

BEHAVIOURAL INHIBITION AND CHILDHOOD ANXIETY

**Behavioural Inhibition and Childhood Anxiety:  
Interventions and the Role of Peer Relationships**

**Jinnie Ooi**

Primary Supervisor: Dr Laura Pass

Secondary Supervisor: Professor Richard Meiser-Stedman

**Doctorate in Clinical Psychology**

**University of East Anglia**

**Faculty of Medicine and Health Sciences**

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Finally, I dedicate this to my papa who is very much loved and dearly missed.

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### Abstract

**Background:** Behavioural inhibition (BI), a temperament style characterised by shy, quiet, or restrained behaviours when exposed to novel situations, has consistently been identified as a key risk factor for the development of anxiety disorders. This thesis aims to examine whether psychological interventions targeting BI are efficacious in reducing BI and anxiety (symptoms and diagnosis) in preschool-aged children. It also aims to examine the longitudinal relationship between BI, peer relationship difficulties, and anxiety in a cohort of young children over an 8-year period. **Method:** The efficacy of interventions targeting BI in preschool-aged children was examined by conducting a systematic review and meta-analysis consisting of 10 studies ( $N = 1475$  children, aged 3 – 7 years). The empirical study included a cohort of 202 preschool-aged children initially assessed as behaviourally inhibited ( $n = 102$ ) and behaviourally uninhibited (BUI;  $n = 100$ ) at baseline. Peer relationship difficulties were assessed at baseline, 2-year, 5-year and 8-year follow-ups. Anxiety symptoms and disorders were assessed at baseline and at 8-year follow-up. **Results:** Intervention significantly reduced behavioural inhibition when outcomes were reported by parents (SMD =  $-.42$ ) and teachers (SMD =  $-.69$ ), but not when assessed by observers (SMD =  $-.13$ ). Additionally, intervention significantly reduced anxiety symptoms when reported by parents (SMD =  $-.35$ ) but not for anxiety diagnosis (OR =  $.39$ ). Results of the empirical study indicated that BI children generally exhibited higher levels of peer relationship difficulties than BUI children across time-points. Peer relationship difficulties across time-points were significantly associated with and predictive of anxiety disorders at age 12 generally. Finally, peer relationship difficulties moderated the longitudinal relationship between BI and anxiety diagnosis predominantly when the difficulties were reported by mothers. **Conclusion:** Intervention targeted at BI preschool-aged children may be effective in reducing BI and anxiety symptoms (but not disorder). Moreover, children's peer relationship difficulties across development impacts on their anxiety diagnosis in early adolescence.

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## Chapter 1: Introduction

Anxiety disorders are the most common mental health difficulties in childhood and adolescence (Costello et al., 2005), affecting approximately 6.5% of children and adolescents worldwide (Polanczyk et al., 2015). Anxiety disorders tend to emerge early in life, with approximately half of those affected experiencing anxiety prior to age 11 (Kessler et al., 2005). This high prevalence is concerning given that anxiety is associated with difficulties in the school environment (i.e., low classroom participation, irregular school attendance, underperformance), social functioning (i.e., initiating and maintaining friendships), and psychological distress (Muroff & Ross, 2011). Additionally, anxiety that emerges in childhood and adolescence tends to persist into adulthood if left untreated (Copeland et al., 2014), resulting in substantial personal, societal and economic burden (Erskine et al., 2015; Fineberg et al., 2013). Indeed, the cost of services for anxiety disorders in England is estimated to be £2 billion by 2026, and the total projected cost including lost employment would rise to £14.2 billion (McCrone et al., 2008).

Although the efficacy of treatments for anxiety disorders in children and adolescence is well-established (James et al., 2020), the aetiology and prevention of these disorders are less well understood. Behavioural inhibition (BI) has consistently been identified as a key risk factor for the development of anxiety disorders (Chronis-Tuscano et al., 2009; Hudson et al., 2019; Luis-Joaquin et al., 2020). This temperament style reflects the tendency to be shy, quiet, or restrained in novel, unfamiliar situations (Kagan et al., 1984). A recent meta-analysis demonstrated that BI in the preschool years is associated with an almost three-fold increase in the odds of developing an anxiety disorder (Sandstrom et al., 2020). Several etiological models of childhood anxiety suggest a central role for BI (e.g., Liu & Pérez-Edgar, 2019; Rapee et al., 2009; Rubin et al., 2009). For instance, Rapee et al. (2009) argued that behavioural inhibition may elicit and interact with environmental risk factors such as parenting behaviours and parental anxiety disorders in the development of anxiety.

Similarly, Rubin et al. (2009) proposed that social withdrawal, a temperament style related to BI (Rubin et al., 2018), may elicit difficult peer relationships (e.g., peer victimisation, rejection, exclusion) due to poor social skills, which further increases the likelihood of developing anxiety.

Given that behavioural inhibition in the preschool years plays a central role in the development of subsequent anxiety, intervention and prevention programmes targeting behavioural inhibition in preschool-aged children have been developed (Rapee & Bayer, 2018). Initial evidence suggests that these interventions might be effective in reducing anxiety and/or inhibition (e.g., Coplan et al., 2010; Kennedy et al., 2009) but positive effects are not consistently found (e.g., Bayer et al., 2018; LaFreniere & Capuano, 1997; Rapee et al., 2005). To date, despite the emerging body of literature, there has been no meta-analytic review of the effectiveness of these interventions for inhibited preschool-aged children.

Additionally, as mentioned above, Rubin et al.'s (2009) transactional model of social withdrawal propose that peer relationship difficulties may begin as early as the preschool years and repeated negative experiences of peer relationships throughout childhood may increase the risk of developing internalizing difficulties (anxiety and depression) in middle childhood and early adolescence. Evidence from longitudinal studies supports this premise, showing that repeated experiences of negative peer relationships throughout childhood in socially withdrawn children is associated with and predictive of internalizing symptoms in early adolescence (Coplan et al., 2013; Ladd, 2006). To our knowledge, the longitudinal impact of peer relationship difficulties on behaviourally inhibited children and young people's anxiety has not been explored.

This thesis aims to address these gaps in the literature. Chapter 2 presents a systematic review and meta-analysis on the efficacy of psychological interventions for behaviourally inhibited preschool-aged children. Specifically, this chapter examines whether such interventions are effective in reducing (a) behavioural inhibition, and (b) anxiety symptoms

and diagnosis. Next, Chapter 4 examines the longitudinal relationship between behavioural inhibition, peer relationship difficulties, and anxiety in a cohort of young children over an 8-year period. Theoretical and conceptual links between these studies are discussed in Chapter 3. Finally, Chapter 5 provides an overview of findings across both studies and discusses the limitations, recommendations for future directions, and clinical implications from this body of work.



**Chapter 2: Systematic Review and Meta-Analysis**

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**The Efficacy of Interventions for Inhibited Preschool-aged Children: A Meta-analysis**

Jinnie Ooi<sup>a,\*</sup>, Helen F. Dodd<sup>b</sup>, Richard Meiser-Stedman<sup>a</sup>, Jennifer L. Hudson<sup>c</sup>, Jessica Bridges<sup>a</sup>,  
Laura Pass<sup>a</sup>

<sup>a</sup> Department of Clinical Psychology and Psychological Therapies, Norwich Medical School,  
University of East Anglia, Norwich, NR4 7TJ, UK.

<sup>b</sup> School of Psychology and Clinical Language Sciences, Harry Pitt Building, Earley Gate,  
Whiteknights, University of Reading, Reading, RG6 6AL, UK.

<sup>c</sup> Black Dog Institute, University of New South Wales, Hospital Road, Randwick NSW 2031,  
Australia.

\*Corresponding author.

E-mail address: [jinnie.ooi@uea.ac.uk](mailto:jinnie.ooi@uea.ac.uk)

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**Abstract**

The current systematic review and meta-analyses examined the efficacy of randomised controlled trials of psychological interventions targeting behavioural inhibition and anxiety in preschool-aged children. Web of Science, MEDLINE, PsycINFO and CINAHL were systematically searched from inception to March 2021. Ten studies ( $N = 1475$  children, aged 3 – 7 years) were included in the current review. Separate analyses were conducted for behavioural inhibition, anxiety symptoms, and anxiety diagnosis as reported by parents, teachers, and observer-ratings. Pooled outcomes ranged from post-intervention to 12-month follow-up due to the limited number of studies. Significant effects were found for behavioural inhibition when outcomes were reported by parents (SMD =  $-.42$ , 95% CI =  $-.76$  to  $-.08$ ) and teachers (SMD =  $-.69$ , 95% CI =  $-1.02$  to  $-.36$ ), but not when assessed by observers (SMD =  $-.13$ , 95% CI =  $-.63$  to  $.38$ ). Additionally, there was a significant effect for anxiety symptoms when reported by parents (SMD =  $-.35$ , 95% CI =  $-.60$  to  $-.11$ ) but not for anxiety diagnosis (OR =  $.39$ , 95% CI =  $0.13$  to  $1.22$ ). Intervention may be effective in reducing BI and anxiety (but not disorder) in preschool-aged children, but this change was not consistently observed across all outcomes or reporters.

*Keywords:* behavioural inhibition, anxiety, meta-analysis, intervention, preschool-aged

## 1. Introduction

Behavioural inhibition (BI) is a temperament style characterised by shy, quiet, or restrained behaviours in response to novel, unfamiliar situations (Kagan et al., 1988). Related temperaments include anxious withdrawal (Rubin et al., 2009), shy-inhibited temperament (Prior et al., 2000) and anxious solitude (Gazelle & Ladd, 2003). Behavioural inhibition in the preschool years has been identified as a major risk factor for subsequent anxiety in a number of longitudinal studies (Chronis-Tuscano et al., 2009; Hudson et al., 2019; Schwartz et al., 1999). A recent meta-analysis concluded that behavioural inhibition in the preschool years was associated with an almost three-fold increase in the odds of developing anxiety subsequently (OR = 2.80, 95% CI = 2.03 to 3.86) (Sandstrom et al., 2020). Several etiological models of childhood anxiety suggest a central role for preschool behavioural inhibition (e.g., Liu & Pérez-Edgar, 2019; Rapee et al., 2009; Rubin et al., 2009). For instance, Rapee et al. (2009) argued that behavioural inhibition may elicit and interact with environmental risk factors such as parenting behaviours and parental anxiety disorders in the development of anxiety. Similarly, Rubin et al. (2009) proposed that social withdrawal may elicit difficult peer relationships (e.g., peer victimisation, rejection, exclusion) due to poor social skills, which further increases the likelihood of developing anxiety.

Recent empirical evidence provides support for these predictions. For example, Hudson, Murayama, Meteyard, Morris and Dodd (2019) found that behaviourally inhibited preschool-aged children experienced greater anxiety symptoms in early adolescence (aged 12) if their mothers were observed to exhibit high levels of overinvolved parenting at age four. Conversely, this elevated risk for anxiety in behaviourally inhibited preschool-aged children was mitigated when their mothers showed low levels of overinvolvement at age four. In terms of peer relationships, Frenkel et al. (2015) demonstrated that behavioural inhibition in childhood interacted with social involvement with peers in adolescence to predict risk for developing anxiety disorders in adulthood. That is, behaviourally inhibited

children involved in smaller and less socially active peer networks were at a heightened risk for anxiety disorders in adulthood, compared to their behaviourally inhibited peers who were involved in larger and more socially active peer networks.

Due to the central role that preschool behavioural inhibition plays in the development of subsequent anxiety, intervention and prevention programmes targeting inhibited preschool-aged children have been developed. These aim to prevent (selective programs) or reduce the severity (indicated programs) of anxiety disorders. Interventions (selective and/or indicated programs) that have been developed so far feature two main pathways, in line with the etiological models described above. First, parent education programs (e.g., Cool Little Kids; Rapee, Kennedy, & Lau, 2010) target key parenting behaviours that interact with preschool behavioural inhibition such as overinvolvement and overcontrol/intrusion to ensure that parents promote social approach behaviours and reduce avoidance in their preschool-aged child. The other intervention pathway focuses on working directly with preschool-aged children, focusing on social skills training (e.g., Social Skills Facilitated Play program; Coplan et al., 2010) with the aim of improving social competence and social participation in behaviourally inhibited children. More recent interventions have also begun to combine both the child-focused and parent-focused approaches (e.g., Turtle Program; Chronis-Tuscano et al., 2015).

There is initial evidence that these interventions might be effective in reducing anxiety and/or behavioural inhibition (e.g., Coplan et al., 2010; Kennedy et al., 2009) but positive effects are not consistently found (e.g., Bayer et al., 2018; LaFreniere & Capuano, 1997; Rapee et al., 2005). To date, there has been no systematic synthesis of the effectiveness of these interventions for behaviourally inhibited preschool-aged children. Given that the literature on interventions for preschool inhibition is beginning to accumulate, this systematic review aimed to provide a preliminary synthesis on the efficacy of such interventions by systematically evaluating and summarising data from randomised

controlled trials of selective and/or indicated psychological interventions for behaviourally inhibited preschool-aged children. This systematic review focused on interventions targeting preschool behavioural inhibition as a risk-factor, regardless of the preschool-aged children's anxiety disorder status at baseline. This approach is distinct from a previous meta-analysis which examined prevention interventions for children and adolescents at-risk of anxiety (e.g., elevated anxiety symptoms or sensitivity, parent anxiety disorder), excluding trials where participants may already have had an anxiety disorder (Lawrence et al., 2017). In defining efficacy, we were interested not only in whether such interventions lead to a reduction in anxiety but also whether they positively affected behavioural inhibition. Therefore, we examined whether interventions for behaviourally inhibited preschool-aged children are effective in reducing (a) behavioural inhibition, and (b) anxiety symptoms and diagnosis.

## **2. Methods**

The protocol for the current meta-analysis was registered on the International Prospective Register of Systematic Reviews (PROSPERO; protocol number: CRD42020170666) on 25 March 2020.

### **2.1 Search Strategy**

We searched four electronic databases (Web of Science, MEDLINE, PsycINFO and CINAHL) from inception to 15 March 2021. Details of the search terms and syntax for each database are available in the PROSPERO protocol (see Supplementary Material 1). No restrictions were imposed for date of publication or language. Reference lists of relevant book chapters, review articles and eligible articles were screened to identify further studies missed by the electronic search.

## 2.2 Eligibility Criteria

Studies were included if they met the following criteria:

1. Participants were preschool-aged children (between 3 – 7 years) and their parents and/or teachers
2. Participants (children) were selected for inclusion on the basis of being behaviourally inhibited, regardless of whether they were identified as having an anxiety disorder or not. Constructs described other than behavioural inhibition (e.g., fearful temperament, shyness/inhibition) were included as long as the definition and measurement of this construct was the same or very similar to behavioural inhibition; which was defined as shyness, fear and avoidance when faced with new stimuli.
3. Reported outcomes using:
  - A validated measure or standardized laboratory observation of behavioural inhibition
  - A recognised diagnostic tool for a DSM-IV or DSM-5 anxiety disorder, or a validated measure of anxiety symptoms
4. Randomised Controlled Trial (RCT) design, comparing an intervention with a waitlist and/or active comparison condition.
5. Included an active intervention which aimed to reduce behavioural inhibition, anxiety symptoms and/or incidence of anxiety disorders in preschool-aged children.
6. Published in a peer-reviewed journal.

Studies without primary data (e.g., reviews) and those that reported qualitative data only were excluded. Additionally, universal interventions (whole populations) and studies that focused on children with intellectual disabilities, neurodevelopmental disorders or specific health conditions were excluded as the current meta-analysis focused on intervention for behaviourally inhibited children from the general population.

### 2.3 Study Selection/ Screening Method

Figure 1 shows a summary of the search and screening method using a Preferred Reporting Items for Systematic Reviews and Meta-analysis (PRISMA) flowchart. Two authors (JO and JB) independently screened all ( $n = 8167$ ) the retrieved titles and abstracts for eligibility. There was a 99.8% agreement on eligibility between raters. Inter-rater reliability on eligibility between raters was substantial,  $\kappa = .99$ . The full texts of eligible studies were then independently reviewed and rated by JO and JB. There was an 88.9% agreement on inclusion between raters. Inter-rater reliability on inclusion between raters was substantial,  $\kappa = .72$ . Disagreements regarding inclusion were resolved by a third member of the research team, LP. Where the same trial was reported in multiple publications (e.g., multiple follow-ups of the same sample), the publication reporting outcomes most relevant to the systematic review was chosen for inclusion to avoid repeated inclusion of data from the same participants.



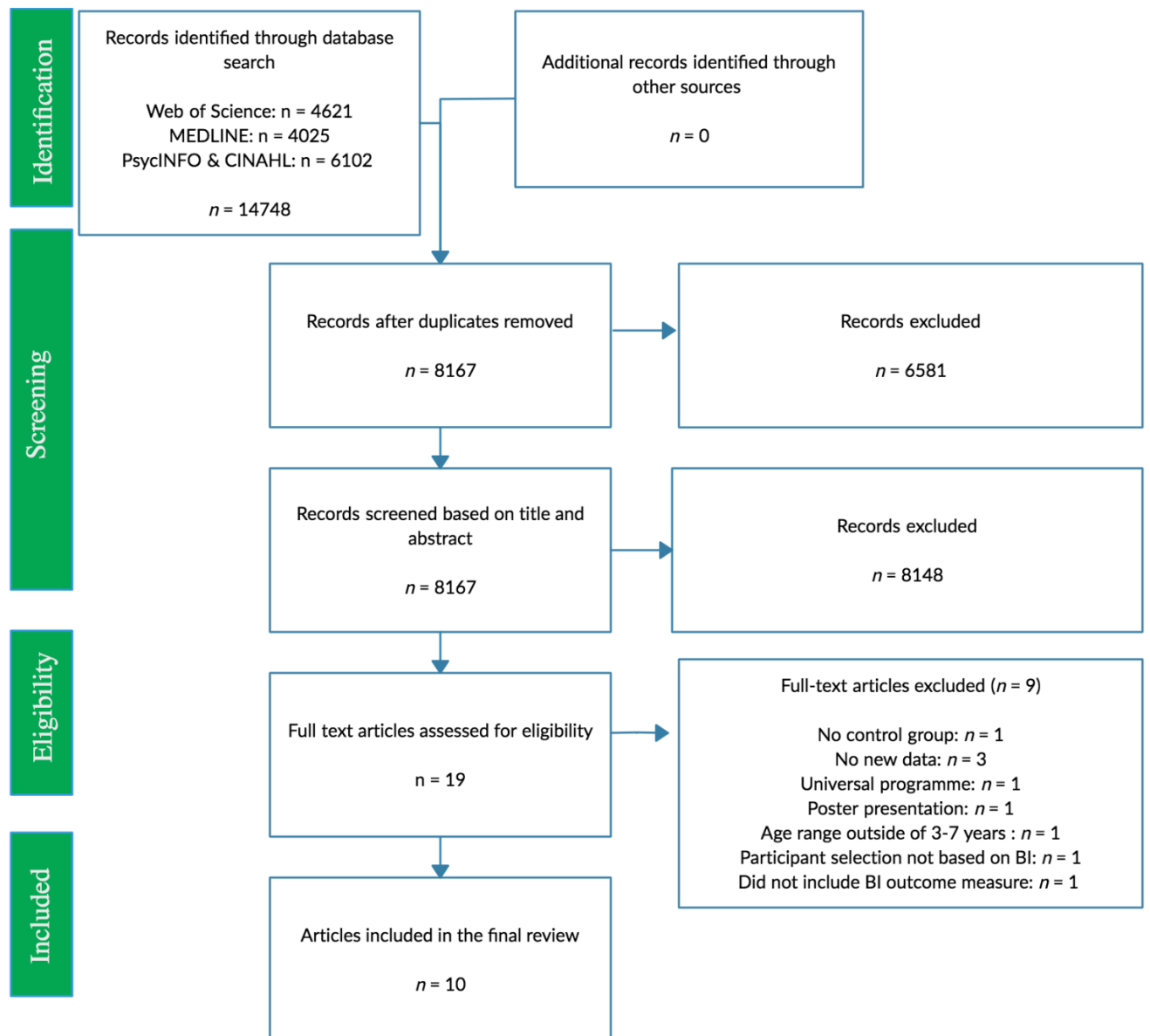


Figure 1. PRISMA diagram of the study selection process.

## 2.4 Data Extraction

Data were extracted and coded by JO. To ensure accuracy, 25% of the studies were cross-checked by JB, resulting in no disagreement. Information extracted were a) study characteristics (e.g., year of publication, study location: country), b) sample characteristics (e.g.,  $N$ , age, nature of risk), c) intervention characteristics and control condition (e.g., intervention recipient: child and/or parent, intervention type: parenting and/or social skills training, waitlist/care as usual), d) primary outcome data for BI, and e) secondary outcome

data for anxiety diagnosis and/or symptoms (e.g., name of BI/anxiety outcome measures, respondent, percentage or *Ms* and *SDs* for each condition at post-intervention and/or follow-ups). See Tables 1 and 2 for characteristics of the included studies and summary of outcome measurement respectively. Study authors were contacted where there was insufficient data for calculating an effect size.

## 2.5 Assessment of Study Quality and Publication Bias

Study quality was assessed using the quality assessment instrument developed by Moncrieff, Churchill, Drummond and McGuire (2001). The Moncrieff et al. (2001) instrument was developed specifically to assess the quality of controlled trials for mental health interventions. The scale assesses specific methodological issues relevant to mental health interventions, such as clear operationalisation of the nature of the mental health condition, including severity. The scale consists of 23 items which are rated between 0 and 2, generating a total score ranging between 0 and 46; higher scores suggests greater quality for studies. To check for reliability, JO rated all the studies ( $n = 10$ ), and 25% of the studies were rated by LP. Percentage agreement for the individual items in the scale was 92.77%. Inter-rater reliability for total quality score between raters was good,  $\kappa = .85$ .

## 2.6 Data Synthesis

Analyses were performed using Meta-Analysis via Shiny (MAVIS version 1.1.3; Hamilton et al., 2017). Random effects models were used to account for the expected heterogeneity in effect sizes between trials due to the diversity in type of interventions trialled, target populations, type of measurements used, and duration of measurement (i.e., post-intervention up to 12-months follow-up).

For continuous outcome measures (i.e., BI-related behaviours and anxiety symptoms), standardized mean differences (SMD) were calculated for each trial by

subtracting the mean of the intervention condition from the mean of the control condition at post-intervention/follow-up, divided by the pooled standard deviation for the intervention and control conditions at post-intervention/follow-up. To calculate the pooled SMDs, the SMD and the 95% confidence interval for each trial was weighted according to sample size using random effects models. Pooled SMDs were reported using Hedge's  $g$ , with 0.2, 0.5, and 0.8 indicating small, moderate, and large effects respectively (Cohen, 1988). For diagnostic outcome measures (i.e., anxiety disorder diagnosis), odds ratios (OR) were calculated and pooled. OR represents the odds that an outcome (diagnosis of one or more anxiety disorders) will occur in the intervention group, compared to the odds of the outcome occurring in the control group. As such, an OR of 1 suggests that the odds for a diagnosis of anxiety disorder are the same for both the treatment and control groups.

Estimates of heterogeneity were calculated using the Q statistic and the  $I^2$  statistic. A statistically significant Q statistic ( $p < .05$ ) suggests evidence of heterogeneity. The  $I^2$  statistic quantifies the degree of heterogeneity, with 25% indicating 'low', 50% indicating 'moderate', and 75% indicating 'high' heterogeneity (Higgins et al., 2003).

For primary outcomes, three meta-analyses were conducted to examine the pooled effects of interventions on BI-related behaviours, assessed using (1) laboratory observations, (2) parent-report and (3) teacher-report. Next, secondary outcomes on the pooled effects of interventions on anxiety were assessed by conducting two meta-analyses: (1) the presence of an anxiety disorder, and (2) parent-report measures of anxiety symptoms. Only two eligible studies assessed teacher-report anxiety symptoms (Chronis-Tuscano et al., 2015; Luke et al., 2017); the SMDs for each study will be reported but the pooled effects will not be explored given that the type of intervention and outcome measures used were different. Moderation analyses were not explored due to the limited number of studies in the meta-analyses.

Effect sizes were included for the available outcome measures within the relevant meta-analysis. Where more than one outcome measure of a single outcome was included (e.g., two parent-report measures of anxiety), the primary outcome measure or the one most widely used in other studies, or with the strongest psychometric properties, was chosen. For parental measures, if paternal- and maternal-report measures were reported separately, the maternal-report measure was used to facilitate pooling of effects across studies; most studies included in this meta-analysis had mothers as the primary reporters. If more than one time-point was reported, data from the latest time-point was used as we were interested in the intervention effects over a sustained period of time. Given the limited number of studies included, it was not possible to conduct separate analyses for specific follow-up periods, which means that the outcome ranges across studies from post-intervention to 12-month follow-up.

### **3. Results**

#### **3.1 Study Selection**

Overall, 8167 studies were identified, and 10 studies met inclusion criteria (see Figure 1). Three studies reported on BI-related behaviours only (Barstead et al., 2018; Coplan et al., 2010; LaFreniere & Capuano, 1997), while two studies reported on anxiety only (Bayer et al., 2018; Morgan et al., 2017). The remaining five studies reported on both outcomes (Chronis-Tuscano et al., 2015; Kennedy et al., 2009; Lau et al., 2017; Luke et al., 2017; Rapee et al., 2005).

#### **3.2 Study Characteristics**

Table 1 summarises the characteristics of all the studies included in the meta-analyses. The total number of participants from the included studies were 1475. Table 2

describes BI screening measures and outcome measures for BI-related behaviours, Table 3 describes outcome measures for anxiety diagnosis and symptoms.

Most ( $\kappa = 8$ ) of the included studies selected preschool-aged children based on their elevated BI only, while two studies selected for preschool-aged children with elevated BI and parental mental health difficulties. Screening for elevated BI was done predominantly using two measures: the Behavioral Inhibition Questionnaire (BIQ; Bishop et al., 2003) ( $\kappa = 4$ ) and the Approach subscale of the Short Temperament Scale for Children (STSC; Prior et al., 2000) ( $\kappa = 5$ ). The cut-off scores used for screening elevated BI varied between studies, even when the same screening measure was used. For the BIQ (Bishop et al., 2003), three studies selected for preschool-aged children scoring on the 85<sup>th</sup> percentile and above, while one study used a lower cut-off on the 80<sup>th</sup> percentile and above. For the Approach subscale of the STSC (Prior et al., 2000), four studies used a cut-off score of 30 and above, while one study used a higher cut-off score of 35 and above.

With regards to the type of interventions, six studies evaluated parent education programs:  $\kappa = 5$  for Cool Little Kids (Rapee, Kennedy, & Lau, 2010),  $\kappa = 1$  for Parent-Child Interaction Training (LaFreniere & Capuano, 1997). One study evaluated a social skills training program: Social Skills Training and Facilitated Play (SST-FP; Coplan et al., 2010). Finally, three studies evaluated programs which combined both parent education and social skills training:  $\kappa = 2$  for Turtle Program (Danko et al., 2018),  $\kappa = 1$  for combination of the Cool Little Kids and the SST-FT programs. Parents were the primary recipients for parent education programs, while preschool-aged children were the primary recipients for social skills training programs.

Additionally, the duration of measurement also varied across studies (see Tables 2 and 3). Four studies reported post-intervention data only. For follow-ups, only one study provided data for 3-month follow-up, while three studies reported 6-month follow-up data as their latest time-point. Out of the two studies that reported data for 12-month follow-up,

one study reported mid- and longer-term follow-up periods (i.e., 2-year, 3-year, and 11-year follow-ups) (Rapee, 2013; Rapee et al., 2005; Rapee, Kennedy, Ingram, et al., 2010), while the remaining study recently reported their 2-year follow-up data (Bayer et al., 2018, 2020). Due to the limited duration of measurement reported in the other studies in this review, only the 12-month follow-up data from both the Rapee et al. (2005) and Bayer et al. (2018) studies will be included in the current meta-analyses. Subsequent follow-ups of these studies will be discussed qualitatively.

In terms of outcome measures, the measures used to assess temperament-related outcomes at post-intervention/follow-ups were varied between studies. Out of the four studies that conducted laboratory observations, two studies used the Reticence/Reticence-Wariness scores from the Play Observation Scale (POS & POS-R; Rubin, 2001, 2008) while the remaining two studies used the procedure developed by Kagan and colleagues (Kagan, 1994; Kagan et al., 1989). For parent-reported temperament-related outcomes, three out of the four studies used the BIQ (Bishop et al., 2003), while one study used the Social Inhibition subscale of the Temperament Assessment Battery for Children – Revised (Presley & Martin, 1994). Similarly, for teacher-reported temperament-related outcomes, two out of the four studies used the Anxious-Fearful subscale of the Child Behaviour Scale (CBS; Ladd & Profilet, 1996), while each of the two remaining studies used the Anxiety-Withdrawal subscale of the Social Competence and Behaviour Evaluation (SCBE; LaFreniere & Dumas, 1995) and the Anxious Shyness subscale of the Chinese Shyness Scale (Xu et al., 2007, CSS; 2009).

There was greater consistency across studies in the outcome measures used to assess anxiety at post-intervention/follow-ups. For anxiety diagnosis, the majority of studies ( $k = 4$ ) used the Anxiety Disorders Interview Schedule for DSM-IV Parent version (ADIS-IV-P; Silverman & Albano, 1996), while each of the remaining two studies used the Online Assessment of Preschool Anxiety (OAPA; Morgan et al., 2019) and the Preschool Age Psychiatric Assessment (PAPA; Egger et al., 1999) respectively. When anxiety symptoms

were reported by parents, five out of the six studies used the Preschool Anxiety Scales (PAS & PAS-R; Edwards et al., 2010; Spence et al., 2001).

Table 1

*Characteristics of Included Studies*

<b>Study</b>	<b>N</b>	<b>Gender % F</b>	<b>M Age (Years) (range)</b>	<b>% Baseline AD Int (Ctrl)</b>	<b>Nature of Risk</b>	<b>Recipient</b>	<b>Intervention Approach</b>	<b>Control Condition</b>	<b>Intervention Target</b>	<b>Intervention Name</b>
Barstead et al. (2018)	40	56	4.3 (3.5 - 5.0)	N/A	BI	P + C	PCIT + SST	WL	BI	Turtle Program
Bayer et al. (2018)	545	48.3	4.6 (4.0)	N/A	BI	P	CBT	UC	AD, AS	Cool Little Kids
Chronis-Tuscano et al. (2015)	40	57.5	4.4 (3.5 - 5.5)	77.8 (45.5)	BI	P + C	PCIT + SST	WL	BI, AD, AS	Turtle Program
Coplan et al. (2010)	28	50	4.7 (4.0 - 5.5)	N/A	BI	C	SST	WL	BI	SST-FP
Kennedy et al. (2010)	71	54.5	3.9 (3.0 - 4.8)	100 (100)	BI + Parent AD	P	CBT	WL	BI, AD, AS	Cool Little Kids
LaFreniere & Capuano (1997)	43	53.49	4.5 (2.6 - 5.8)	N/A	BI	P	PCIT	UC	BI	NA
Lau et al. (2017)	72	47.2	4.3 (3.0 - 5.4)	100 (100)	BI + High PES	P + C	CBT + SST	WL	BI, AD, AS	Cool Little Kids + SST-FP
Luke et al. (2017)	57	38.6	3.9 (3.0 - 5.3)	N/A	BI	P	CBT	WL	BI, AS	Cool Little Kids
Morgan et al. (2017)	433	52.7	4.8 (3.0 - 6.0)	N/A	BI	P	CBT	WL	AS	Cool Little Kids Online
Rapee et al. (2005)	146	54.5	3.9 (3.0 - 5.2)	90.0 (91.5)	BI	P	CBT	UC	BI, AD, AS	Cool Little Kids

**% Baseline AD [Int (Ctrl)]:** % Baseline Anxiety Diagnosis [Intervention (Control)]; **Nature of risk:** BI = Elevated Behavioural Inhibition, High PES = High Parental Emotional Distress [at least one parent scoring  $\geq 30$  on the Depression Anxiety Stress Scales (Lovibond & Lovibond, 1995)], Parent AD = at least one parent meeting DSM-IV criteria for diagnosis of anxiety disorder; **Recipient:** C = child, P = parent; **Intervention Approach:** CBT = Cognitive Behavioural Therapy, SST = Social Skills Training, PCIT = Parent-



Child Interaction Training; **Control Condition:** WL = Wait-List control, UC = Usual Care; Intervention Target: BI = Behavioural Inhibition, AD = Anxiety Diagnosis, AS = Anxiety Symptoms; **Intervention Name:** Cool Little Kids (Rapee, Kennedy, & Lau, 2010), SST-FP = Social Skills Training and Facilitated Play Program (Coplan et al., 2010), Turtle Program (Danko et al., 2018).

Table 2

*Outcome Measures for Temperament-related Behaviours and Duration of Measurement*

<b>Study</b>	<b>BI Screening Measure</b>	<b>Respondent for BI screening</b>	<b>Temperament-related Outcome Measures</b>	<b>Respondent of Temperament-related Outcomes</b>	<b>Duration of Measurement (months follow-up)</b>
Barstead et al. (2018)	BIQ BI cut-off: score of 132 or more (85th percentile and above)	P	Reticence (POS-Revised) Anxious-Fearful subscale (CBS)	C T	Post-intervention
Bayer et al. (2018)	Approach subscale of the STSC BI cut-off: score of 30 and above	P	N/A	N/A	N/A
Chronis-Tuscano et al. (2015)	BIQ BI cut-off: score of 132 or more	P	BIQ	P	Post-intervention
Coplan et al. (2010)	BIQ BI cut-off: highest 15%	P	Reticence-wariness (POS) Anxious-Fearful subscale of the CBS	C T	Post-intervention
Kennedy et al. (2010)	Approach subscale of the STSC BI cut-off: score of higher than 35 + Laboratory Observation	P + C	Laboratory Observation BIQ	C P	6
LaFreniere & Capuano (1997)	Anxiety-Withdrawal subscale of the SCBE BI cut-off: 1SD above mean	T	Anxiety-Withdrawal subscale of the SCBE	T	Post-intervention
Lau et al. (2017)	Approach subscale of the STSC BI cut-off: score of 30 and above	P	BIQ	P	6

Luke et al. (2017)	BIQ BI cut-off: highest 20%	T	Anxious Shyness subscale of the Chinese Shyness Scale (CSS-AS)	T	3
Morgan et al. (2017)	Approach subscale of the STSC BI cut-off: score of 30 and above	P	N/A	N/A	N/A
Rapee et al. (2005)	Approach subscale of the STSC BI cut-off: score of higher than 30 + Laboratory Observation	P + C	Laboratory Observation  Social Inhibition subscale of the TABC-R	C  P	12 24

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**BI screening measure:** STSC = Short Temperament Scale for Children (Prior et al., 2000), BIQ = (Bishop et al., 2003), SCBE = Social Competence and Behaviour Evaluation (LaFreniere & Dumas, 1995), Laboratory Observation (Asendorpf, 1990; Kagan, 1994; Kagan et al., 1984, 1989); **Respondent for BI screening:** P = Parent, T = Teacher, C = Clinician; **BI-related Outcome Measures:** CSS = Chinese Shyness Scale (Xu et al., 2007, 2009), BIQ = (Bishop et al., 2003), POS = Play Observation Scale (Rubin, 2001), POS-Revised = Play Observation Scale - Revised (Rubin, 2008), laboratory observation (Kagan, 1994; Kagan et al., 1989); TABC-R = Temperament Assessment Battery for Children – Revised (Presley & Martin, 1994), CBS = Child Behaviour Scale (Ladd & Profilet, 1996), SCBE = Social Competence and Behaviour Evaluation (LaFreniere & Dumas, 1995); **Respondent of BI-related Outcomes:** T = Teacher, P = Parent, C = Clinician; N/A = Information not available.

Table 3

*Outcome Measures for Anxiety and Duration of Measurement*

<b>Study</b>	<b>Anxiety Diagnostic Tool (Respondent)</b>	<b>Anxiety Symptoms Measure (Respondent)</b>	<b>Duration of Measurement (months)</b>
Barstead et al. (2018)	N/A	N/A	N/A
Bayer et al. (2018)	ADIS-IV-P (Clinician)	Emotional Symptoms subscale of SDQ (Parent)	12
		PAS-R (Parent)	24
Chronis-Tuscano et al. (2015)	PAPA (Clinician)	PAS (Parent)	Post-intervention
Coplan et al. (2010)	N/A	N/A	N/A
Kennedy et al. (2010)	ADIS-IV-P (Clinician)	PAS-R (Parent)	6
LaFreniere & Capuano (1997)	N/A	N/A	N/A
Lau et al. (2017)	ADIS-IV-P (Clinician)	PAS-R (Parent)	6
Luke et al. (2017)	N/A	Internalising construct of CBS (Teacher)	3
Morgan et al. (2017)	OAPA (Parent)	PAS-R (Parent)	3 6
Rapee et al. (2005)	ADIS-IV-P (Clinician)	PAS (Parent)	12 24 36 132

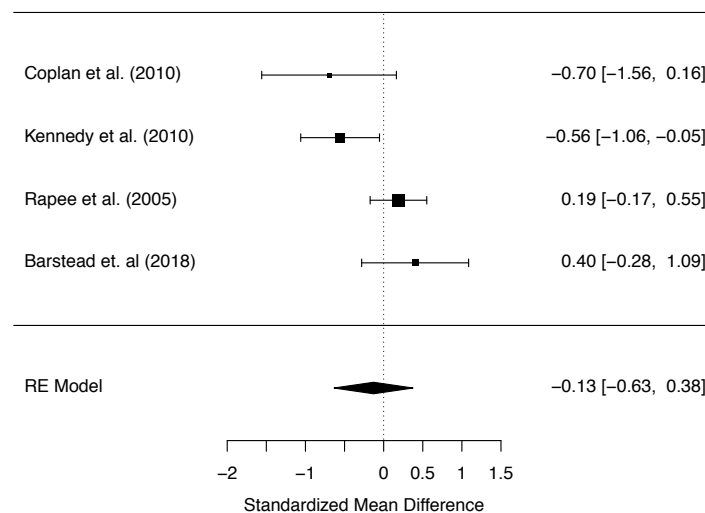
**Anxiety Diagnostic Tool:** ADIS-IV-P = Anxiety Disorders Interview Schedule for DSM-IV Parent version (Any Anxiety Disorders) (Silverman & Albano, 1996), OAPA = Online Assessment of Preschool Anxiety (Any Anxiety Diagnosis) (Morgan et al., 2019), PAPA = Preschool Age Psychiatric Assessment (Any Anxiety Diagnosis) (Egger et al., 1999);

**Anxiety Symptoms Measure:** SDQ = Strength and Difficulties Questionnaire (Goodman, 2001), PAS-R = Preschool Anxiety Scale Revised (Edwards et al., 2010), CBS = Child Behaviour Scale (Ladd, 2010), PAS = Preschool Anxiety Scale (Spence et al., 2001); N/A = Information not available.

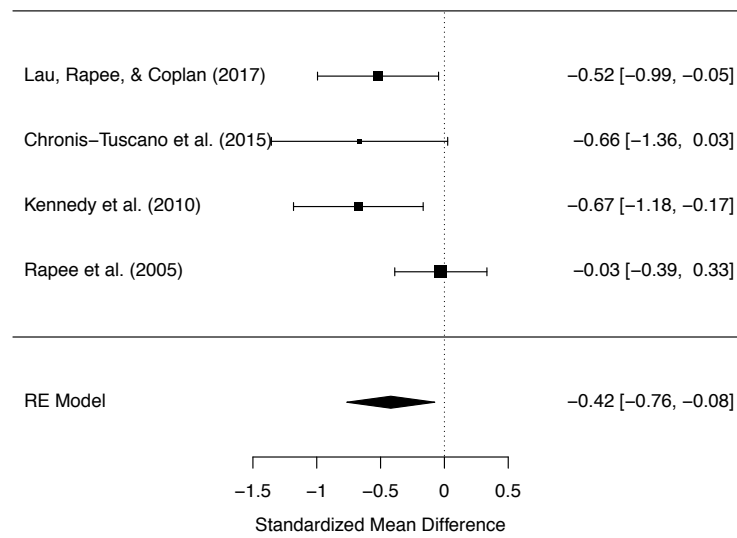
### 3.3 The Effect of Intervention on Preschool-aged Children's Behavioural Inhibition

For laboratory observations of BI, there was a non-significant effect of intervention (SMD =  $-0.13$ , 95% CI =  $-0.63$  to  $0.38$ ,  $p = .62$ ,  $\kappa = 4$ ) (See Figure 2A). Statistical heterogeneity in effect sizes across studies was moderate ( $Q = 9.43$ ,  $p = .02$ ,  $I^2 = 68.5\%$ ). In contrast, parent-report measures showed a significant small effect of intervention (SMD =  $-0.42$ , 95% CI =  $-0.76$  to  $-0.08$ ,  $p = .02$ ,  $\kappa = 4$ ). Heterogeneity between studies in this analysis was low ( $Q = 5.91$ ,  $p = .12$ ,  $I^2 = 49.42\%$ ) (See Figure 2B). Finally, teacher-report measures showed a significant moderate effect of intervention (SMD =  $-0.69$ , 95% CI =  $-1.02$  to  $-0.36$ ,  $p < .001$ ,  $\kappa = 4$ ). Statistical heterogeneity between studies in this analysis was low ( $Q = 1.48$ ,  $p = .69$ ,  $I^2 = 0.00\%$ ) (See Figure 2C).

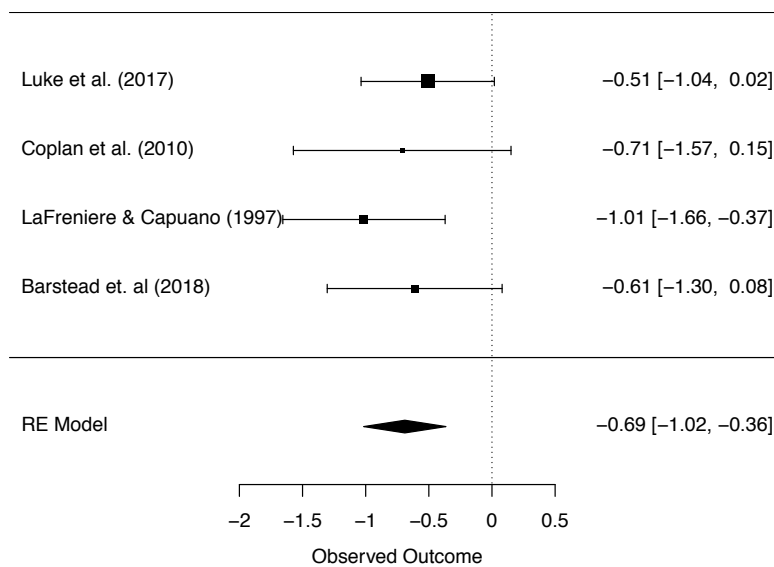
(A)



(B)



(C)



**Figure 2.** Forest plot of the effect of intervention on young children’s behavioural inhibition.

**Note:** A: Laboratory observations; B: Parent-report measures; C: Teacher-report measures

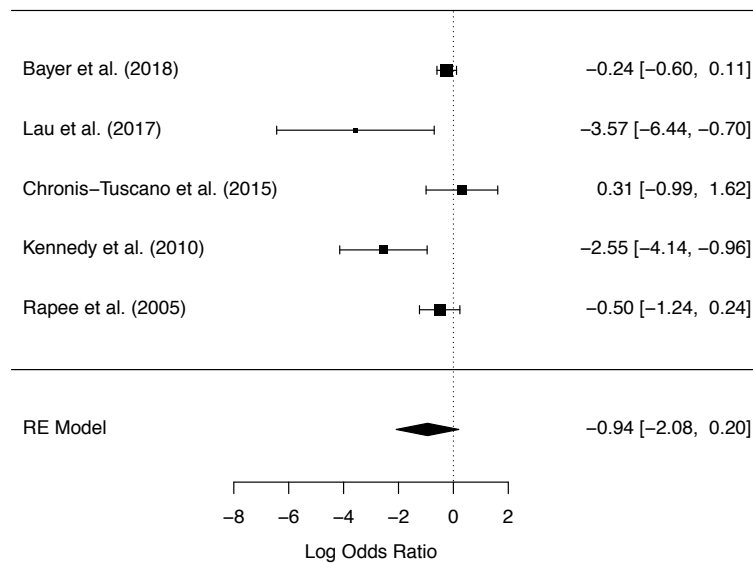
### 3.4 The Effect of Intervention on Preschool-aged Children’s Anxiety

There was a non-significant effect of intervention on behaviourally inhibited preschool-aged children’s anxiety diagnosis (log OR = -.94, 95% CI = -2.08 to .20,  $p = .11$ ).

Statistical heterogeneity between studies was high ( $Q = 13.62$ ,  $p < .01$ ,  $I^2 = 84.78\%$ ) (See Figure 3A).

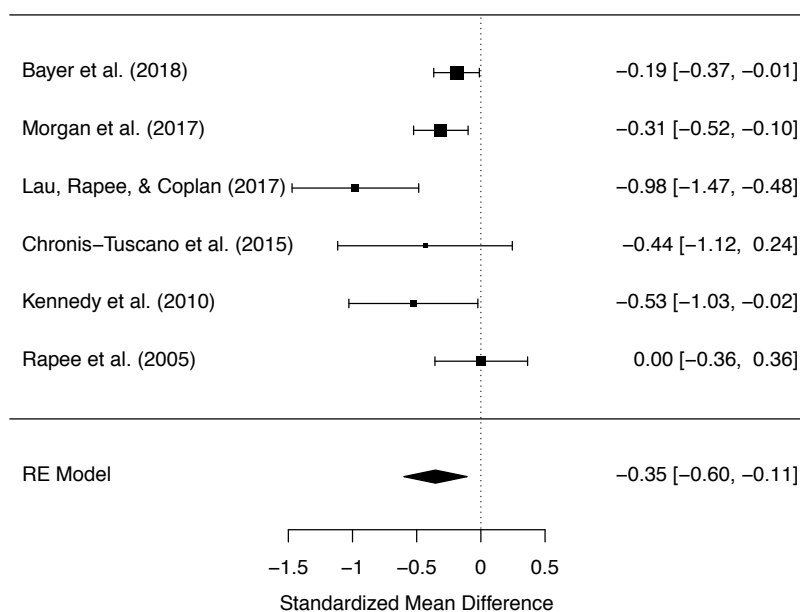
In contrast, parent-report anxiety symptom measures showed a significant small effect of intervention (SMD =  $-0.35$ , 95% CI =  $-0.60$  to  $-0.11$ ,  $p < .01$ ,  $\kappa = 6$ ). Statistical heterogeneity between studies was moderate ( $Q = 12.25$ ,  $p = .03$ ,  $I^2 = 68.34\%$ ) (See Figure 3B). For teacher-report anxiety symptoms, only two studies were identified. As such, results from these studies were not included in a meta-analysis and effect sizes of the individual studies were described instead. Chronis-Tuscano et al. (2015) reported a large effect size in favour of intervention (Hedge's  $g = -0.67$ , CI =  $-1.36$  to  $0.03$ ). In contrast, Luke et al. (2017) reported a small effect size in the opposite direction to intervention (Hedge's  $g = -0.13$ , CI =  $-0.39$  to  $.65$ ).

(A)





(B)



**Figure 3.** Forest plot of the effect of interventions on young children's anxiety.

**Note:** A: Diagnosis of Anxiety Disorder; B: Parent-report measures of anxiety symptoms

### 3.5 Quality Ratings

Scores from the Moncrieff et al. (2001) quality rating indicated common methodological problems in the design and reporting of studies. Likely due to limited resources, half of the studies ( $k = 5$ ) were rated as having inadequate sample size ( $n$  per group  $< 50$ ). Similarly, only half of the studies ( $k = 5$ ) were rated as having a trial duration (including follow-up) that was long enough to assess longer-term outcomes ( $\geq 6$  months). In terms of reporting, only 3 out of the 10 studies reported details of the power calculation, while 4 out of the 10 studies explicitly reported 'intention to treat' analyses. Additionally, only 3 studies reported the number of withdrawals by group, including the reason for withdrawal, while the remaining 7 studies reported on the number of withdrawals only, without reporting on the reason for withdrawal. Correlations between the quality rating and study effect size was not explored due to the limited number of studies included in this review.

### 3.6 Publication Bias

Given the limited number of studies included in the analyses, it was not possible to reach firm conclusions about publication bias.

## 4. Discussion

The current meta-analysis aimed to provide a preliminary synthesis on the effectiveness of intervention for behaviourally inhibited preschool-aged children. Firstly, we examined whether intervention was efficacious in reducing behavioural inhibition, as reported by the following informants: (a) laboratory observers (b) parents, and (c) teachers. Findings on the efficacy of such interventions were mixed. Observer-ratings of structured laboratory observations (SMD = -.13) indicated a non-significant effect of intervention. In contrast, parent-report (SMD = -.42) and teacher-report (SMD = -.69) measures of behavioural inhibition showed significant small and moderate effects of intervention respectively, in favour of the intervention conditions. Overall, intervention appeared to reduce behavioural inhibition in preschool-aged children when reported by parents and teachers, but not when assessed by laboratory observers.

Next, we explored whether intervention was effective in reducing anxiety disorders and anxiety symptoms as reported by parents and teachers. Intervention was not significantly associated with a greater reduction in the odds of having an anxiety diagnosis in the intervention conditions, compared to control (OR = .39, 95% CI = 0.13 to 1.22). However, parents reported a significant, albeit small, reduction in anxiety symptoms in the intervention conditions, compared to the control conditions (SMD = -.35). Given that only two studies included teacher-report measures, the effect size of each study was described. While Chronis-Tuscano et al. (2015) reported a moderate effect of teacher-report anxiety symptoms in favour of the intervention condition (Hedge's  $g$  = -.67), Luke et al. (2017) only found a small effect favouring the intervention condition (Hedge's  $g$  = -.13). In summary, intervention appeared to reduce anxiety symptoms in preschool-aged children when

reported by parents, while evidence on teacher-report anxiety symptoms is currently limited. There was no evidence that intervention was effective in reducing anxiety *disorders*, as assessed by laboratory observers, in preschool-aged children.

#### 4.1 Conceptual and Clinical Implications

As noted previously, studies in this meta-analysis only reported outcomes between post-intervention and 1-year follow-up. It is therefore important to stress that findings should be interpreted as *short-term* outcomes of intervention for inhibited young children. Accordingly, the conceptual and clinical implications should be interpreted with this limited interval in mind.

Findings revealed that some aspects of preschool behavioural inhibition may be more amenable than previously thought (Buss & Plomin, 1984; Kagan, 1994), which is consistent with longitudinal evidence that temperament fluctuates across development (Pérez-Edgar & Fox, 2005; Sanson, 1996). However, the evidence is not yet compelling. Although parents and teachers reported a reduction in preschool-aged children's behavioural inhibition following intervention, this change was not observed in structured laboratory observations.

Current evidence supports the risk/vulnerability model (Rapee & Coplan, 2010), in which temperament is considered distinct from psychopathology and affects a child's likelihood of developing an internalising disorder (Dodd et al., 2017). Rapee and Bayer (2018) argued that interventions may be altering the more transient expression of anxiety, while temperamental inhibition remains unchanged. Based on our findings, it is possible that the reductions observed in parent- and teacher-report measures of inhibition reflected changes in preschool-aged children's expression of anxiety. Meanwhile, the lack of evidence for changes in behavioural inhibition based on laboratory observations may indicate that true inhibition remained unchanged by intervention. Alternatively, it is possible that the effects of intervention was not substantial enough in the current meta-analysis to meet the high

threshold for detecting significant change using structured laboratory observations (e.g., Kagan, 1994; Kagan et al., 1989), which is typically considered the 'gold standard' for assessing inhibition due to its methodological rigour. Parent- and teacher-report measures, on the other hand, may be able to detect more subtle changes in certain features of inhibition that were altered by intervention. Additionally, it is also possible that changes in inhibition may be more apparent in familiar contexts where children feel relatively comfortable. Therefore, such changes may be more observable to parents and teachers. In contrast, children with a history of inhibition may revert to more typical ways of responding in unfamiliar contexts, such as in laboratory observations. Finally, findings on parent-reported changes in inhibition should be interpreted with caution given that it was not possible to keep parents blinded from the condition that their children were assigned to due to the nature of the interventions (e.g., parenting education vs waitlist control). However, the concordant evidence from independent sources (i.e., parents and teachers) on the effect of intervention is encouraging, especially given that teachers in all the studies were unaware of the children's condition allocations.

This meta-analysis also demonstrated that intervention was effective in decreasing the severity of anxiety symptoms in behaviourally inhibited preschool-aged children, as reported by their parents. However, there was no evidence that intervention was effective in reducing preschool-aged children's odds of developing an anxiety disorder. As discussed above, it is possible that the effects of intervention were only observable at the symptom severity level but were not substantial enough to alter preschool-aged children's diagnosis status, at least within the duration measured in this meta-analysis (post-intervention to 12-month follow-up).

Beyond the short-term perspective (up to 12-month follow-up) explored in this meta-analysis, two studies also reported mid- and longer-term outcomes (Bayer et al., 2018; Rapee et al., 2005). As mentioned previously, only data from the 12-month follow-up of

these studies were included in this meta-analysis. Bayer and colleagues (2020) recently reported outcomes from their 2-year follow-up, when the children were approximately aged 6. There was a small effect of intervention for both anxiety diagnosis (OR = 1.23) and parent-report anxiety symptoms (Hedge's  $g = -.18$ ). For comparison, Rapee et al. (2010, described further below) reported larger effects for anxiety diagnosis (OR = 3.57, medium effect) but similar effects for parent-report anxiety symptoms (Hedge's  $g = -.17$ , small effect) at 2-year follow-up. However, there is promising indication that preschool-aged children continue to benefit from intervention in the longer term. Rapee and colleagues monitored the cohort of behaviourally inhibited preschool-aged children for 11 years, up to middle adolescence when they were approximately 15 years old (Rapee, 2013; Rapee et al., 2005; Rapee, Kennedy, Ingram, et al., 2010). For anxiety diagnosis, the odds of being diagnosed with an anxiety disorder for preschool-aged children in the intervention group, compared to those in the control group decreased from 1-year follow-up (OR = 1.64, small effect) to 3-year follow-up (OR = 3.45, medium effect). In terms of parent-report anxiety symptoms, the effect of intervention increased from a small effect at 1-year follow-up (Hedge's  $g < .01$ ) to a medium effect at 3-year follow-up (Hedge's  $g = -.45$ ). At 11-year follow-up, girls in the intervention group were less likely to be diagnosed with internalising disorders (anxiety and depressive) and have lower parent-report anxiety symptoms than those in the control group (Rapee, 2013). On the other hand, behavioural inhibition remained largely comparable over time. Overall, these findings indicate that at least for anxiety, intervention may yield benefits in the medium- and long-term.

For a meaningful consideration of clinical implications, it is important to recognise that findings from this review are limited to short-term outcomes and may well underestimate the overall effects of intervention. This is reflected in the quality rating of studies in this review where half of the studies ( $k = 5$ ) measured outcomes (including follow-up) for less than 6 months. At best, the evidence is tentative and preliminary, and

interpretation requires the consideration that this effort is an encouraging first step to a longer-term endeavour in examining the efficacy of intervention for preschool-aged children at risk of developing anxiety. Therefore, longer-term follow-up of interventions is needed to inform the longitudinal clinical implications of intervention, although such an approach raises ethical considerations about withholding treatment from children in the control condition for a protracted period of time. There is also debate about whether intervention should focus on changing inhibited temperament given that approximately half of inhibited preschool-aged children do not go on to develop anxiety later on (Fox et al., 2013). Additionally, evidence for population level intervention is currently limited. A recent population-delivered parenting intervention found modest participation from parents, with only 29.4% of eligible parents attending most sessions offered and only 20.5% of parents reporting using the skills with their children frequently in the first year following intervention (Bayer et al., 2018). These findings suggest that such interventions, at least the parenting programmes, could be more suitable as treatment options for families actively seeking help to prevent anxiety in their preschool-aged children rather than as population level prevention programmes.

An additional limitation of this meta-analysis is that specific factors that impact on the efficacy of intervention could not be explored due to the limited number of studies currently available in the literature. As such, exploration of methodological heterogeneity (e.g., nature of risk: severity of behavioural inhibition, parental mental health, type of intervention: parenting and/or social skills training, recipient of intervention: parent and/or child, duration of outcome measurement: post-intervention, mid- and longer-term follow-ups) through moderation and subgroup analyses could not be carried out. Moreover, scores from the quality rating of the studies also highlighted common methodological problems that might impact on the findings of this review. For instance, half of all studies ( $k = 5$ ) were

rated as having inadequate sample size, which may result in limited statistical power. Indeed only 3 out of the 10 studies reported details of the power calculation.

#### **4.2 Future Directions**

The findings of this review lead to key recommendations for further intervention research. First, there was substantial variation across studies on how preschool behavioural inhibition was defined and measured. The field would benefit from bringing together the various strands of research that examine constructs associated with inhibited temperament, including behavioural inhibition, anxious-withdrawal, shy-inhibited, and anxious solitude. Improving consensus on the definition of inhibited temperament would promote greater consistency in the measurement of inhibition, ideally arriving with a set of mutually agreed multimethod assessment tool (i.e., structured lab observations, parent- and teacher report measures) that can be used across the board (Rapee & Coplan, 2010), in line with recent efforts by the National Institute of Mental Health (NIMH) and the Wellcome Trust calling for greater consensus on outcome measurement in mental health research (The Lancet Psychiatry, 2020).

Second, outcomes from various intervals (post-intervention, and 3-month, 6-month and 12-month follow-ups) were clustered together in the current review partly due to the limited number of available studies, but also from the varied intervals in which outcomes were reported (e.g., post-intervention only vs. first time-point reported at 3-month or 6-month follow-up without post-intervention outcomes). Given that psychological interventions aim to have an enduring impact on preschool-aged children's well-being and functioning, measuring outcomes at more consistent intervals and ideally over the long term would improve our understanding of potential benefits at different stages of the intervention (i.e., short-, medium- and long-term).

Finally, as further evidence continues to accumulate, future efforts could consider exploring factors that may moderate and mediate the effects of intervention. Exploring

intervention characteristics (e.g., type, duration, number of sessions, format of delivery and recipient of intervention), as well as child (e.g., gender, severity of behavioural inhibition, social skills), and environmental factors (e.g., parenting behaviours, parental mental health) would enhance our understanding of factors that moderate the efficacy of intervention. Additionally, exploring how specific treatment components/processes (e.g., exposure, parent training) are associated with change in preschool-aged children's behavioural inhibition and anxiety could enhance the efficacy of intervention.

### **4.3 Conclusion**

Preliminary evidence from this meta-analysis indicated that intervention targeted at behaviourally inhibited preschool-aged children may be effective in reducing behavioural inhibition and anxiety, but not disorder but this change was not consistently observed across all outcomes. Further work is needed to gain a more comprehensive understanding on how to best support preschool-aged children identified as at-risk for anxiety.



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**Supplementary Materials 1****Search Terms and Syntax for Systematic Review****Web of Science, Core Collection****#1**

TI=(behavi\* inhibit\* or inhibited temperament or fearful temperament or inhibit\* or shy\* or anxious-withdrawn) OR AB=(behavi\* inhibit\* or inhibited temperament or fearful temperament or inhibit\* or shy\* or anxious-withdrawn)

**#2**

TI=(preschool\* or pre-school\* or young child\* or child\* or kid\*) OR AB=(preschool\* or pre-school\* or young child\* or child\* or kid\*)

**#3**

TI=(parent\* or social\*) OR AB=(parent\* or social\*)

**#4**

#3 AND #2 AND #1

**MEDLINE via Ovid****1**

(behavi\* inhibit\* or inhibited temperament or fearful temperament or inhibit\* or shy\* or anxious-withdrawn).ab,ti

**2**

(preschool\* or pre-school\* or young child\* or child\* or kid\*).ab,ti

**3**

(parent\* or social\*).ab,ti

**4**

1 AND 2 AND 3

**PsychINFO and CINAHL via EBSCOhost****S1**

TI ( ("behavi\* inhibit\*" or "inhibited temperament" or "fearful temperament" or inhibit\* or shy\* or anxious-withdrawn) ) OR AB ( ("behavi\* inhibit\*" or "inhibited temperament" or "fearful temperament" or inhibit\* or shy\* or anxious-withdrawn) )

**S2**

TI ( ( preschool\* or pre-school\* or "young child\*" or child\* or kid\* ) ) OR AB ( ( preschool\* or pre-school\* or "young child\*" or child\* or kid\* ) )

S3

TI ( (parent\* or social\*) ) OR AB ( (parent\* or social\*) )

S4

S1 AND S2 AND S3

### Chapter 3: Bridging Chapter

The systematic review and meta-analyses in Chapter 2 examined the efficacy of randomized controlled trials of psychological intervention targeting behavioural inhibition and anxiety in preschool-aged children. Interventions that have been developed so far target two main pathways: (1) parent education programs and (2) social skills training for preschool-aged children.

First, parent education programs (e.g., Cool Little Kids; Rapee et al., 2010) target key parenting behaviours that interact with preschool behavioural inhibition such as overinvolvement and intrusion to ensure that parents promote social approach behaviours and reduce avoidance in their preschool-aged child. This approach derived from a large body of evidence showing that parenting behaviours such as parental control/overinvolvement impacts on the development of anxiety in children and young people (Creswell et al., 2011; McLeod et al., 2007; Rose et al., 2018; Van Der Bruggen et al., 2008).

The second pathway focuses on working directly with preschool-aged children, focusing on social skills training (e.g., Social Skills Facilitated Play program; Coplan et al., 2010) with the aim of improving social competence and social participation in behaviourally inhibited children. This approach derived from the social withdrawal literature, which showed that socially withdrawn children tend to exhibit poor social skills, resulting in peer relationship difficulties and subsequent internalising problems (Rubin et al., 2009, 2015, 2018). There is emerging evidence that behaviourally inhibited children are also at a heightened risk of having poor social skills (e.g., Walker et al., 2014). However, the longitudinal impact of peer relationship difficulties on behaviourally inhibited children and young people's anxiety has not been explored. Therefore, Chapter 3 will examine the interplay between preschool behavioural inhibition, peer relationship difficulties, and anxiety in a sample of preschool-aged children over an 8-year period.

**Chapter 4: Empirical Study**

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**The Role of Behavioural Inhibition and Peer Relationship Difficulties in Predicting Anxiety Disorders: A Prospective Study from Early Childhood to Early Adolescence**

Jinnie Ooi<sup>a,\*</sup>, Jennifer L. Hudson<sup>b</sup>, Richard Meiser-Stedman<sup>a</sup>, Laura Pass<sup>a</sup>, Helen F. Dodd<sup>c</sup>

<sup>a</sup> Department of Clinical Psychology and Psychological Therapies, Norwich Medical School, University of East Anglia, Norwich, NR4 7TJ, UK.

<sup>b</sup> Black Dog Institute, University of New South Wales, Hospital Road, Randwick NSW 2031, Australia.

<sup>c</sup> School of Psychology and Clinical Language Sciences, Harry Pitt Building, Earley Gate, Whiteknights, University of Reading, Reading, RG6 6AL, UK.

\*Corresponding author.

E-mail address: [jinnie.ooi@uea.ac.uk](mailto:jinnie.ooi@uea.ac.uk)

Declaration of interest: none.

### Abstract

**Background:** The present study examined the longitudinal relationship between behavioural inhibition (BI), peer relationship difficulties, and anxiety over an 8-year period.

**Methods:** A total of 202 preschool-aged children (aged 3 – 4 years) initially assessed as behaviourally inhibited ( $n = 102$ ) and behaviourally uninhibited (BUI;  $n = 100$ ) were recruited at baseline. Their temperament was assessed using observation and parent-report at baseline, while peer relationship difficulties were reported by mothers and teachers using questionnaires at baseline, 2-year, 5-year and 8-year follow-ups. Anxiety symptoms and disorders were assessed using questionnaires and diagnostic interviews at baseline and at 8-year follow-up.

**Results:** BI children generally exhibited higher levels of peer relationship difficulties than BUI children across time-points. Peer relationship difficulties across time-points were significantly associated with and predictive of anxiety disorders at age 12 generally. Finally, peer relationship difficulties moderated the longitudinal relationship between BI and anxiety diagnosis predominantly when the difficulties were reported by mothers.

**Conclusions:** Outcomes from mothers' assessments suggest that peer relationship difficulties may have less impact on BI compared to BUI children's anxiety risk, suggesting that other factors contribute to BI children's elevated risk. Teachers' assessment however, indicated that high peer relationship difficulties, increase anxiety risk regardless of the children's BI status.

**Keywords:** behavioural inhibition, peer relationships, anxiety, adolescence, longitudinal design

### Introduction

Anxiety disorders are the most common psychological disorders in adolescence (Costello et al., 2005), affecting approximately 10% to 31.9% of young people (Merikangas et al., 2010). Adolescent anxiety also runs a chronic course if left untreated, predicting anxiety in adulthood as well as substance and alcohol abuse/dependence (Copeland et al., 2014; Essau et al., 2014), resulting in substantial personal, societal and economic burden (Erskine et al., 2015; Fineberg et al., 2013). Although the efficacy of treatments for anxiety disorders in children and adolescence is well-established (James et al., 2020), the aetiology of these disorders is less well understood.

Behavioural inhibition (BI) has consistently been identified as a key risk factor for the development of anxiety disorders in a number of longitudinal studies (Chronis-Tuscano et al., 2009; Hudson et al., 2019; Luis-Joaquin et al., 2020). This temperament style reflects the tendency to be shy, quiet, or restrained in novel, unfamiliar situations (Kagan et al., 1984). A recent meta-analysis demonstrated that BI in the preschool years is associated with an almost three-fold increase in the odds of developing an anxiety disorder (Sandstrom et al., 2020). Although this study focuses on BI, alongside peer relationship difficulties, evidence on related temperament constructs such as social reticence, social withdrawal, anxious withdrawal/solitude, and shyness (Fox et al., 2001; Rubin et al., 1999; Schmidt et al., 1997) will also be considered given the close relationship between these constructs.

Etiological models of childhood anxiety have highlighted the importance of the interplay between child temperament and environmental risk factors in understanding the development of anxiety. Peer relations, defined as experiences that individuals have with non-familial age-mates (Rubin et al., 2015), has been identified as one of the environmental factors that may interact with BI in the development of anxiety (Henderson et al., 2018; Rubin et al., 2009). Henderson et al. (2018) suggested that BI may interact with children's social world (including peers) in shaping unique developmental trajectories for inhibited



children. Additionally, Rubin et al. (2009) proposed that social withdrawal may elicit difficult peer relationships (e.g., peer victimisation, rejection, exclusion) due to poor social skills, which may in turn increase the likelihood of internalising problems (anxiety and depression) in middle childhood and early adolescence.

Decades of developmental research has underscored the significance of peer relations for healthy psychosocial development in children and young people. As such, children and young people who struggle in the peer domain are considered at-risk for maladaptive outcomes such as anxiety (see Bukowski et al., 2018, for a review). Peer relations can be examined from multiple levels that vary in the extent of social complexity, namely peer interactions, relationships, and groups (Hinde & Stevenson-Hinde, 2014). Rubin et al. (2018) emphasized the significance of examining BI and peer relations in the context of familiar peers, given that it is within this context that peer relations constructs such as peer relationships and groups occur. More specifically, they proposed that peer interactions and peer relationships with familiar peers may play a particularly important role in moderating the relationship between BI and maladaptive socio-emotional development.

To date, research on the association between BI and peer relations has predominantly focused on interactions (or the lack thereof) with unfamiliar peers. BI in early childhood (from infancy to preschool years) has consistently been associated with social reticence (i.e., low levels of social behaviours involving unoccupied or onlooking behaviours) in laboratory play sessions with unfamiliar peers (e.g., Fox et al., 2001; Henderson et al., 2004; Rubin et al., 1997, 2002). Additionally, early BI has been shown to predict social withdrawal and social discomfort with unfamiliar peers in adolescence (Pérez-Edgar, Bar-Haim, et al., 2010; Pérez-Edgar, McDermott, et al., 2010). Evidence also suggest that children assessed as behaviourally inhibited in early childhood have a heightened risk of having poor social skills. For instance, BI assessed in toddlerhood predicts poor social problem-solving skills (i.e., greater social withdrawal and lower assertiveness) at age seven when interacting with

unfamiliar peers during a social exclusion task (Walker et al., 2014). It is likely that the difficulty BI children have in engaging effectively in social interactions may be due to their fear of novel social situations, which may interfere with their ability to navigate social challenges in a flexible manner (Fox et al., 2005).

Within the context of familiar peer interactions, the literature is relatively limited but there is some suggestion that BI children may lack social competence even when interacting with familiar peers. For instance, when observed in a classroom setting, highly inhibited preschool-aged children displayed fewer positive peer interactions and appeared less confident than their less inhibited peers (Tarullo et al., 2011). Similarly, BI assessed at age 4 predicted lower levels of social competence when interacting with familiar peers at school at age 8 (Bohlin et al., 2005). This is in keeping with Rubin, Coplan and Bowker's (2009) theoretical ideas that BI may be an early indicator of risk for developing an anxiously withdrawn phenotype, characterized by anxiously motivated, self-imposed isolation in the company of familiar peers.

Although the literature on the relationship specifically between BI and peer relationships is limited, a large body of research suggests that anxiously withdrawn children and young people experience difficulties in forming or maintaining positive relationships with their peers and that these difficulties are linked to internalising psychopathology. That is, social withdrawal has been shown to be associated with and predictive of rejection, victimization, and exclusion from familiar peers (e.g., Avant et al., 2011; Bukowski et al., 2010; Coplan et al., 2008; Gazelle & Ladd, 2003; Gazelle & Spangler, 2007; Ladd et al., 2011; Rubin et al., 1993). One explanation offered for why socially withdrawn children experience negative peer relationships is because withdrawal behaviours violate social norms in cultures that value exuberance, sociability and assertiveness (Rubin et al., 2009). Empirical evidence showed that preschool-aged children expressed less liking and desire to play with a socially withdrawn (i.e., shy) peer than a socially competent peer when presented with hypothetical

vignettes (Coplan et al., 2007; Zava et al., 2020). Additionally, social withdrawal is considered to be increasingly less desirable by peers as children increase in age (Ladd, 2006; Molina et al., 2003).

In turn, a recent meta-analysis demonstrated that difficult peer relationships, specifically peer victimization, predicts internalising symptoms (anxiety and depression) in school-aged children (Christina et al., 2021). Moreover, the experience of peer relationship difficulties seem to take a chronic course (Pouwels et al., 2016), with children experiencing peer rejection as early as the preschool years and remaining stable through to early adolescence (age 5 to 12) (Ladd, 2006). Rubin et al.'s (2009) transactional model of social withdrawal propose that peer relationship difficulties may begin as early as the preschool years and repeated negative experiences of peer relationships throughout childhood may increase the risk of developing internalising difficulties in middle childhood and early adolescence. Consistent with this premise, longitudinal studies have shown that repeated experiences of negative peer relationships throughout childhood in socially withdrawn children is associated with and predictive of internalising symptoms in early adolescence (Coplan et al., 2013; Ladd, 2006). For instance, peer rejection from as young as age 5 conferred additional risks to socially withdrawn children in predicting internalising problems in early adolescence (age 12) (Ladd, 2006).

Given the paucity of research on BI and peer relationships, the present study aimed to examine the longitudinal relationship between BI, peer relationships, and anxiety in a sample of young children over an 8-year period. Previous research with this sample showed that BI assessed in the preschool years (age 4) predicts anxiety symptoms and disorders in early adolescence (age 12) (Hudson et al., 2019). The present study aimed to extend these findings by examining the relationship between early BI and subsequent peer problems as well as whether peer relationships moderate the longitudinal relationship between BI and anxiety. Peer relationship difficulties were assessed across four time-points: at age 4, age 6,

age 9 and age 12, as reported by both mothers and teachers. Given that research on peer relations involving familiar peers has predominantly relied on teachers' assessment of children's behaviours in the school setting, the present study provides a unique multi-informant perspective incorporating both teacher- and mother-report peer relationship behaviours in both the school and non-school settings. Research of this nature has the potential to inform our understanding of the development and/or maintenance of anxiety, as well as informing intervention. Recent developments in early intervention for behaviourally inhibited children, such as the Social Skills Facilitated Play program (SSF-FP; Coplan et al., 2010) and the Turtle Program (Danko et al., 2018), include a social skills training component aimed at improving social competence and social participation during the preschool years. Identifying whether peer relationship difficulties is an additive or interactive risk factor across various developmental stages will further tailor such intervention efforts (e.g., when to intervene, who to target interventions) aimed at reducing the risk of developing anxiety.

First, consistent with findings in social withdrawal, it was hypothesised that BI children will exhibit higher levels of peer relationship difficulties than BUI children across the four time-points. Second, in line with recent findings from Christina et al. (2021), we predicted that higher levels of peer relationship difficulties at each time-point will predict greater anxiety at age 12. Third, based on the transactional model of social withdrawal (Kenneth H Rubin et al., 2009), we hypothesized that peer relationship difficulties at each time-point would moderate the longitudinal relationship between BI identified at age 4 and anxiety at age 12.

### **Method**

This study is part of an extensive longitudinal research project involving a sample of behaviourally inhibited (BI) and behaviourally uninhibited (BUI) preschool-aged children and their parents. A detailed description of the sample, measures and assessments conducted at

baseline, 2-year, 5-year and 8-year follow-up can be found in our earlier papers (Hudson et al., 2012, 2019; Hudson, Dodd, & Bovopoulos, 2011; Hudson, Dodd, Lyneham, et al., 2011).

### **Participants**

At baseline, 202 (102 BI) children aged approximately 4 years ( $M = 4$  years,  $SD = 4$  months; 50% male) participated in assessments. Of these, 178 (87 BI) children participated at the 2-year follow-up, 160 (71 BI) children participated at the 5-year follow-up, and 147 (61 BI) children participated at the 8-year follow-up. At 8-year follow-up, the children were approximately aged 12 ( $M = 11.73$  years,  $SD = 4.08$  months, 48.4% male). Mean time between baseline assessment and 8-year follow-up was 7 years 10 months ( $SD = 4.9$  months). Participants were initially recruited through local preschools and via an advertisement in a free parenting magazine. BI classification was made at baseline on the basis of mother's report using the Short Temperament Scale for Children (STSC), described below. Children scoring one standard deviation above or below the normative mean on the Approach subscale were classified as BI and BUI respectively. There were no significant differences between BI group on age, sex, family income, maternal age, and family structure for families participating in the 8-year follow-up. Significant group differences were found for ethnicity, with the BI group being more likely to identify themselves as being of Asian ethnicity,  $\chi^2(5) = 12.39, p = .03$ .

### **Measures**

**Maternal-reported BI.** BI was assessed at baseline using the Approach scale of the STSC, a parent-report measure containing 30 items. The Approach scale consist of seven items, with higher scores indicating lower approach behaviours. The STSC has adequate validity, good internal consistency and reliability (Sanson et al., 1994). The internal consistency for the Approach scale in the present sample at baseline was  $\alpha = .92$ .

**Observed BI.** BI was also assessed at baseline using observed laboratory tasks similar to those used by Kagan and colleagues (Garcia-Coll et al., 1984). Children's responses to a new room, novel toy, masked experimenter dressed in a strange suit and a same-sex unfamiliar peer were observed and coded. Behaviours used to determine inhibition status included: i) time spent proximal to the mother; ii) amount of time spent staring at the peer; iii) time spent talking; iv) number of approaches to the stranger; and v) number of approaches to the peer. The children were classified as BI based on observation if they scored above a pre-determined cut-off on three or more of these five behaviours (Rapee et al., 2005). A second trained coder independently scored the videotapes for 25% of the sample. The inter-rater reliability for the number of cut-offs exceeded was ICC = .91, and for overall BI classification was kappa = .79.

**Child Anxiety Disorders.** Child anxiety diagnoses were assessed at baseline, 2-year, 5-year, and 8-year follow-up using the Anxiety Disorders Interview Schedule for DSM-IV, parent-child version (ADIS-P-IV) (Albano & Silverman, 1996). At baseline and 2-year follow-up, only the parent was interviewed. At 5-year and 8-year follow-up, both the parent and child were interviewed, and composite diagnoses were assigned. Trained psychologists who were unaware of the child's BI status conducted the interviews and the assignment of diagnoses. Diagnoses were only considered 'clinical' if the clinical severity rating (CSR) was four or greater. To assess reliability, a second clinician coded 20% of the interviews. Inter-rater agreement for the presence of clinical anxiety diagnosis was as follows: baseline kappa = .86, 2-year follow-up kappa = .80, 5-year follow-up kappa = .85, 8-year follow-up kappa = 1.0. In the current study, anxiety disorders were defined as the presence or absence of a diagnosis.

**Peer Relationship Difficulties.** Mother- and teacher-reported peer relationship difficulties were assessed using the Peer Relationship Problems scale of the Strengths and Difficulties Questionnaire (SDQ; Goodman, 2001). The Peer Relationship Problems scale

consists of 5 items, with higher scores indicating greater peer relationship difficulties. Items include 'Rather solitary, tends to play alone' and 'Picked on or bullied by other children'. The SDQ has satisfactory reliability and validity when reported by parents and teachers (Goodman, 2001). Mother-reported peer relationship difficulties were assessed across four time-points: baseline, 2-year, 5-year, and 8-year follow-up. Teacher-reported data was assessed across three time-points only, up to 5-year follow-up, due to limited funding. The internal consistency for the Peer Relationship Problems scale in the present sample was as follows: Mother-report baseline  $\alpha = .62$ , 2-year follow-up  $\alpha = .66$ , 5-year follow-up  $\alpha = .67$ , 8-year follow-up  $\alpha = .53$ ; Teacher-report baseline  $\alpha = .62$ , 2-year follow-up  $\alpha = .63$ , 5-year follow-up  $\alpha = .60$ . The low Internal consistency across the time-points and respondents could be attributable to the small number of items in the subscale.

### **Procedure**

Macquarie University's Human Ethics Committee approved this study. Following the initial screen using the STSC, children meeting entry criteria were invited to take part in the full study. Mothers provided written informed consent for their family's participation in the study. Participants visited the university for 2-hour sessions at baseline and follow-up assessments. In the follow-up assessments, child anxiety diagnoses were assessed, and additional measures not described here, were completed. After completing each assessment, families received \$50 and a small gift for the child.

### **Analysis Plan**

All reported analyses were conducted based on parent-report BI group status (i.e. BI or BUI), which was how the participants were initially recruited to the study. To check whether the pattern of results was consistent with the reduced sample of participants whose *parent-report* BI grouping was consistent with their *observed* BI group allocation, all

analyses were conducted again. The overall pattern of results remained similar, although some minor differences in statistical significance were found between the sets of analyses, likely due to reduced power resulted in. Where differences in significance were found, these are reported.

First, to examine whether children classified as BI at age 4 were more likely to experience greater levels of peer relationship difficulties than BUI children across the four time-points, chi-square tests were conducted. These analyses were conducted for mother-report and teacher-report peer-relationship difficulties respectively. Next, hierarchical multiple regression analyses were used to examine the interplay between BI, peer relationship difficulties, and anxiety. The dependent variable was the presence of an anxiety diagnosis at age 12. Given that the presence of an anxiety diagnosis is a dichotomous variable, hierarchical logistic regressions were used for this outcome. Predictors were added to the model in the following order: (Step 1) baseline anxiety and Asian ethnicity (0 = No, 1 = Yes) were entered to control for initial differences in anxiety and group differences in ethnicity at baseline; (Step 2) peer relationship difficulties; (Step 3) BI status was added; (Step 4) the interaction between BI and peer relationship difficulties was included in the final step. The association between peer relationship difficulties and anxiety at age 12 was explored in Step 2, while Step 4 assessed whether peer relationship difficulties at each time-point moderated the longitudinal relationship between BI identified at age 4 and anxiety at age 12. All continuous variables were centered for the regression analyses. To ensure sufficient power and avoid multi-collinearity, the moderator variable as reported by mothers and teachers at each of the four time-points were analysed separately.

The peer relationship variables were extremely skewed, and the application of various transformation methods did not substantially improve the distributions to approximate normality. Therefore, the peer relationship variables were dichotomised to two levels (normal vs borderline/abnormal) based on cut-off scores recommended for the Peer



Relationship Problems scale of the SDQ (SDQ; Goodman, 2001). For parent-reported peer relationship difficulties, scores of 0-2 were categorized as 'normal', while scores of 3-10 were categorized as 'borderline/abnormal'. For the teacher-report variable, scores of 0-3 were categorized as 'normal', while scores of 4-10 were categorized as 'borderline/abnormal'. These dichotomized peer relationship variables were used in the chi-square tests. For the regression analyses, the continuous variables for peer relationship difficulties were used given that the assumptions for linear regression models (e.g., normal distribution of residuals) were met.

Supplementary Table (S1) shows the percentage of missing data for the following variables across the various time-points by BI status: mother- and teacher-report peer relationship difficulties, and the presence of an anxiety diagnosis. To deal with missing data, multiple imputation (Enders, 2010) was used to create 20 datasets with complete follow-up data. Pooled outcomes across these imputed datasets are reported in the results below. Analyses were conducted in SPSS version 27.

## Results

Table 1 shows the descriptive statistics for peer relationship difficulties across all time-points, according to BI status. It also provides descriptive details for the presence of an anxiety disorder at ages four and twelve.

**Table 1**  
Descriptive Statistics for Peer Relationship Difficulties and Anxiety Over Time by Group

	Age 4		Age 6		Age 9		Age 12	
	BI (n = 102)	BUI (n = 100)	BI (n = 87)	BUI (n = 91)	BI (n = 71)	BUI (n = 89)	BI (n = 61)	BUI (n = 86)
<b>Peer Relationship Difficulties - M (SD)</b>								
<b>Maternal reported</b>	3.02 (2.08)	1.52 (1.73)	1.84 (1.67)	1.06 (1.71)	1.57 (1.85)	1.48 (1.92)	1.67 (1.73)	1.47 (1.72)
<b>Teacher reported</b>	2.83 (2.30)	2.31 (2.30)	1.60 (1.92)	1.36 (1.51)	1.05 (1.88)	1.86 (1.95)	-	-

**Peer Relationship Difficulties – % of total count per time-point*****Maternal reported***

Normal	21.9%	38.8%	33.2%	44.3%	35.2%	38.9%	34.4%	37.5%
Borderline/ Abnormal	28.4%	10.9%	16.2%	6.4%	13.5%	12.3%	14.5%	13.6%

***Teacher reported***

Normal	31.9%	35.2%	40.9%	42.5%	37.5%	37.0%	-	-
Borderline/ Abnormal	18.6%	14.3%	9.5%	7.1%	9.8%	15.7%	-	-

**Anxiety**

Presence of anxiety diagnosis	74 (73%)	17 (17%)	-	-	-	-	22 (36%)	16 (19%)
<i>Total number (% of group)</i>								

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*Note:* BI = Behaviourally Inhibited, BUI = Behaviourally Uninhibited. Descriptive statistics for anxiety diagnosis are reported for ages 4 and 12 only because data from these time-points are included in the analyses.

**Group Differences in Peer Relationship Difficulties**

Chi-square tests were conducted to examine whether BI children exhibit higher levels of peer relationship difficulties than BUI children. Results of the chi-square tests are summarised in Table 2.

**Table 2**  
Results of Chi-Square Tests on Group and Peer Relationship Difficulties Across Time-Points

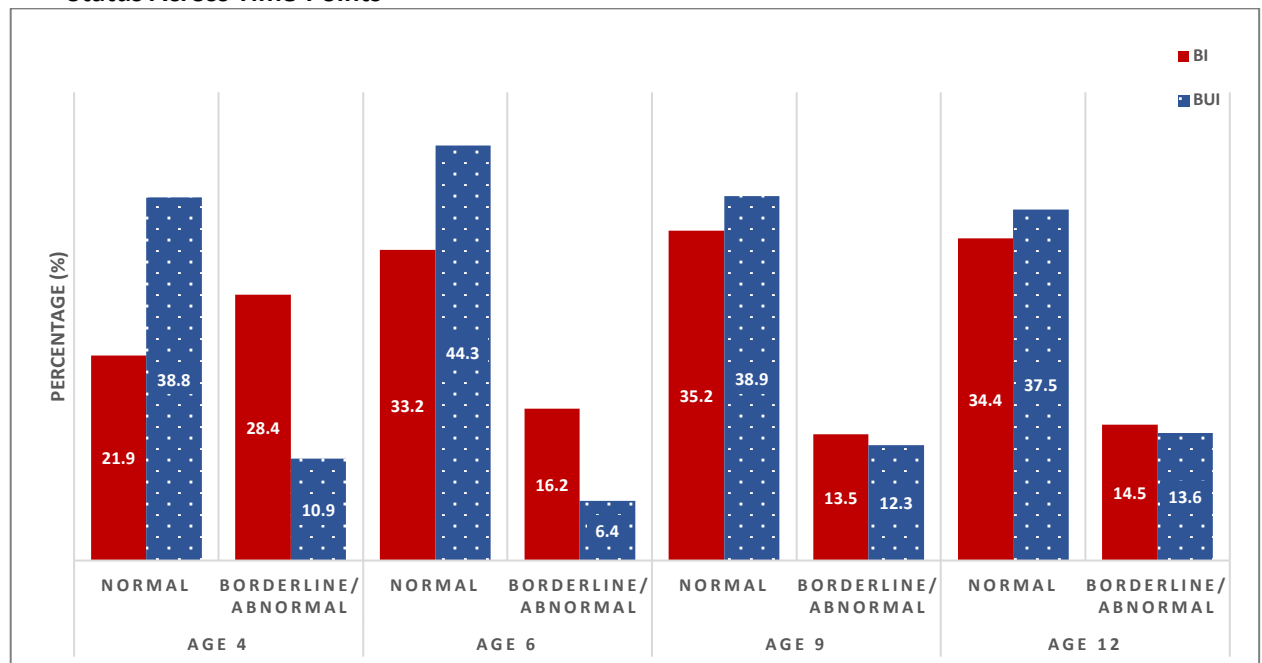
	$\chi^2$	<i>df</i>	<i>n</i> <i>imputed</i>	<i>OR</i>	95% CI <i>OR</i>
<b>Maternal reported Peer Difficulties</b>					
Age 4	524.53***	1	4221	4.59	4.02 – 5.25
Age 6	238.36***	1	4063	3.40	2.90 – 4.00
Age 9	6.88**	1	3781	1.21	1.05 – 1.40
Age 12	4.13*	1	3706	1.16	1.01 – 1.34
<b>Teacher reported Peer Difficulties</b>					
Age 4	28.64***	1	4144	1.43	1.25 – 1.63
Age 6	15.66***	1	4007	1.40	1.19 – 1.66
Age 9	39.45***††	1	3598	.61	.53 - .72

Note: \* $p < .05$ ; \*\* $p < .01$ ; \*\*\*  $p < .001$ . OR = Odds Ratio; OR effect size: 1.68 (small), 3.47 (medium), and 6.71 (large) (Chen et al., 2010)

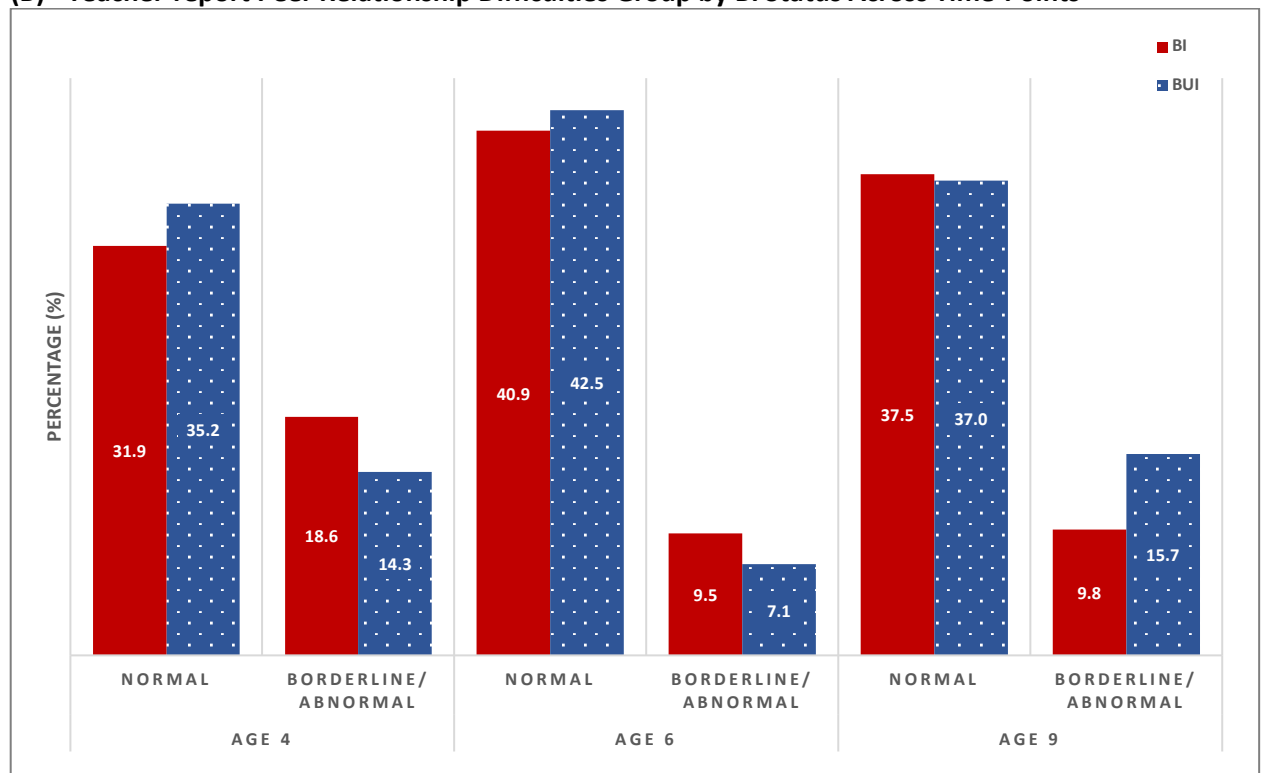
†† Borderline significant when analyses were run with only consistently categorised behaviourally inhibited children.

Overall, BI group assessed at age 4 was significantly associated with and predictive of mother- and teacher-report peer relationship difficulties across all time points. Specifically, mothers were more likely to report borderline/abnormal levels of peer relationship difficulties across the four time-points if their child was in the BI group compared to the BUI group at age 4 (See Figure 1A). Across time, the effect size of the odds ratio reduced from a medium effect (OR = 4.59) at age 4 to a small effect (OR = 1.16) at age 12. Similarly, teachers were more likely to report borderline/abnormal levels of peer relationship difficulties at age 4 and age 6 if a child was assessed as BI compared to BUI at age 4. The effect size of the odds ratio was small at ages 4 and 6, with OR = 1.43 and OR = 1.40 respectively. However, at age 9, teachers reported that BI children were *less* likely to exhibited borderline/abnormal levels of peer relationship difficulties compared to BUI children (OR = .61) (See Figure 1B).

**(A) Mother-report Peer Relationship Difficulties (Normal vs Borderline/Abnormal) by BI Status Across Time-Points**



**(B) Teacher-report Peer Relationship Difficulties Group by BI Status Across Time-Points**



**Figure 1.** BI Status by Peer Relationship Difficulties Group at Ages 4, 6, 9, and 12.

### Interplay between Peer Relationship Difficulties, Behavioural Inhibition, and Anxiety

To examine the interplay between peer relationship difficulties, BI and the presence of an anxiety disorder (at 8-year follow-up), hierarchical logistic regression was used.

Separate models were tested for mother-report (across 4 time-points) and teacher-report (across 3 time-points) peer relationship difficulties.

Initial analyses showed that all interactions between BI and peer relationship difficulties were significant across informants (i.e., mother- and teacher-report) and the various time-points, except for when peer relationship difficulties were reported by teachers at ages 4 and 9 ( $p > .05$ ). For these teacher reported time-points, a more parsimonious model excluding these interactions was tested, as recommended by various authors (Judd & Kenny, 1981; Meyers et al., 2006). Results of the final models are summarised in Table 3 and Table 4. Across all models, baseline anxiety, ethnicity, and BI were significant unique predictors of the presence of an anxiety diagnosis at age 12 (as reported in previous publications; Broeren et al., 2014; Hudson et al., 2012, 2019; Hudson, Dodd, & Bovopoulos, 2011; Hudson, Dodd, Lyneham, et al., 2011).

**Table 3**

Final Hierarchical Logistic Regression Models for Peer Relationship Difficulties, BI, and Presence of an Anxiety Disorder (Mother Reported)

Variables	$\chi^2$ Block	<i>b</i>	<i>SE</i>	Wald	<i>OR</i>	95% CI <i>OR</i>
<b>Any Anxiety Disorder at Age 12: Mother Reported Peer Relationship Difficulties at Age 4</b>						
<b>Step 1</b>						
Baseline Anxiety Disorders	329.86***	.88	.08	136.24***	2.41	2.08 – 2.79
Asian Ethnicity		1.210	.11	121.58***	3.36	2.71 – 4.16
<b>Step 2</b>						
Baseline Anxiety Disorders	30.30***	.71	.08	77.54***	2.04	1.74 – 2.40
Asian Ethnicity		1.19	.11	117.78***	3.29	2.66 – 4.08
Peer Relationship Difficulties Age 4		.10	.02	30.45***	1.11	1.07 – 1.15
<b>Step 3</b>						
Baseline Anxiety Disorders	14.99***	.42	.11	13.56***	1.52	1.21 – 1.89
Asian Ethnicity		1.14	.11	106.39***	3.13	2.52 – 3.89
Peer Relationship Difficulties Age 4		.09	.02	26.60***	1.10	1.06 – 1.14
BI		.42	.11	14.87***	1.52	1.23 – 1.88
<b>Step 4</b>						
Baseline Anxiety Disorders	32.50***	.39	.11	11.84**	1.47	1.18 – 1.83
Asian Ethnicity		1.12	.11	102.73***	3.06	2.47 – 3.80

Peer Relationship Difficulties Age 4		.23	.03	59.37***	1.26	1.19 – 1.34
BI		.93	.14	43.60***	2.53	1.92 – 3.32
BI*Peer Relationship Difficulties Age 4		-.21	.04	32.57***	.81	.75 - .87
Total $\chi^2$	407.64***					

#### Any Anxiety Disorder at Age 12: Mother Reported Peer Relationship Difficulties at Age 6

<b>Step 1</b>						
Baseline Anxiety Disorders	327.34***	.88	.08	136.25***	2.41	2.08 – 2.79
Asian Ethnicity		1.20	.11	119.92***	3.33	2.69 – 4.14
<b>Step 2</b>						
Baseline Anxiety Disorders	220.91***	.71	.08	100.48***	2.19	1.88 – 2.54
Asian Ethnicity		.81	.12	49.92***	2.25	1.80 – 2.82
Peer Relationship Difficulties Age 6		.31	.02	208.52***	1.36	1.31 – 1.42
<b>Step 3</b>						
Baseline Anxiety Disorders	10.30**	.53	.11	22.73***	1.70	1.37 – 2.11
Asian Ethnicity		.78	.12	45.24***	2.17	1.73 – 2.72
Peer Relationship Difficulties Age 6		.30	.02	201.93***	1.35	1.30 – 1.41
BI		.35	.11	10.23**	1.42	1.15 – 1.76
<b>Step 4</b>						
Baseline Anxiety Disorders	8.06**	.53	.11	22.65***	1.70	1.37 – 2.12
Asian Ethnicity		.80	.12	48.23***	2.22	1.77 – 2.78
Peer Relationship Difficulties Age 6		.37	.03	135.34***	1.44	1.35 – 1.53
BI		.38	.11	11.68**	1.46	1.17 – 1.81
BI*Peer Relationship Difficulties Age 6		-.12	.04	8.00**	.89	.82 - .96
Total $\chi^2$	566.60***					

#### Any Anxiety Disorder at Age 12: Mother Reported Peer Relationship Difficulties at Age 9

<b>Step 1</b>						
Baseline Anxiety Disorders	324.41***	.87	.08	134.16***	2.40	2.07 – 2.78
Asian Ethnicity		1.20	.11	119.63***	3.33	2.68 – 4.13
<b>Step 2</b>						
Baseline Anxiety Disorders	150.86***	.92	.08	141.54***	2.51	2.15 – 2.92
Asian Ethnicity		1.13	.11	103.76***	3.11	2.50 – 3.87
Peer Relationship Difficulties Age 9		.23	.02	148.76***	1.26	1.21 – 1.30
<b>Step 3</b>						
Baseline Anxiety Disorders	18.72***	.57	.11	26.04***	1.77	1.42 – 2.20
Asian Ethnicity		1.08	.11	92.08***	2.94	2.36 – 3.66
Peer Relationship Difficulties Age 9		.23	.02	148.78***	1.26	1.21 – 1.30
BI		.47	.11	18.51***	1.60	1.29 – 1.99
<b>Step 4</b>						
Baseline Anxiety Disorders	9.90**	.59	.11	27.09***	1.80	1.44 – 2.24
Asian Ethnicity		1.06	.11	90.42***	2.90	2.32 – 3.60
Peer Relationship Difficulties Age 9		.29	.03	113.11***	1.34	1.27 – 1.41
BI		.50	.11	20.44***	1.65	1.33 – 2.05
BI*Peer Relationship Difficulties Age 9		-.12	.04	9.92**	.89	.83 - .96
Total $\chi^2$	503.89***					

#### Any Anxiety Disorder at Age 12: Mother Reported Peer Relationship Difficulties at Age 12

<b>Step 1</b>						
Baseline Anxiety Disorders	324.13***	.88	.08	135.11***	2.41	2.07 – 2.79
Asian Ethnicity		1.20	.11	118.13***	3.31	2.67 – 4.10
<b>Step 2</b>						
Baseline Anxiety Disorders	48.30***	.86	.08	128.98***	2.37	2.04 – 2.75
Asian Ethnicity		1.16	.11	111.33***	3.20	2.58 – 3.98
Peer Relationship Difficulties Age 12		.14	.02	48.63***	1.15	1.11 – 1.20

<b>Step 3</b>						
Baseline Anxiety Disorders	18.17***	.52	.11	22.09***	1.68	1.36 – 2.09
Asian Ethnicity		1.11	.11	99.16***	3.03	2.44 – 3.77
Peer Relationship Difficulties Age 12		.14	.02	48.40***	1.15	1.11 – 1.20
BI		.46	.11	17.96***	1.59	1.28 – 1.96
<b>Step 4</b>						
Baseline Anxiety Disorders	53.48***	.60	.11	28.39***	1.82	1.46 – 2.27
Asian Ethnicity		1.07	.11	93.15***	2.92	2.35 – 3.63
Peer Relationship Difficulties Age 12		.32	.03	99.89***	1.37	1.29 – 1.46
BI		.49	.11	19.51***	1.63	1.31 – 2.02
BI*Peer Relationship Difficulties Age 12		-.30	.04	52.84***	.74	.68 - .80
Total $\chi^2$	444.07***					

Note: Behavioural inhibition is coded 0 = BUI, 1 = BI. OR = Odds Ratio; OR effect size: 1.68 (small), 3.47 (medium), and 6.71 (large) (Chen et al., 2010)

\* $p < .05$ ; \*\* $p < .01$ ; \*\*\* $p < .001$ .

**Table 4**

Final Multiple Hierarchical Logistic Regression Models for Peer Relationship Difficulties, BI, and Presence of an Anxiety Disorder (Teacher Reported)

Variables	$\chi^2$ Block	<i>b</i>	<i>SE</i>	Wald	OR	95% CI OR
<b>Any Anxiety Disorder at Age 12: Teacher Reported Peer Relationship Difficulties at Age 4</b>						
<b>Step 1</b>						
Baseline Anxiety Disorders	330.37***	.88	.08	135.89***	2.41	2.08 – 2.79
Asian Ethnicity		1.21	.11	121.64***	3.37	2.71 – 4.17
<b>Step 2</b>						
Baseline Anxiety Disorders	55.99**	.83	.08	118.11***	2.29	1.97 – 2.66
Asian Ethnicity		1.18	.11	112.72***	3.24	2.61 – 4.03
Peer Relationship Difficulties Age 4		.12	.02	55.84***	1.12	1.09 – 1.16
<b>Step 3</b>						
Baseline Anxiety Disorders	17.54***	.50	.11	20.45***	1.64	1.33 – 2.04
Asian Ethnicity		1.21	.11	100.57***	3.07	2.46 – 3.82
Peer Relationship Difficulties Age 4		.12	.02	55.36***	1.12	1.09 – 1.15
BI		.45	.11	17.37***	1.57	1.27 – 1.94
Total $\chi^2$	403.91***					
<b>Any Anxiety Disorder at Age 12: Teacher Reported Peer Relationship Difficulties at Age 6</b>						
<b>Step 1</b>						
Baseline Anxiety Disorders	329.22***	.88	.08	136.95***	2.42	2.09 – 2.81
Asian Ethnicity		1.21	.11	120.67***	3.36	2.71 – 4.17
<b>Step 2</b>						
Baseline Anxiety Disorders	1.88	.88	.08	136.05***	2.42	2.08 – 2.80
Asian Ethnicity		1.17	.11	106.89***	3.24	2.59 – 4.04
Peer Relationship Difficulties Age 6		.03	.02	1.89	1.03	.99 – 1.07
<b>Step 3</b>						
Baseline Anxiety Disorders	17.76***	.55	.11	25.41***	1.74	1.40 – 2.15
Asian Ethnicity		1.12	.12	95.55***	3.07	2.45 – 3.84
Peer Relationship Difficulties Age 6		.03	.02	1.81	1.03	.99 – 1.07
BI		.45	.11	17.58***	1.57	1.27 – 1.94
<b>Step 4</b>						
Baseline Anxiety Disorders	4.64*	.57	.11	26.84***	1.77	1.42 – 2.19
Asian Ethnicity		1.14	.12	98.62***	3.14	2.50 – 3.93

Peer Relationship Difficulties Age 6		.09	.04	6.51*	1.10	1.02 – 1.18
BI		.44	.11	16.46***	1.55	1.25 – 1.91
BI*Peer Relationship Difficulties Age 6		-.10	.04	4.66*	.91	.84 - .99
Total $\chi^2$	353.50***					
<b>Any Anxiety Disorder at Age 12: Teacher Reported Peer Relationship Difficulties at Age 9</b>						
<b>Step 1</b>						
Baseline Anxiety Disorders	322.05***	.88	.08	133.74***	2.41	2.08 – 2.80
Asian Ethnicity		1.20	.11	117.79***	3.33	2.68 – 4.13
<b>Step 2</b>						
Baseline Anxiety Disorders	41.97***	.88	.08	132.17***	2.41	2.07 – 2.80
Asian Ethnicity		1.19	.11	115.08***	3.29	2.65 – 4.09
Peer Relationship Difficulties Age 9		.12	.02	41.61***	1.13	1.09 – 1.17
<b>Step 3</b>						
Baseline Anxiety Disorders	51.38***	.28	.11	5.90*	1.32	1.06 – 1.65
Asian Ethnicity		1.09	.11	93.04***	2.97	2.38 – 3.70
Peer Relationship Difficulties Age 9		.17	.02	73.58***	1.19	1.14 – 1.23
BI		.83	.12	50.52***	2.30	1.83 – 2.89
Total $\chi^2$	415.40***					

*Note:* Behavioural inhibition is coded 0 = BUI, 1 = BI. OR = Odds Ratio; OR effect size: 1.68 (small), 3.47 (medium), and 6.71 (large) (Chen et al., 2010)

\* $p < .05$ ; \*\* $p < .01$ ; \*\*\*  $p < .001$ .

To explore the significant interactions between BI and peer relationship difficulties in predicting the presence of an anxiety disorder at age 12, simple slopes analyses were run. Separate analyses were run for the interactions between BI and mother-report peer relationship difficulties across all time-points. A further analysis was run for the interaction between BI and teacher-report peer relationship difficulties at age 6. Results of the simple slopes analyses are summarised in Table 5 and the interactions are plotted in Figure 2.

*Mother-report Peer Relationship Difficulties:* BI children were significantly more likely than BUI children to be diagnosed with an anxiety disorder at age 12 when they exhibited low (-1 SD) or mean levels of mother-report peer relationship difficulties across the 4 time-points. In contrast, the likelihood of having an anxiety diagnosis was comparable for both BI and BUI children when they exhibited high (+1 SD) levels of peer relationship difficulties at ages 4, 6, and 12. At age 9 however, BI children were significantly more likely than BUI children to be diagnosed with an anxiety disorder even when they showed high levels of mother-report peer relationship difficulties.



*Teacher-report Peer Relationship Difficulties:* At age 6, BI children were significantly more likely than BUI children to be diagnosed with an anxiety disorder at age 12 across the 3 levels (low, mean, and high) of teacher-report peer relationship difficulties.

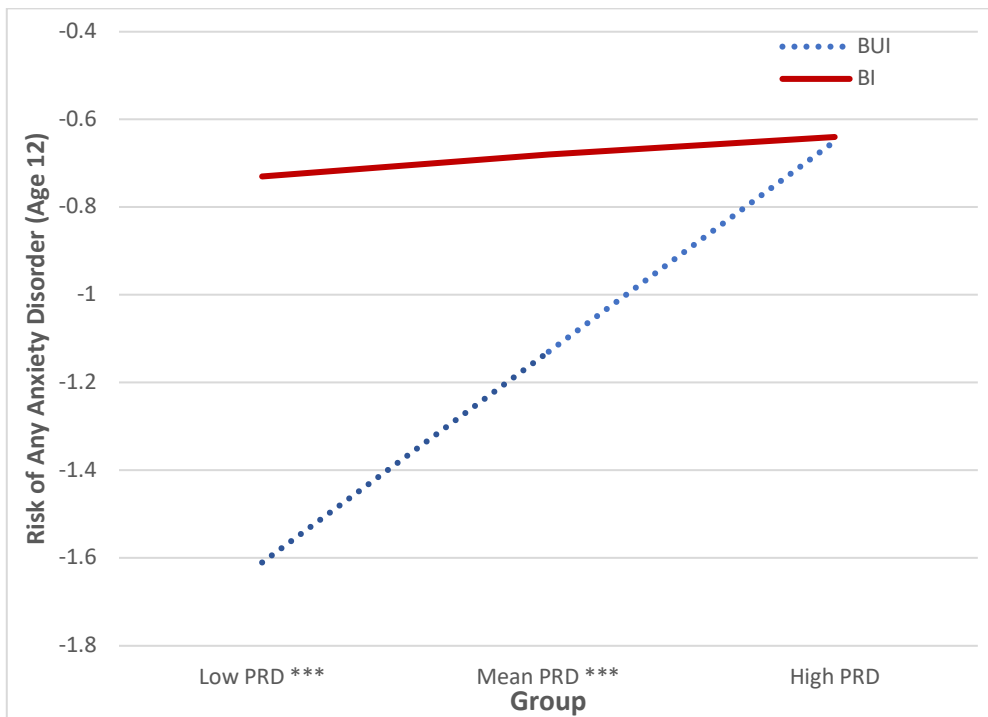
**Table 5**

Effect of BI on Risk of Having an Anxiety Diagnosis (aged 12) at Varying Levels of Peer Relationship Difficulties

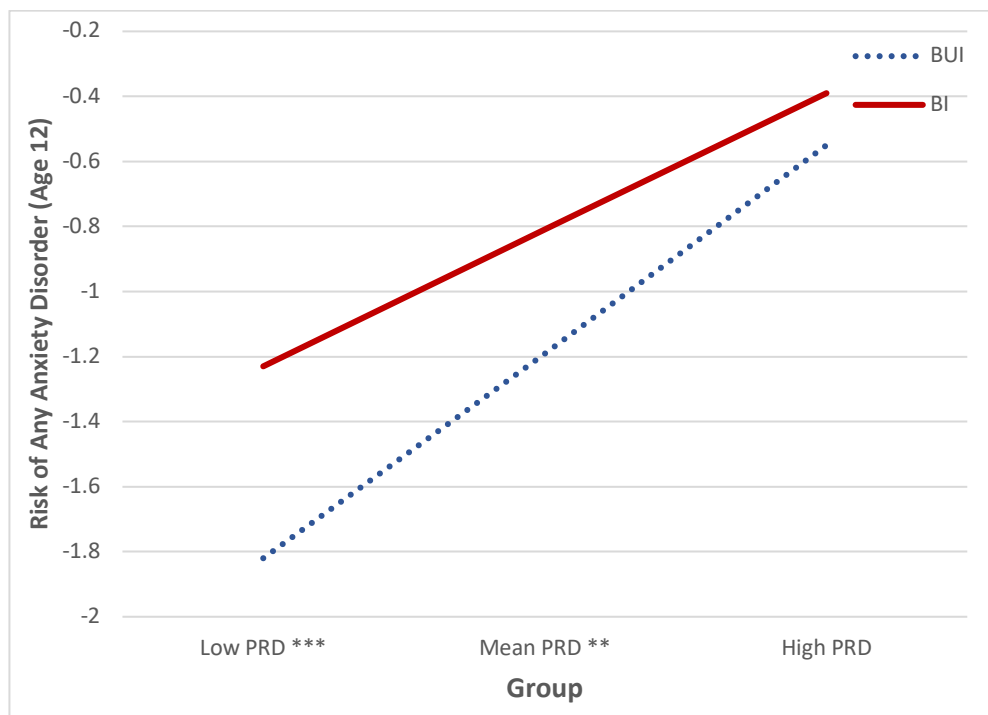
Level of Peer Relationship Difficulties	B	SE	Wald
<b>BI x Mother Reported Peer Relationship Difficulties at Age 4</b>			
Low	.88	.14	6.51***
Mean	.44	.11	4.13***
High	.01	.13	.06
<b>BI x Mother Reported Peer Relationship Difficulties at Age 6</b>			
Low	.58	.14	4.25***
Mean	.38	.11	3.41**
High	.17	.13	1.32
<b>BI x Mother Reported Peer Relationship Difficulties at Age 9</b>			
Low	.73	.14	5.30***
Mean	.50	.11	4.53***
High	.28	.13	2.23*
<b>BI x Mother Reported Peer Relationship Difficulties at Age 12</b>			
Low	1.01	.13	7.52***
Mean	.48	.11	4.41***
High	-.04	.13	-.28
<b>BI x Teacher Reported Peer Relationship Difficulties at Age 6</b>			
Low	.60	.13	4.67***
Mean	.44	.11	4.06***
High	.27	.14	2.03*

Note: \* $p < .05$ ; \*\* $p < .01$ ; \*\*\*  $p < .001$ .

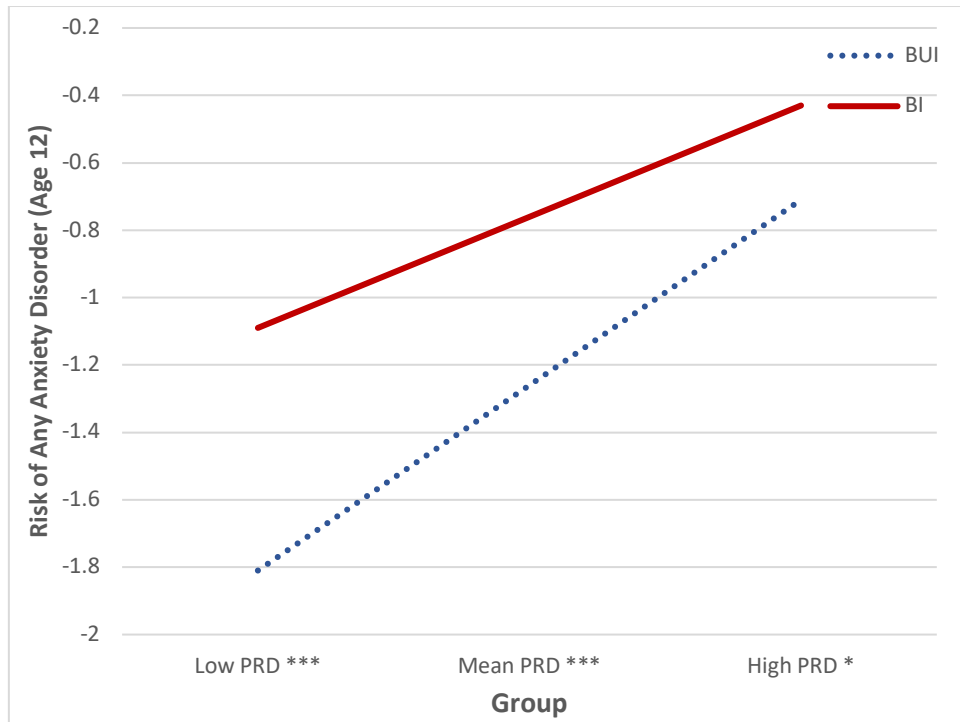
**(A)** BI x Mother Reported Peer Relationship Difficulties at Age 4



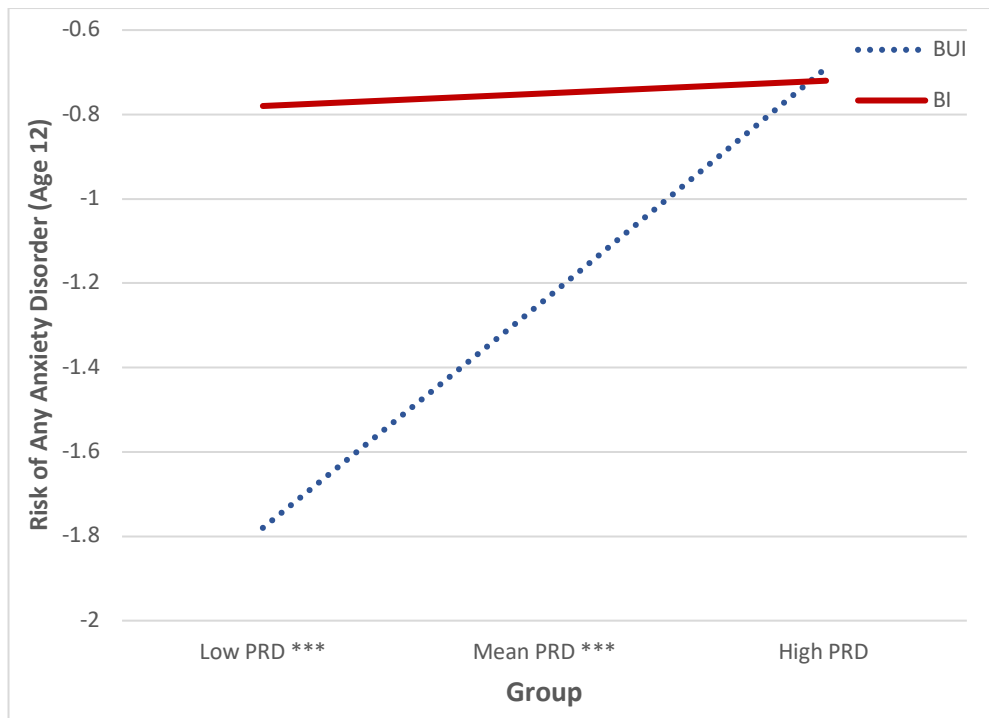
**(B)** BI x Mother Reported Peer Relationship Difficulties at Age 6

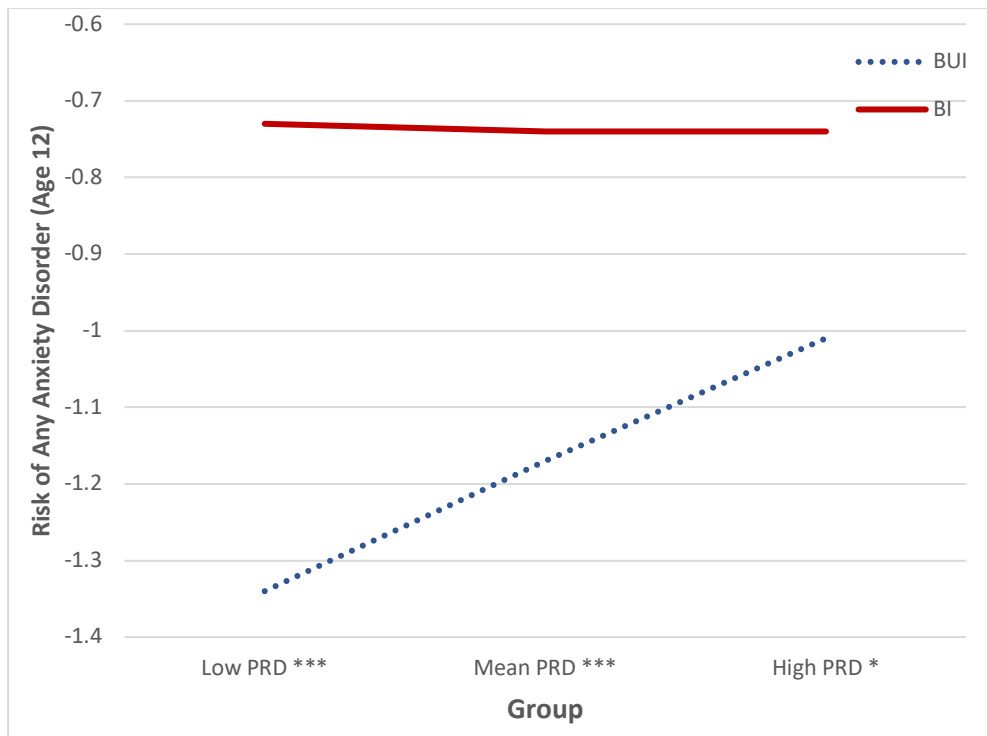


**(C)** BI x Mother Reported Peer Relationship Difficulties at Age 9



**(D)** BI x Mother Reported Peer Relationship Difficulties at Age 12



**(E) BI x Teacher Reported Peer Relationship Difficulties at Age 6**

Note: PRD = Peer Relationship Difficulties. \* $p < .05$ ; \*\* $p < .01$ ; \*\*\* $p < .001$  for group differences (BI vs. BUI) at each level of PRD.

**Figure 2.** Simple slopes for interactions between BI and peer relationship difficulties on the presence of an anxiety disorder.

Additionally, as seen in Figure 2 (A-E), the gradient of the BUI slopes appears greater than the BI slopes, suggesting that peer relationship difficulties may have a greater impact on BUI children than BI children. As such, exploratory analyses were conducted to examine the extent to which the risk of having an anxiety disorder diagnosis is impacted by the level of peer relationship difficulties (low vs. high) for each group. Hierarchical logistic regression analyses were run, with separate analyses for the BI and BUI groups at each time-point. The dependent variable was the presence of an anxiety diagnosis. Baseline anxiety and Asian ethnicity were entered first into the models to control for initial differences in anxiety and group differences in ethnicity at baseline. Next, peer relationship difficulties (High  $\geq 1SD$

above the mean, Low  $\leq$  1SD below the mean) was included in the final step. Results showed that when reported by mothers, BUI children exhibiting high peer relationship difficulties were significantly more likely to have an anxiety disorder diagnosis compared to those who exhibited low difficulties across time-points (beta<sub>age 4</sub> = -1.96, beta<sub>age 6</sub> = -1.28, beta<sub>age 9</sub> = -.87, beta<sub>age 12</sub> = -1.36,  $ps < .05$ ). For BI children, the likelihood of having an anxiety disorder diagnosis was high regardless of their level of peer relationship difficulties at ages 4 and 12 (beta<sub>age 4</sub> = -.02, beta<sub>age 12</sub> = .29,  $ps > .05$ ). At ages 6 and 9 however, BI children with high peer relationship difficulties were significantly more likely to have an anxiety disorder diagnosis compared to those with low difficulties (beta<sub>age 6</sub> = -1.30, beta<sub>age 9</sub> = -.99,  $ps < .05$ ). When reported by teachers at age 6, BI children's likelihood of having an anxiety disorder was high regardless of their level of peer relationship difficulties (beta = .13,  $p > .05$ ). However, for BUI children, those with high peer relationship difficulties were significantly more likely to have an anxiety disorder diagnosis, compared to those with low difficulties (beta = -1.22,  $p < .01$ ).

### Discussion

Longitudinal research suggests that, for socially withdrawn children, repeated experiences of peer relationship difficulties throughout childhood predict internalising symptoms in early adolescence (Coplan et al., 2013; Ladd, 2006). To our knowledge, this longitudinal relationship has yet to be explored with behaviourally inhibited children. The present study aimed to address this gap in the literature by examining the interplay between BI, peer relationship difficulties, and anxiety in a sample of preschool-aged children over an 8-year period.

Consistent with the first hypothesis, BI children generally exhibited higher levels of peer relationship difficulties compared to BUI children across time-points, except for teacher-report peer relationship difficulties at age 9. Specifically, mothers and teachers reported that BI children were significantly more likely to exhibit borderline/abnormal levels

of peer relationship difficulties than BUI children across the various time-points. This finding is consistent with previous research showing that anxiously withdrawn children tend to experience difficulties forming or maintaining positive relationships with their peers (e.g., Avant et al., 2011; Bukowski et al., 2010; Coplan et al., 2008; Gazelle & Ladd, 2003; Gazelle & Spangler, 2007; Ladd et al., 2011; Rubin et al., 1993). Although the group difference in peer relationship difficulties was significant across the time-points, the magnitude of this group difference appeared to decrease gradually as the children increased in age. That is, when reported by mothers, the odds of having borderline/abnormal levels of peer relationship difficulties was 4.59 times higher for BI children compared to BUI children at age 4. By age 12, the odds of having borderline/abnormal levels of peer relationship difficulties was only 1.16 times higher for BI children compared to BUI children. As shown in Figure 1A, the rates of BI children assessed as having borderline/abnormal levels of peer relationship difficulties decreased over time, while the rates for BUI children in this category increased. The reason for this increasing trend for the rates of BUI children in the borderline/abnormal category remains unclear. Evidence suggests that although BI appears to be a protective factor against externalising symptoms (e.g., aggression, delinquent behaviours) across childhood and early adolescence (Williams et al., 2009), low levels of BI have been shown to predict aggressive behaviours (Kimonis et al., 2006). It is plausible that the increasing rates for BUI children in the borderline/abnormal category of peer relationship difficulties reflect an increase in the children's externalising behaviours over time, which may impact on their relationship with peers. Additionally, although a similar trend was observed by teachers (See Figure 1B), they reported that BUI children were significantly more likely to exhibit borderline/abnormal levels of peer relationship difficulties than BI children at age 9.

Next, in line with the second hypothesis, peer relationship difficulties across time-points were significantly associated with and predictive of anxiety disorders at age 12, except for teacher-report peer relationship difficulties at age 6. That is, children who

experienced higher levels of peer relationship difficulties at each time-point were significantly more likely to be diagnosed with an anxiety disorder at age 12. This finding is consistent with a recent meta-analysis which showed that peer victimization predicted internalising symptoms in school-aged children (Christina et al., 2021).

Finally, there was partial support for our third hypothesis which predicted that peer relationship difficulties at each time-point would moderate the longitudinal relationship between BI assessed at age 4 and anxiety at age 12. When reported by mothers, peer relationship difficulties at ages 4, 6, 9, and 12 interacted with BI status to significantly predict the presence of an anxiety diagnosis at age 12. As shown in Figure 2 (A-E), peer relationship difficulties have a greater impact on BUI children than BI children. For the BUI group across all time-points, children with high peer relationship difficulties were significantly more likely to have an anxiety diagnosis, compared to those with low difficulties. Indeed, for BUI children with high peer relationship difficulties, their risk of having an anxiety diagnosis was as high as that of BI children at various time-points (i.e., mother-reported difficulties at ages 4, 6, and 12). In contrast, the impact of peer relationship difficulties on BI children was more variable across time-points. When reported by mothers at ages 6 and 9, peer relationship difficulties in BI children increased their likelihood of having an anxiety diagnosis. In contrast, this increased risk conferred by peer relationship difficulties was not found for BI children when reported by mothers at ages 4 and 12, and by teachers at age 6. Specifically, their likelihood of having an anxiety diagnosis at these time-points remained high regardless of whether they exhibited high or low difficulties with peers; there was no additive and protective effect. Overall, the pattern of results suggests that although peer relationship difficulties have some effect on BI children, they may be particularly problematic during middle childhood and in general appear to have a greater influence on BUI children's anxiety risk.

It is likely that BI children's ability to initiate and maintain positive peer relationships (i.e., low peer relationship difficulties) as reported by mothers at ages 6 and 9 may be a protective factor against anxiety. However, at ages 4 and 12, other risk factors previously identified in this cohort such as their inhibited temperament, maternal anxiety disorders, or maternal overinvolvement (Hudson et al., 2019) may play a more prominent role in predicting anxiety risk. Based on teachers' assessment, the ability to initiate and maintain positive peer relationships appear to be protective against anxiety even for BI children as young as age 4. It is plausible that for younger children (age 4), their social behaviours may be more salient in a school setting where there are more opportunities to socialise with their peers compared to non-school settings. As such, teachers may be able to identify positive peer relationships in BI children earlier than parents.

A limitation of the present study was that teacher-report peer relationship difficulties was not assessed at age 12. Data from this time-point could be particularly informative given the unexpected finding at age 9 in which a greater proportion of BUI children showed borderline/abnormal levels of peer relationship difficulties compared to BI children. Given that the present study is one of the first to explore children's ability to initiate and maintain peer relationship in the context of BI and anxiety, a broad construct of peer relationship difficulties was used for this purpose. Further work could consider including more specific measures such as peer rejection (see Ladd, 2006) or victimization to explore more specific domains of peer relationship difficulties. Additionally, including children and young people's perception of their own difficulties with peers could enhance our understanding of how peer relationship difficulties are experienced, and how they impact on anxiety.

Despite these limitations, the findings of the present study have clear implications for clinical practice. Outcomes based on mothers' assessment suggest that peer relationship difficulties may have less impact on BI children than BUI children in terms of their anxiety



risk, suggesting that other factors contribute to BI children's elevated risk for anxiety. Teachers' assessment however tended to indicate that high peer relationship difficulties, regardless of the children's BI status, increase their risk for anxiety. Integration of these multi-informant findings suggest that early intervention involving the combination of parent education (targeting parenting behaviours such as reducing overinvolvement, reducing child avoidance) and social skills training for children (aimed at increasing social competence and social participation) such as the Turtle Program (Danko et al., 2018) may yield the best outcomes compared to single component (either parenting education or social skills training) programs. Additionally, targeting preschool-aged children's social skills in a school setting could be beneficial given that teachers in the present study were able to identify positive peer relationships as a protective factor against anxiety in children as young as age 4. Finally, the results highlight that some BUI children may require support, especially those showing high levels of peer relationship difficulties given that this group of children also experience elevated risk for anxiety.

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## Supplementary Materials

**Table S1**

Percentage of Missing Data Across Time-Points by BI status

	Age 4		Age 6		Age 9		Age 12	
	BI	BUI	BI	BUI	BI	BUI	BI	BUI
<b>Peer Relationship Difficulties (% missing)</b>								
Maternal reported	0%	0%	15.7%	7.0%	33.3%	19.0%	46.1%	29.0%
Teacher reported	13.7%	10.0%	31.4%	29.0%	71.6%	60.0%	-	-
<b>Anxiety (% missing)</b>								
Presence of anxiety diagnosis	0%	0%	-	-	-	-	40.0%	14.0%

## **Chapter 5: Discussion and Critical Evaluation**

The research conducted for this thesis aimed to explore the efficacy of psychological interventions in reducing behavioural inhibition and anxiety (symptoms and diagnosis) in behaviourally inhibited preschool-aged children. It also examined the longitudinal impact of peer relationship difficulties on behaviourally inhibited children and young people's anxiety diagnosis. This chapter begins with an overview of the findings of each study, followed by a discussion on some limitations of the studies and recommendations for future directions. Finally, the chapter ends with a discussion on the clinical implications of the findings.

### **5.1 Overview of Findings**

#### ***5.1.1 Systematic Review: The Efficacy of Interventions for Inhibited Preschool-aged Children: A Meta-analysis***

Behavioural inhibition in the preschool years has consistently been identified as a major risk factor for subsequent anxiety (Sandstrom et al., 2020). To our knowledge, this thesis is the first to examine the efficacy of randomised controlled trials (RCTs) of psychological interventions targeting behavioural inhibition and anxiety in preschool-aged children using a systematic review and meta-analysis methodology. Four electronic databases (Web of Science, MEDLINE, PsycINFO and CINAHL) were systematically searched from inception to March 2021. Ten studies met criteria to be included in the current review, involving a total of 1475 children aged between 3 – 7 years. Results indicated that intervention significantly reduced behavioural inhibition when outcomes were reported by parents and teachers, but not when observed in a laboratory setting. For anxiety diagnosis, intervention was not significantly associated with a greater reduction in the odds of having an anxiety diagnosis in the intervention conditions, compared to controls. Finally, intervention significantly reduced anxiety symptoms when outcomes were reported by parents. In summary, intervention may be effective in reducing BI and anxiety symptoms

(but not disorder) in preschool-aged children, but this change was not consistently observed across all outcomes or informants.

***5.1.2 Empirical Study: The Role of Behavioural Inhibition and Peer Relationship Difficulties in Predicting Anxiety Disorders: A Prospective Study from Early Childhood to Early Adolescence***

Evidence suggests that, for socially withdrawn children, repeated experiences of peer relationship difficulties throughout childhood predict internalising symptoms in early adolescence (Coplan et al., 2013; Ladd, 2006). To date, this longitudinal relationship has yet to be explored with behaviourally inhibited children. The empirical study in this thesis aimed to address this gap in the literature by examining the interplay between BI, peer relationship difficulties, and anxiety in a sample of preschool-aged children over an 8-year period. Findings showed that BI children generally exhibited higher levels of peer relationship difficulties than BUI children at ages 4, 6, 8 and 12, although the difference decreased in magnitude over time. Additionally, peer relationship difficulties across time-points were significantly associated with and predictive of anxiety diagnosis at age 12 generally. Finally, peer relationship difficulties moderated the longitudinal relationship between BI at age 4 and anxiety diagnosis at age 12, predominantly when the difficulties were reported by mothers. In summary, when outcomes were reported by mothers, peer relationship difficulties appear to have a greater impact on BUI compared to BI children's anxiety risk. However, when outcomes were reported by teachers, peer difficulties increased anxiety risk for all children, regardless of their BI status.

**5.2 Limitations and Future Directions**

This section will discuss some of the limitations from the studies in this thesis, which will in turn form the basis for recommendations for future work. First, it is important to

recognize that findings from the systematic review and meta-analysis are limited to short-term outcomes (i.e., outcomes measures between post-intervention to 12-month follow-up). As such, the evidence is tentative and preliminary at best, and interpretation requires the consideration that findings from this systematic review and meta-analysis is an encouraging first step to a longer-term effort in examining the efficacy of intervention for behaviourally inhibited preschool-aged children. Therefore, longer-term follow-up of interventions beyond the 12-month follow-up period is needed to inform the longitudinal clinical implications of intervention. Related to this issue, the outcomes from various intervals (between post-intervention to 12-month follow-up) were clustered together in the current review partly due to the limited number of available studies, but also from the varied intervals in which outcomes were reported (e.g., post-intervention only vs. first time-point reported at 3-month or 6-month follow-up without post-intervention outcomes). Measuring outcomes at more consistent intervals and ideally over the long term would improve our understanding of potential benefits at different stages of the intervention (i.e., short-, medium- and long-term).

Additionally, there was substantial variation across studies on how preschool behavioural inhibition was defined and measured. Improving consensus on the definition of inhibited temperament would promote greater consistency in the measurement of inhibition, ideally arriving with a set of mutually agreed multimethod assessment tool (i.e., structured lab observations, parent- and teacher report measures) that can be used across the board (Rapee & Coplan, 2010). Finally, as further evidence continues to accumulate, future efforts could consider exploring factors that may moderate the effects of intervention. Specifically, exploring intervention characteristics, as well as child and environmental factors could enhance our understanding of factors that moderate the efficacy of intervention.

In terms of the empirical study, teacher-report peer relationship difficulties were not assessed at age 12. Data from this time-point could be particularly informative given the unexpected finding at age 9 in which a greater proportion of BUI children showed borderline/abnormal levels of peer relationship difficulties compared to BI children. Future work could consider exploring young people's peer relationship difficulties in early adolescence (age 12) from teachers' perspective to ascertain whether BUI children experience greater levels of difficulties than BI children at this developmental stage. Additionally, a broad construct of peer relationship difficulties (i.e., Peer Relationship Problems scale of the Strengths and Difficulties Questionnaire) was used to explore children's ability to initiate and maintain peer relationship difficulties in the empirical study. Future work could consider exploring more specific domains of peer relationship difficulties by including specific measures that assess peer rejection or victimisation. Finally, in efforts to gain a multi-informant perspective, further work could consider including children and young people's perception of their own peer difficulties. This understanding could help us understand how peer relationship difficulties are experienced across the various developmental stages and its impact on children and young people's anxiety.

### **5.3 Clinical and Conceptual Implications**

Findings from the systematic review and meta-analysis revealed that some aspects of preschool inhibition may be more amenable to intervention than previously thought (Buss & Plomin, 1984; Kagan, 1994), which is consistent with longitudinal evidence that temperament fluctuates across development (Pérez-Edgar & Fox, 2005; Sanson, 1996). Rapee and Bayer (2018) argued that interventions may be altering the more transient expression of anxiety, while temperamental inhibition remains unchanged. Based on our findings, it is possible that the reductions observed in parent- and teacher-report measures of inhibition reflected changes in preschool-aged children's expression of anxiety.

Meanwhile, the lack of evidence for changes in behavioural inhibition based on laboratory observations may indicate that true inhibition remained unchanged by intervention. Alternatively, it is possible that the effects of intervention was not substantial enough in the current meta-analysis to meet the high threshold for detecting significant change using structured laboratory observations (e.g., Kagan, 1994; Kagan et al., 1989). Parent- and teacher-report measures, on the other hand, may be able to detect more subtle changes in certain features of inhibition that were altered by intervention. Additionally, it is also possible that changes in inhibition may be more apparent in familiar contexts where children feel relatively comfortable. Therefore, such changes may be more observable to parents and teachers. In contrast, children with a history of inhibition may revert to more typical ways of responding in unfamiliar contexts, such as in laboratory observations. With regards to anxiety, it is possible that the effects of intervention were only observable at the symptom severity level but were not substantial enough to alter preschool-aged children's diagnosis status, at least within the duration measured in this meta-analysis.

Results from the empirical study provides a multi-informant perspective on how peer relationship difficulties impact on anxiety across development. Integration of these findings suggest that early intervention involving the combination of parent education and social skills training for children such as the Turtle Program (Danko et al., 2018) may yield the best outcomes compared to single component (either parenting education or social skills training) programs. Additionally, targeting preschool-aged children's social skills in a school setting could be beneficial given that teachers in the present study were able to identify positive peer relationships as a protective factor against anxiety in children as young as age 4. Finally, the results highlight that some BUI children may require support, especially those showing high levels of peer relationship difficulties given that this group of children also experience elevated risk for anxiety. This latter finding is particularly interesting because peer relationship difficulties was a risk factor for anxiety especially for the BUI children, a



group typically associated with low anxiety risk (Sanson et al., 1994). Specifically, BUI children presenting with high peer difficulties experienced similarly high levels of anxiety risk as BI children generally. It is likely that the repetitive and chronic nature of peer relationship difficulties (Pouwels et al., 2016, Rubin et al., 2009) result in repeated conditioning events throughout children's daily interactions with their peers, conferring anxiety risk even for BUI children.

Given that anxiety tends to emerge early in life (Kessler et al., 2005) and persists into adulthood without intervention (Copeland et al., 2014), early intervention is important for reducing the substantial personal, societal and economic impact associated with these disorders. Findings from both the studies in this thesis highlight the efficacy and implication for such an approach. Although research on the cost-effectiveness of such interventions are only emerging, preliminary evidence suggests that early intervention targeting behaviourally inhibited preschool-aged children may be cost-effective in the longer term (Chatterton et al., 2020; Mihalopoulos et al., 2015). Economic evaluation of a currently ongoing translational trial using the Cool Little Kids parenting program (Rapee et al., 2010) which offers population-based screening for early behavioural inhibition indicates that early intervention may potentially be cost-effective from both a societal and health sector perspectives in the longer term (Chatterton et al., 2020). However, there are challenges around implementation at a population level including modest parent participation rate (only 29.4% of parents attended most sessions) and low frequency of skills practise with their children (only 20.5% used the skills regularly in the first year)(Bayer et al., 2018), necessitating further exploration on ways to increase parent motivation for involvement.

#### **5.4 Conclusions**

Taken together, preliminary evidence from the systematic review and meta-analysis suggest that intervention targeted at behaviourally inhibited preschool-aged children may

be effective in reducing behavioural inhibition and anxiety symptoms (but not disorder). However, this change was not observed consistently across all outcomes or informants, and further work is needed to gain a more comprehensive understanding of how to best support behaviourally inhibited preschool-aged children. Additionally, integration of the multi-informant perspective in the empirical study suggests that children's peer relationship difficulties across development (aged 4, 6, 9 and 12) has an impact on their anxiety diagnosis in early adolescence. Indeed, BUI children may require support, especially those exhibiting high levels of peer relationship difficulties as this group of children also experience elevated risk of developing anxiety.

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## Appendix A



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