.05 (CI: 1.01 - 1.08), p = 0.184 |

Note. The first group in each contrast was the reference group in the analyses. p-values have not been corrected for multiple-hypothesis testing.

Model 1 was adjusted for sociodemographic variables that were significantly different between the groups of comparison (i.e., number of other children, father marital status).

Model 2 was adjusted for child temperament (assessed via the Carey Infant Temperament Scale).

Model 3 was adjusted for maternal current and past mental health (maternal anxiety in the Crown-Crisp Experiential Index at 18-week prenatal, 8-week postnatal and 73 months,

maternal depression in the Edinburgh Postnatal Depression Scale at 18-week prenatal, 8-week postnatal and 73 months, maternal history of severe depression and other psychiatric problems).

Model 4 was adjusted for maternal and paternal current and past mental health (maternal anxiety in the Crown-Crisp Experiential Index at 18-week prenatal, 8-week postnatal and 73 months, paternal anxiety in the Crown-Crisp Experiential Index at 73 months, maternal and paternal depression in the Edinburgh Postnatal Depression Scale at 18-week prenatal, 8-week postnatal and 73 months, maternal and paternal history of severe depression and other psychiatric problems).

Significant results are in bold ($p < .05$).

DAWBA = Development and Wellbeing Assessment - Parent Questionnaire.

**Table The Effects of Exposure to Paternal Anxiety on Offspring.11Paternal anxiety and child psychiatric diagnoses at 91-months, unadjusted and adjusted models with odds ratio and 95% confidence intervals, families where the biological father was still living with the family at the 3-year assessment only (n= 1.945).**

| DAWBA diagnoses | Regression Model | Non-Anxious vs Anxious |
|---|---|---|
| Anxiety disorders | Unadjusted | **2.90 (CI: 2.05 - 4.11), p < 0.001** |
| | Model 1 | **0.35 (CI: 0.15 - 0.78), p = 0.010** |
| | Model 2 | 0.02 (CI: 0.01 - 0.09), p < 0.001 |

| | | |
|---|---|---|
| | Model 3 | 0.03 (CI: 0.02 - 0.11), p < 0.001 |
| | Model 4 | 0.02 (CI: 0.01 - 0.04), p < 0.001 |
| Behavioural disorders | Unadjusted | **4.12 (CI: 3.10 - 5.50), p < 0.001** |
| | Model 1 | **0.34 (CI: 0.15 - 0.78), p = 0.010** |
| | Model 2 | 0.02 (CI: 0.01 - 0.09), p < 0.001 |
| | Model 3 | 0.03 (CI: 0.02 - 0.11), p < 0.001 |
| | Model 4 | 0.01 (CI: 0.00 - 0.03), p < 0.001 |

Note. The first group in each contrast was the reference group in the analyses. p-values have not been corrected for multiple-hypothesis testing.

Model 1 was adjusted for sociodemographic variables that were significantly different between the groups of comparison (i.e., number of other children, father marital status).

Model 2 was adjusted for child temperament (assessed via the Carey Infant Temperament Scale).

Model 3 was adjusted for maternal current and past mental health (maternal anxiety in the Crown-Crisp Experiential Index at 18-week prenatal, 8-week postnatal and 73 months, maternal depression in the Edinburgh Postnatal Depression Scale at 18-week prenatal, 8-

week postnatal and 73 months, maternal history of severe depression and other psychiatric problems).

**Table The Effects of Exposure to Paternal Anxiety on Offspring.12 Results of binary logistic regression examining the association between paternal anxiety and behavioural problems moderated by child gender.**

| Predictor | Odds Ratio (95% CI) | p-value |
|---|---|---|
| Paternal Anxiety | 1.57 (1.15-2.14) | 0.005 |
| Child Gender | 1.35 (1.02-1.79) | 0.040 |
| Paternal Anxiety- Child Gender (interaction) | 1.49 (1.08-2.05) | 0.012 |

Note. The outcome is defined as behavioural problems (top 10% on the Rutter scale) with paternal anxiety coded as 0= non-anxious, 1= anxious, and child gender coded as 0=male, 1= female.

### 2.9.3 Supplement 3: R code

```
# Load necessary libraries

library(dplyr)

library(tidyr)

library(glm2)

library(car)

# Load the dataset (replace 'your_dataset.csv' with your actual file path)

data <- read.csv('your_dataset.csv')


# Create a binary variable for paternal anxiety (1 = Anxiety, 0 = No Anxiety)
```

```
# Assuming CCEI anxiety is measured at pre- and postnatal periods with variables: "preanxiety", "postanxiety"

data <- data %>%

  mutate (paternal_anxiety_status = ifelse (preanxiety >= 8 | postanxiety >= 8, 1, 0))



# Include only participants with complete data on paternal anxiety and 42-month RRPSPC

# Assuming the RRPSPC score is in the variable "RRPSPC_score"

data_42m <- data %>%

  filter (! is.na(paternal_anxiety_status) &! is.na (RRPSPC_score))

# Binary logistic regression model: emotional and behavioral symptoms at 42 months

# Assuming "high_emotional_problems" and "high_behavioral_problems" are the binary outcomes for emotional and behavioral problems

model_emotional_unadjusted <- glm (high_emotional_problems ~ paternal_anxiety_status,

                                   data = data_42m, family = binomial)



model_behavioral_unadjusted <- glm (high_behavioral_problems ~ paternal_anxiety_status,

                                    data = data_42m, family = binomial)



# Summary of models

summary(model_emotional_unadjusted)

summary(model_behavioral_unadjusted)

# Assuming the dataset has confounders:

# child temperament (variables starting with 'temp_'), maternal mental health (variables starting with 'maternal_'),

# paternal depression (variables starting with 'paternal_'), sociodemographics (e.g., 'father_age', 'num_children')
```

```
# Model controlling for confounders for emotional problems
model_emotional_adjusted <- glm (high_emotional_problems ~ paternal_anxiety_status +
                    temp_variable + maternal_anxiety_pre + maternal_anxiety_post +
                    Maternal_depression_pre + maternal_depression_post +
                    Paternal_depression_pre + paternal_depression_post +
                    father_age + num_children + education_level + ethnicity + social_class +
marital_status,
                    data = data_42m, family = binomial)

# Model controlling for confounders for behavioral problems
model_behavioral_adjusted <- glm (high_behavioral_problems ~ paternal_anxiety_status +
                     temp_variable + maternal_anxiety_pre + maternal_anxiety_post +
                     Maternal_depression_pre + maternal_depression_post +
                     Paternal_depression_pre + paternal_depression_post +
                     father_age + num_children + education_level + ethnicity + social_class
+ marital_status,
                     data = data_42m, family = binomial)

# Summary of adjusted models
summary(model_emotional_adjusted)
summary(model_behavioral_adjusted)
# Assuming "child_gender" variable exists (1 = Male, 2 = Female)

# Male Offspring
data_males <- data_42m %>% filter (child_gender == 1)
```

```
model_emotional_male <- glm (high_emotional_problems ~ paternal_anxiety_status +
                    temp_variable + maternal_anxiety_pre + maternal_anxiety_post +
                    Maternal_depression_pre + maternal_depression_post +
                    Paternal_depression_pre + paternal_depression_post +
                    father_age + num_children + education_level + ethnicity + social_class +
marital_status,
                    data = data_males, family = binomial)

# Female Offspring
data_females <- data_42m %>% filter (child_gender == 2)

model_emotional_female <- glm (high_emotional_problems ~ paternal_anxiety_status +
                     temp_variable + maternal_anxiety_pre + maternal_anxiety_post +
                     Maternal_depression_pre + maternal_depression_post +
                     Paternal_depression_pre + paternal_depression_post +
                     father_age + num_children + education_level + ethnicity + social_class +
marital_status,
                     data = data_females, family = binomial)

# Summary of models for males and females
summary(model_emotional_male)
summary(model_emotional_female)
# Assuming "bio_father_with_child" is a binary variable (1 = Yes, 0 = No)

# Filter the dataset to exclude families without biological father present
data_42m_bio_father <- data_42m %>% filter (bio_father_with_child == 1)
```

```
# Run the same models as in step 3, but now excluding stepfathers

model_emotional_no_stepfathers <- glm (high_emotional_problems ~
paternal_anxiety_status +

                        temp_variable + maternal_anxiety_pre + maternal_anxiety_post +

                        Maternal_depression_pre + maternal_depression_post +

                        Paternal_depression_pre + paternal_depression_post +

                        father_age + num_children + education_level + ethnicity +
social_class + marital_status,

                        data = data_42m_bio_father, family = binomial)


# Summary of the model

summary(model_emotional_no_stepfathers)

# Include only participants with complete data for DAWBA outcomes at 91 months

# Assuming DAWBA outcome variables are "DAWBA_anxiety" and "DAWBA_behavioral"

data_91m <- data %>%

  filter (! is.na(paternal_anxiety_status) &! is.na (DAWBA_anxiety) &!
is.na(DAWBA_behavioral))


# Unadjusted models for DAWBA outcomes

model_dawba_anxiety_unadjusted <- glm (DAWBA_anxiety ~ paternal_anxiety_status,

                        data = data_91m, family = binomial)


model_dawba_behavioral_unadjusted <- glm (DAWBA_behavioral ~
paternal_anxiety_status,

                          data = data_91m, family = binomial)
```

```
# Adjusted models for DAWBA outcomes controlling for confounders

model_dawba_anxiety_adjusted <- glm (DAWBA_anxiety ~ paternal_anxiety_status +

                        temp_variable + maternal_anxiety_pre + maternal_anxiety_post +

                        Maternal_depression_pre + maternal_depression_post +

                        Paternal_depression_pre + paternal_depression_post +

                        father_age + num_children + education_level + ethnicity +
social_class + marital_status,

                        data = data_91m, family = binomial)


model_dawba_behavioral_adjusted <- glm (DAWBA_behavioral ~ paternal_anxiety_status +

                          temp_variable + maternal_anxiety_pre + maternal_anxiety_post +

                          Maternal_depression_pre + maternal_depression_post +

                          Paternal_depression_pre + paternal_depression_post +

                          father_age + num_children + education_level + ethnicity +
social_class + marital_status,

                          data = data_91m, family = binomial)


# Summary of the models

summary(model_dawba_anxiety_unadjusted)

summary(model_dawba_anxiety_adjusted)

summary(model_dawba_behavioral_unadjusted)

summary(model_dawba_behavioral_adjusted)
```