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Fear, Social Inhibition, and Social Anxiety in Early Childhood



Early Social Fear Predicts Kindergarteners' Socially Anxious Behaviors: Direct Associations, Moderation by Inhibitory Control, and Differences from Nonsocial Fear

Abstract

Although social and nonsocial fear are discernable as early as preschool, little is known about their distinct associations with developmental outcomes. For example, fear has been identified as a predictor of social anxiety problems, but no work has examined whether social and nonsocial fear make independent contributions to risk. We investigated the extent to which early social and nonsocial fear were associated with socially anxious behaviors during kindergarten. To do this, we identified distinct trajectories of social and nonsocial fear across toddlerhood and preschool. Only social fear was associated with socially anxious behaviors at ages 2 and 5. Because the ability to regulate fear contributes to the degree to which fearful children are at risk for anxiety problems, we also tested whether an early-developing aspect of self-regulation modulated associations between early fear and kindergarten socially anxious behaviors. Specifically, we tested whether inhibitory control differentially modulated associations between early levels of social and nonsocial fear and socially anxious behaviors during kindergarten. Associations between trajectories of early social fear and age 5 socially anxious behaviors were moderated by individual differences in inhibitory control. Consistent with previous research showing associations between overcontrol and anxiety symptoms, more negative outcomes were observed when stable, high levels of social fear across childhood were coupled with high levels of inhibitory control. Results suggest that the combination of social fear and overcontrol reflect a profile of early risk for the development of social inhibition and social anxiety problems.

Keywords

Social Fear; Nonsocial Fear; Inhibitory Control; Social Anxiety Risk

Heightened temperamental fearfulness is an early risk factor for Social Anxiety Disorder (Buss, 2011; Chronis-Tuscano et al., 2009; Volbrecht & Goldsmith, 2010). Recently, fear in social contexts was shown to be unique from nonsocial fear (Dyson, Klein, Olino, Dougherty, & Durbin, 2011; Scarr & Salapatek, 1970). The unique developmental trajectories of different types of fear have not been delineated, making it difficult to understand whether distinguishing between developing social and nonsocial fear might enhance our understanding of the links between early fear and early risk for disorder. Identifying how non-fear characteristics may modulate associations between early fearfulness and socially anxious behaviors would also further enhance our understanding of the nature of early risk. Currently, self-regulatory behaviors, which may be necessary for dampening fear responses, have been linked to both mitigated (e.g., Eisenberg et al., 1995; Moffitt et al., 2011) and exacerbated (e.g., Brooker et al., 2011; Kiel & Buss, 2011) anxiety risk. Distinguishing between social and nonsocial fear, which have largely been combined in prior research, may help to clarify the nature of associations among fear, self-regulation, and early risk.

To address gaps in the current literature, we examined early trajectories of social and nonsocial fear and their unique associations with early social inhibition, defined as withdrawal and avoidance in novel social contexts (Rubin & Asendorpf, 1993), and early socially anxious behaviors. We also tested an early-developing aspect of self-regulation, inhibitory control (i.e., the ability to inhibit a prepotent behavioral response (Rothbart & Bates, 1998)), as a moderator of associations between social and nonsocial fear and early risk.

Developmental Trajectories of Fear and Risk for Anxiety Problems

Goldsmith and Campos (1982) define temperament as individual differences in propensities for experiencing the primary emotions. Greater temperamental fear, assessed through observations of fear behaviors (e.g., fear expressions, freezing, crying, etc.), is linked to increased risk for anxiety problems in typically-developing children (Buss, 2011). Temperamentally fearful children are at particular risk for Social Anxiety Disorder, though other anxiety diagnoses are not uncommon (Biederman et al., 2001; Chronis-Tuscano et al., 2009). Similar risk exists for related fear-based constructs. For example, behaviorally inhibited children, a group characterized by extreme levels of fear and reactivity to novelty during infancy, are at high risk for anxiety problems during adolescence (Biederman et al., 2001; Chronis-Tuscano et al., 2009). Similarly, shy children, characterized both by fear and social-evaluative concerns (Rubin & Asendorpf, 1993), are at greater risk for anxiety problems relative to non-shy children (Volbrecht & Goldsmith, 2010). We focus our report on temperamental fearfulness, the basic common unit linking fear with broader constructs such as inhibition and shyness.

There is limited stability between early fear and later disorder (Clauss & Blackford, 2012), which has made it difficult to determine which children are most at risk. Thus, efforts to refine the aspects of early fear that may be most relevant for long-term risk are increasing. Such efforts have included mapping trajectories of developing fear, using temporal information to aid in predicting risk. On average, fearfulness increases during infancy

(Brooker et al., 2013; Gartstein et al., 2010), before declining over time (Côté, Tremblay, Nagin, Zoccolillo, & Vitaro, 2002). Atypical trajectories, including sustained high levels of fear or steeper-than-average increases in early fear are associated with a greater risk for disorder. For example, steep increases in infant fear in the first year of life are associated with more severe anxious behaviors in toddlerhood (Gartstein et al., 2010). Similarly, the link between early fear and anxiety risk is strongly tied to stability in high levels of fear from 2 to 7.5 years of age (Chronis-Tuscano et al., 2009; Hirshfeld et al., 1992).

Early fear is a particularly robust predictor of Social Anxiety Disorder (Hirshfeld-Becker et al., 2007), suggesting that the development of social fear may be of particular importance for identifying early risk for social anxiety problems. Consistent with a definition of social fear as distress in the presence of novel social partners, the literature on developing social fear focuses primarily on early fear of strangers. Mirroring the normative trajectory of more global fear measures, stranger fear increases in the first year of life (Emde, Gaensbauer, & Harmon, 1976; Sroufe, 1977). During late childhood and adolescence, social-evaluative fears also increase (Westenberg, Gullone, Bokhorst, Heyne, & King, 2007), though it is unclear whether this trajectory is linked to social fear during infancy. To our knowledge, only one study has isolated developmental trajectories of social fear, reporting four independent patterns between 6 and 36 months of age (Brooker et al., 2013). Although most infants followed the normative trajectory of increasing stranger fear, a substantial number followed a trajectory of sustained, high levels of fear over time similar to that associated with risk for social anxiety problems (Hirshfeld et al., 1992). However, because no comparison was made to nonsocial fear, it is unclear whether these trajectories are specific to developing social fear or whether they reflect fear development more broadly. We examined this in the current study.

Relative to social fear, less is known about nonsocial fear development, defined as distress in the presence of objects or nature. One cross-sectional study found that 30% – 40% of infants responded with fear to the presentation of novel objects by 7 months of age, well before stranger fear emerged (Scarr & Salapatek, 1970). This work also suggested that nonsocial fear was stable in the first year of life. Presumably, fearfulness toward unfamiliar objects would become adaptive later in development, as children's mobility and independence continued to increase. While this has not yet been investigated empirically, theories about fear development have suggested that unique critical periods may exist for the maturation of different types of fear (Bronson, 1965; Hebb, 1946; Hess, 1959).

Despite possible differences across development, social and nonsocial fear measures are most frequently composited in multi-method assessments of a single fear construct (Buss, 2011; Fox, Henderson, Rubin, Calkins, & Schmidt, 2001; Goldsmith, 1996; Rothbart, Ahadi, Hershey, & Fisher, 2001). Thus, developmental differences in associations between different types of fear and social anxiety risk are not well understood. Cross-sectional, empirical studies have shown a distinction between social and nonsocial fear in infants and young children, suggesting that anxious behaviors are more strongly associated with social than with nonsocial fear (Dyson et al., 2011; Scarr & Salapatek, 1970). However, the possibility that developmental trajectories may further distinguish the roles of social and

nonsocial fear in early risk for social anxiety problems remains untested. We addressed this in the current study.

Inhibitory Control and Risk for Anxiety Problems

Although distinguishing trajectories of social and nonsocial fear will be important for fully understanding the nature of early risk, inconsistent relations between early fear and problems with social anxiety may also indicate the presence of moderators in child outcomes. Regulatory aspects of temperament may be particularly important to examine. Inhibitory control is an early-appearing dimension of self-regulation and comprises one facet of broader regulatory constructs such as effortful control, cognitive control, and executive function. Defined as the ability to inhibit a dominant or prepotent behavioral response (Rothbart & Bates, 2006), inhibitory control can be measured as early as infancy through paradigms that stress the suppression of inappropriate or incorrect responses (Kochanska, Murray, Jacques, Koenig, & Vandegeest, 1996). In the current study, we adopt this view of inhibitory control as an early-developing facet of self-regulation.

Inhibitory control emerges for most children in the second year of life (Kochanska, Murray, & Harlan, 2000; Rothbart & Bates, 2006), increases throughout childhood (Williams, Ponsse, Schachar, Logan, & Tannock, 1999), and remains relatively stable thereafter. Increases in inhibitory control are thought to depend primarily on the maturation of structures that support control over behavior, including the prefrontal cortex and anterior cingulate (Posner & Rothbart, 1998; Rothbart & Ahadi, 1994).

Traditional theories assume that greater inhibitory control is inherently adaptive. In general, greater inhibitory control appears to enable the down-regulation of negative emotions (Saarni, 1984). Individual differences in inhibitory control are most frequently examined in association with externalizing outcomes, with most research reporting negative associations between inhibitory control and childhood externalizing problems (Buss, Kiel, Morales, & Robinson, 2014; Kochanska & Knaack, 2003).

Links between inhibitory control and internalizing problems, such as anxiety, are less clear. At least one study has reported that greater inhibitory control is associated with fewer internalizing symptoms (Eisenberg et al., 2001). This work assessed, using both parent-reported and observed control, links between the measures of delay and persistence and internalizing symptoms in a cross-sectional sample of children ($M_{\text{age}} = 73.58$ months). In contrast, other work has shown positive associations between inhibitory control and internalizing behaviors (Murray & Kochanska, 2002). This work focused on broad assessments of observed control from toddlerhood through school age, incorporating delay and persistence along with slowing down, response inhibition, and effortful attention.

Although both approaches offer important information about links between regulation and children's behavior problems, Murray and Kochanska's longitudinal design included children as young as age 2, making it more likely to capture variability in developing social fear as it peaks and declines early in life. Thus, associations between developing social fear and

inhibitory control that are related to early risk may have been more evident via a longitudinal design that includes the toddler period. Thus, this was the approach used in the current study.

The implication of using different behavioral composites is less clear. Broad assessments of inhibitory control indicate associations between low levels of control and a range of problematic outcomes (Moffitt et al., 2011). However, recent developmental neuroscience research supports the notion that anxiety risk, in particular, is associated with behavioral over-control and hyper-monitoring (Brooker & Buss, 2014; Santesso, Segalowitz, & Schmidt, 2006; Torpey, Hajcak, & Klein, 2009). Practically, this suggests that the inhibition of behaviors or responses when such inhibition is unnecessary may be maladaptive. Such ideas align with developmental psychopathology theory, from which links between over-control and risk for internalizing problems have been posited (Nigg, 2000).

It is important to note that the degree to which behaviors such as inhibitory control are truly adaptive is dependent on context, goals, and outcomes. Perspectives on emotion regulation have underscored the importance of one's ability to accurately perceive changing contextual demands and flexibly apply regulatory strategies (Bonanno & Burton, 2013; Kashdan & Rottenberg, 2010; Ryan, La Guardia, Solky-Butzel, Chirkov, & Kim, 2005). Given evidence that social and nonsocial fear are distinct constructs, may follow unique developmental pathways, and are elicited by unique contextual demands (Dyson et al., 2011; Scarr & Salapatek, 1970), the utility of inhibitory control as a regulator of fear responses may not be universal (Bonanno & Burton, 2013). For these reasons, the degree to which fear composites have mixed social versus nonsocial assessments of fear may be contributing to mixed results in the literature. Thus, a final aim of the current study was to test early inhibitory control as a moderator of longitudinal links between both social and nonsocial fear and social anxiety risk.

The Current Study

In sum, we addressed three primary aims. First, we isolated separate trajectories of social and nonsocial fear across the toddler and preschool years given that these ages (1) overlap with both previous work on longitudinal trajectories of fear and prior work distinguishing social from nonsocial fear, (2) may capture critical periods of fear development, (3) evidence broad individual differences in fear, and (3) produce associations between fear and risk for social anxiety problems. Based on previous work suggesting cross-sectional differences in the observations of social and nonsocial fear across early development (Scarr & Salapatek, 1970), we hypothesized that social and nonsocial fear would follow distinct developmental trajectories across toddlerhood and preschool.

Second, we tested whether trajectories of social and nonsocial fear uniquely predicted behaviors indicative of social anxiety. Based on previous work by Dyson and colleagues (2011), we hypothesized that trajectories of social fear would be more strongly associated with socially anxious behaviors than would trajectories of nonsocial fear. Specifically, we expected that children with stable, high levels of social fear over time would show the greatest number of socially anxious behaviors.

Finally, we tested whether inhibitory control moderated associations between fear trajectories and socially anxious behaviors. We decided *a priori* to test inhibitory control as a moderator of both the association between social fear and socially anxious behaviors and also the association between nonsocial fear and socially anxious behaviors. Given the relevance of social fear to anxiety symptoms (Dyson et al., 2011) and recent evidence linking early overcontrol with early fear (Brooker & Buss, 2014; Murray & Kochanska, 2002), we expected that trajectories of high social fear coupled with high inhibitory control would be associated with greater numbers of socially anxious behaviors at age 5. We expected less robust associations between nonsocial fear and inhibitory control in relation to socially anxious behaviors.

Method

Participants

Participants were 111 2-year-olds ($M = 2.00$; *range* 1.5–2.5; 55% boys) recruited from a Midwestern US city and surrounding rural county. Only families with infants weighing more than 5.5 lbs. at birth, as noted in birth records published in local newspapers, were contacted for recruitment. Consistent with the area from which they were recruited, the sample was largely middle-class (Hollingshead index: $M = 48.84$; $SD = 10.55$; *range* 17–66) and predominantly (90.1%) non-Hispanic European American (3.6% African-American, 3.6% Hispanic, 1.8% Asian-American, 0.09% Indian-American). Most parents were married (< 2% divorced or single-parent at first assessment; 6% at final assessment).

Follow-up assessments were conducted via mail at ages 3 and 4 (total follow-up of 95 children; 86% participation). Follow-up assessments also occurred during the kindergarten year. As part of this, participants, unfamiliar to one another, returned to the laboratory in groups of 3–4 same-sex peers (85% participation). Families who did and did not participate in follow-up assessments did not differ (Buss, 2011). One child received a diagnosis of Autism Spectrum Disorder during the follow-up period and was excluded from analyses.

Procedures

Recruitment—Families were mailed letters describing the study and asking that they return an informational postcard if interested in participating. Parents who returned the postcard were contacted via phone to schedule a time to visit the laboratory.

Questionnaires—The primary caregiver completed a battery of questionnaires assessing child temperament along with early child mental and physical health at child ages 2, 3, and 4. Parents completed the same questionnaire battery one-month prior to kindergarten entry (Age 5 Fall) and in the spring of the kindergarten year (Age 5 Spring).

Age 2 laboratory visit—At age 2, children participated in six laboratory episodes from the toddler version of the Laboratory Temperament Assessment Battery (Lab-TAB; Buss & Goldsmith, 2000). The order of episodes was partially counterbalanced such that children did not participate in consecutive episodes that targeted the same emotion (i.e., 2 consecutive fear episodes); an equal number of girls and boys completed each episode order. Parents

remained present throughout the laboratory episodes in order to avoid inducing child distress due to parent-child separation. The *Puppet Show* and *Clown* episodes each lasted approximately 3 minutes. In these episodes, either two friendly puppets or a friendly, unfamiliar female experimenter dressed as a clown presented a series of age-appropriate toys and invited toddlers to play. The *Stranger Approach* and *Stranger Working* episodes each lasted approximately 2 minutes. In *Stranger Approach*, an unfamiliar male experimenter entered the room and attempted to engage the child in conversation while gradually approaching the child, eventually sitting down within 2 feet of him/her. In *Stranger Working*, an unfamiliar female experimenter entered the room holding a clipboard, walked to a desk at the far end of the room, and pretended to “work.” She only interacted with the child if the child initiated conversation. The *Spider* and *Robot* episodes each lasted approximately one minute. In *Spider*, the child sat opposite a large spider mounted on a remote-controlled vehicle. An unseen experimenter in a control room manipulated the spider so that it gradually approached the child, coming all the way up to him/her. In *Robot*, children sat facing a platform containing a remote-controlled toy robot. An experimenter in a different room manipulated the robot so that it appeared to move independently around the platform. All episodes were video-recorded through a one-way mirror.

Age 5 laboratory visit—At age 5, an experimenter led children, in groups of 3–4 unfamiliar, same-aged, same-sex peers, into a room filled with age-appropriate toys. Similar to previous procedures designed to tap anxious behaviors (Coplan, Rubin, Fox, Calkins, & Stewart, 1994), children were told that they could play with the toys however they liked. The experimenter then left the room and children were allowed to engage in unstructured play for 15 minutes. The episode was recorded through a one-way mirror.

Measures

Parent-reported social and nonsocial fear—Children's levels of social and nonsocial fear were defined as typical levels of fear in social (i.e., people) and nonsocial (i.e., objects or nature) contexts according to parent reports. Primary caregivers completed age-appropriate temperament questionnaires at child ages 2 (*Toddler Behavior Assessment Questionnaire (TBAQ)*; Goldsmith, 1996), 3, 4, and 5 years (Fall and Spring; *Children's Behavior Questionnaire (CBQ)*; Rothbart et al., 2001). Questions from the TBAQ object fear and CBQ fear scales are highly overlapping, asking about children's fears of the dark, loud noises, storms, and either real (e.g., bugs) or pretend “monsters.” Sample questions from the 10-item scale on the TBAQ included “When a dog or other large animal approached your child, how often did s/he cling to you?” and “When hearing loud noises, how often did s/he become distressed?” Sample questions from the 6-item scale on the CBQ included “Is frightened by “monsters” seen on TV or at movies” and “Is afraid of loud noises.” Because questions focus on children's fear in response to nonsocial stimuli, these scales were used as age-appropriate measures of nonsocial fear.

Questions from the TBAQ social fear and CBQ shyness scales are similarly overlapping, asking about children's comfort and levels of activity and interaction with familiar and unfamiliar individuals. Sample questions from the 10-item scale on the TBAQ included “When your child was approached by a stranger when you and s/he were out, how often did

your child show distress or cry?” and “When one of the parents' friends who did not have daily contact with your child visited the home, how often did your child talk much less than usual?” Sample questions from the 6-item scale on the CBQ included “Acts shy around new people” and “Sometimes turns away shyly from new acquaintances.” Because of their focus on children's fear responses to social interactions, these scales were used as age-appropriate measures of social fear.

TBAQ and CBQ scales have demonstrated construct equivalence over time (Goldsmith, Buss, & Lemery, 1997) and have been used together to model longitudinal fear development (Brooker et al., 2013). Given suggestions that it is necessary to adjust longitudinal measures to remain sensitive to developmental stage (Knight & Zerr, 2010), we prioritized construct definitions based on temperament theory in our examination of the development of social and nonsocial fear; thus, unadjusted raw TBAQ and CBQ scores were used.

The TBAQ and CBQ asked parents to rate, on identical seven-point scales, the frequency with which their child has displayed numerous behaviors during the previous month (1 = never; 7 = always). The reliability of all scales was high (mean $\alpha = 0.77$ across scales and ages).

Anxious behaviors

Observed dysregulated fear at age 2: Dysregulated fear was defined as a mismatch between observed fear and both (a) normative patterns of fear across episodes and (b) the incentive properties of emotion-eliciting contexts (Cole, Michel, & Teti, 1994). Based on this definition, dysregulated fear was derived from patterns of observed fear across emotion-eliciting episodes at age 2. Because dysregulated fear is intended to contrast children's displays of fear *across contexts*, it is most beneficial to include a variety of contexts in its calculation. As a result, both nonsocial and social contexts are included in its calculation.

Facial fear, bodily fear, freezing, and proximity to caregiver in each of the 6 laboratory episodes were reliably ($\kappa > .65$; agreement $> 80\%$) micro-coded on a second-by-second basis for each episode. Facial fear was coded using the AFFEX system, which differentiates emotion expressions based on three regions of the face (Izard, Dougherty, & Hembree, 1983). Fear was coded when brows were straight and raised, eyes were open wide, and mouth was open with corners pulled back. Bodily expressions of fear were coded when activity was diminished, children remained still/rigid for more than two consecutive seconds, and/or muscles appeared tensed or trembling. Proximity to caregiver was scored when the child was within approximately 2 ft. of their caregiver. A PCA was conducted for each episode. In each analysis, a factor emerged which accounted for approximately 25% of the variance in the original variables and included the duration or timing of each fear behavior. Fear behaviors were thus composited into a single variable for each episode (ICCs: 0.61 – 0.73) that indexed the proportion of time that children were engaged in fear behaviors.

As reported previously (Buss, 2011), comparisons of fear composites revealed that the *Spider* and *Robot* episodes elicited the most fear ($M = 37.79$, $SD = 17.48$) while *Clown* and *Puppet Show* elicited the least fear ($M = 23.49$, $SD = 22.92$). Based on this pattern, episodes were ordered according to the average amount of fear elicited by the episode (lowest to highest). Episode ordering took into account only levels of fear; episode ordering did not distinguish between social and nonsocial fear. Ordered in this way, a typical pattern of fear across contexts would be such that children generally showed the least fear in the *Clown* and *Puppet Show* episodes, more fear in the *Stranger Approach* and *Stranger Working* episodes, and the most fear in the *Robot* and *Spider* episodes. That is, children would typically show increases in fear as the episodes increased in putative threat.

In order to characterize individual patterns of fear dysregulation, multilevel models were used to create an individual slope of observed fear across the 6 episodes for each child. On average, children showed increases, in fearfulness across episodes (Buss, 2011). Because increases in fear was expected across the episodes, more positive slope values indicated better regulation/less dysregulation, as fearfulness remained consistent with eliciting contexts (Cole et al., 1994) and normative patterns of emotion across contexts. Flat (i.e., consistently high or consistently low fear, despite changes in threat) or more negative (i.e., decreasing fear despite increasing threat) slope values indicated greater fear dysregulation. We categorized dysregulated fear as an anxious behavior given its consistency with diagnostic criteria describing unnecessarily high levels of fear and avoidance that interfere with typical or normative function (*DSM-5*, 2013).

Socially anxious behaviors with peers at age 5: The Play Observation Scale was used to code children's behavior during free play with their peers (Rubin, 2001). Engagement in solitary, parallel, and group play was coded along with instances of anxious and aggressive behaviors. Data were scanned for groups that were outliers on behaviors that may have influenced the presence of anxious behaviors (e.g., aggressiveness). No groups were found to fit this description. The total proportion of each behavior was entered into a PCA. Three factors emerged that accounted for 70.64% of the variance in the original variables. The first factor (average loading = 0.77) reflected anxious behaviors with peers and had high positive loadings for reticent behaviors (watching others play without engaging, playing in parallel to others, avoiding conversations), anxious behaviors (displays of wariness), and hovering (watching other children play nearby [<3 ft]). This factor was defined as a socially anxious behavior given its consistency with diagnostic criteria describing excessive fear and avoidance of interacting with others (Social Anxiety Disorder; *DSM-5*, 2013). Regression-based factor scores reflecting anxious behaviors with peers were saved during the analysis. Additional factors reflected aggressive behaviors and solitary play, neither of which were explored further.

Parent-reported social inhibition at age 5: During the age 5 mailing, primary caregivers completed the *MacArthur Health Behavior Questionnaire* (HBQ; Essex et al., 2002), which assesses a variety of behaviors that index mental and physical health in children. Respondents rated, on a three-point scale (0 = *never true*, 2 = *often or very true*), the degree to which behaviors were characteristic of their child in the past six months. Given study

hypotheses, we focused on the Social Inhibition scale, which contained 3 items ($\alpha = 0.72$) asking parents to rate the degree to which their child was shy with strangers, unfamiliar adults, and other children. Scale scores served as a measure of anxious behaviors, given the role of the HBQ in providing developmentally-sensitive assessments of precursors to adult symptoms consistent with social anxiety disorder (*DSM-5*, 2013; Essex et al., 2002).

Inhibitory Control—Inhibitory control at age 2 was assessed using both parent report and observational methods. During the laboratory visit, children participated in a *Snack Delay* episode, comprising six trials requiring children to wait between 0 and 30 sec before eating a treat placed in front of them. Trained coders scored the number of seconds the child was able to wait on each trial and a total wait score reflecting inhibitory control was calculated ($\kappa = 0.89$).

A scale of inhibitory control is also included on the TBAQ. Thus, parents provided ratings (1 = never; 7 = always) of children's ability to wait or suppress impulsivity in normative situations requiring behavioral control. The scale's internal consistency was high ($\alpha = 0.82$).

On average, children were able to wait during *Snack Delay* trials ($M_{\text{trials}} = 4.45$, $SD = 1.58$) and substantial variability was seen in the number of seconds that each child was able to wait ($M_{\text{sec}} = 11.56$, $SD = 4.92$). A PCA suggested that a single component comprising children's observed and parent-reported inhibitory control accounted for 59.13% of the variance in the original variables (factor scores = 0.77). Thus, a standardized composite was formed to index inhibitory control per the definition of inhibitory control as the ability to suppress a prepotent response in the service of employing a subdominant response (Rothbart & Bates, 1998).

Plan for Analysis

To test the hypothesis that that social and nonsocial fear would follow distinct developmental trajectories across toddlerhood and preschool, we examined heterogeneity in the development of social and nonsocial fear using Latent Class Growth Analyses (LCGA; MPlus Version 4: Muthén & Muthén, 2006), which identifies latent classes whose trajectories differ from the overall sample by relaxing the assumption that all individuals are drawn from a single population (Jung & Wickrama, 2008; Muthén, 2004). Doing so allows for the emergence of different groups that follow their own developmental trajectories. Models were centered at the first assessment age and slopes reflecting changes in social or nonsocial fear were estimated for each group. Relative to assessments at ages 2–4, the final two assessments were spaced unequally (spring and fall of the kindergarten year); this was accounted for in the growth weight parameters. Analyses began with a 1-class solution and progressed until additional classes no longer improved model fit. All final models were judged to be of adequate fit as suggested by fit indices.

The LCGA approach was selected above a continuous-measure approach for two reasons. First, LCGA allows for subsets of groups that follow qualitatively distinct patterns relative to the overall sample. That is, not all members of the sample are assumed to follow the trajectory that is indicated by the mean-level change, as is the case with traditional growth models. Thus, this approach allows us to identify the presence and nature of non-normative

fear development over time. Second, to the extent that the current work is intended to inform targeted programs of prevention and intervention, LCGA approaches can lead to practical cutoffs for identifying children who are most at risk.

Following the LCGA, we tested the hypothesis that that stable, high levels of social fear over time would be associated with the greatest number of socially anxious behaviors using Analyses of Variance (ANOVAs). Trajectories of social and nonsocial fear were included in separate models to examine the specificity of findings to social fear. Significant effects in separate models were compared using effect sizes.

Finally, we used hierarchical regression models to test the hypothesis that high levels of inhibitory control coupled with trajectories of high social fear would predict greater numbers of socially anxious behaviors at age 5. Analyses focused on age 5 anxious behaviors in order to take advantage of the longitudinal nature of the data, allowing for stronger inferences than would cross-sectional data.

Missing Data

Rates of missing data ranged from 9.1% children missing observed social and nonsocial fear at age 2 to 47.1% of children missing parent-reported fearfulness at the age 4 assessment. On average, roughly 25% of data were missing from assessments. An analysis of patterns of missing data suggested that data were missing completely at random (Little's MCAR $\chi^2(262)=268.90, p > 0.10$). Under these conditions, it is appropriate to employ a Full Information Maximum Likelihood (FIML) procedure to account for missing data in the estimation of LCGA classes in Mplus (Graham, 2009). Given that the highest proportion of missing data was in measures used in the creation of latent profile groups rather than validation or outcome measures (i.e., most validation and outcome variables had less than 10% missing values), subsequent analyses using profile groupings were conducted as complete-case analyses.

Results

Descriptive Statistics, Bivariate Associations, and Sex Differences

Means and bivariate correlations are shown in Tables 1 and 2, respectively. Nonsocial fear was significantly correlated at adjacent assessments, but correlations decreased as time between assessments increased and became more variable.

Independent samples *t*-tests (Table 1) revealed greater parent-reported social fear for girls ($M = 3.76, SD = 1.40$) than boys ($M = 3.04, SD = 1.04$) and greater observed nonsocial fear for girls ($M = 3.07, SD = 0.89$) than boys ($M = 2.69, SD = 0.91$) at age 2. Thus, sex was used as a covariate in all regression and ANOVA models.

Trajectories of Social Fear in Early Childhood

Comparisons of LCGA models based on parent ratings of social fear suggested that a 3-class model fit the data best (Table 3). The average probability for membership in latent classes was high ($M = 0.86$). The first class ($n = 20$) was reported as having high social fear across all assessments (Figure 1a). A second class ($n = 52$) was reported as having moderate social

fear across all assessments. A third class ($n = 39$) was reported as having low social fear across all assessments. Thus, children were divided into three groups (i.e., high social fear, moderate social fear, or low social fear); each child was placed into the group for which his/her probability of membership was highest. Sex was unrelated to social fear group ($\chi^2[2] = 0.86, p > 0.10$).

To verify the independence of groups, we used a Univariate ANOVA to test for group differences in parent-reported social fear at each assessment. That is, we tested whether groups reflected meaningful differences in parents' original ratings. This test revealed significant differences between groups in parent-reported social fear at ages 2 ($F_{2, 103} = 16.87, p < 0.01, \eta_p^2 = 0.23$), 3 ($F_{2, 64} = 24.07, p < 0.01, \eta_p^2 = 0.43$), 4 ($F_{2, 60} = 47.98, p < 0.01, \eta_p^2 = 0.62$), and in the fall ($F_{2, 77} = 123.50, p < 0.01, \eta_p^2 = 0.76$) and spring ($F_{2, 73} = 134.54, p < 0.01, \eta_p^2 = 0.79$) of the kindergarten year. Post-hoc tests showed that all three groups differed in social fear at each assessment; the high social fear group was always reported as having the highest levels of social fear and the low social fear group was always reported as having the lowest levels of social fear.

Trajectories of Nonsocial Fear in Early Childhood

The process for deriving the nonsocial fear trajectory groups was identical to that for deriving the social fear groups. Comparisons of LCGA models for nonsocial fear suggested that a 3-class model fit the data best (Table 3). The average estimated probability for membership in latent classes was high ($M = 0.85$). All classes showed relatively similar levels of nonsocial fear at age 2 (Figure 1b). Over time, steep increases followed by high levels of nonsocial fear across assessments were reported for one of the classes ($n = 17$). Moderate increases followed by moderate levels of nonsocial fear across assessments were reported for a second class ($n = 81$). A third class ($n = 14$) was reported as having low, stable levels of nonsocial fear across all assessments. Thus, children were divided into three groups (i.e., high nonsocial fear, moderate nonsocial fear, low nonsocial fear); each child was placed into the group for which his/her probability of membership was highest. Sex of child was unrelated to nonsocial fear trajectory group ($\chi^2[2] = 0.27, p > 0.10$). Nonsocial fear group was also unrelated to social fear group ($\chi^2[4] = 6.84, p > 0.10$), suggesting that trajectories did not simply reflect global levels of fear.

Again, we used a Univariate ANOVA to test for group differences in parent-reported nonsocial fear at each assessment to determine whether groupings reflected meaningful differences in parents' original ratings of nonsocial fear. Significant group differences in nonsocial fear were seen at ages 2 ($F_{2, 103} = 3.78, p < 0.01, \eta_p^2 = 0.07$), 3 ($F_{2, 64} = 11.70, p < 0.01, \eta_p^2 = 0.27$), 4 ($F_{2, 60} = 29.22, p < 0.01, \eta_p^2 = 0.49$), and during the fall ($F_{2, 77} = 72.78, p < 0.01, \eta_p^2 = 0.65$) and spring ($F_{2, 73} = 63.89, p < 0.01, \eta_p^2 = 0.64$) of the kindergarten year. Post-hoc tests showed that at age 2, only the low and moderate groups differed from one another in levels of nonsocial fear, with the moderate group reported as having greater levels of nonsocial fear than the low fear group. At age 3, all comparisons *except* that between the low and moderate groups were significant; the high fear group was reported as having greater levels of nonsocial fear than the other two groups. At ages 4 and 5, all groups were significantly different from one another in levels of nonsocial fear; the

high and low fear groups were reported as having the highest and lowest levels of nonsocial fear, respectively. Thus, consistent with Hypothesis 1, social fear and nonsocial fear appeared to follow distinct developmental trajectories between ages 2 and 5.

Associations between Trajectory Groups and Children's Anxious Behaviors

We then used a Univariate ANOVA to test hypotheses about unique associations between social fear groups, nonsocial fear groups, and our measure of anxious behaviors at age 2. Social fear group was significantly associated with slopes of dysregulated fear ($F_{2, 106} = 6.54, p < 0.01, \eta_p^2 = 0.11$). Follow up tests suggested that both the high ($t_{89} = 2.30, p < 0.05, d = 0.50$) and moderate ($t_{57} = 3.65, p < 0.01, d = 0.96$) social fear groups showed more dysregulated fear than the low social fear group. The high social fear group showed moderately more dysregulated fear than the moderate social fear group ($t_{70} = 1.79, p < 0.10, d = 0.46$). Nonsocial fear groups were not associated with slopes of dysregulated fear at age 2 ($F_{2, 106} = 2.19, p > 0.10$). Consistent with Hypothesis 2, this pattern of results suggests that a trajectory of high, stable social fear during toddlerhood and preschool was associated with the greatest amount of dysregulated fear.

Next, we used Univariate ANOVAs to test associations between social fear, nonsocial fear, and anxious behaviors at age 5. Anxious behaviors with peers and parent-reported social inhibition were predicted in separate models. Social fear group significantly predicted anxious behaviors with peers ($F_{2, 66} = 4.52, p < 0.05, \eta_p^2 = 0.12$). The high social fear group showed more anxious behaviors with peers than both the low ($t_{37} = -2.75, p < 0.01, d = 0.92$) and moderate ($t_{43} = -2.09, p < 0.05, d = 0.62$) social fear groups. The low and moderate social fear groups did not differ in the numbers of anxious behaviors displayed with peers ($t_{54} = -0.66, p > 0.10$). Nonsocial fear groups were unrelated to anxious behaviors with peers ($F_{2, 66} = 0.68, p > 0.10$). Again, consistent with Hypothesis 2, results suggest that a trajectory of high, stable social fear during toddlerhood and preschool was associated with the greater numbers of socially anxious behaviors at age 5.

Social fear trajectory groups also significantly predicted parent reported social inhibition at age 5 ($F_{2, 78} = 29.91, p < 0.05, \eta_p^2 = 0.43$). Children in the high social fear group were reported as greater in social inhibition at age 5 relative to both the low ($t_{44} = -7.37, p < 0.01, d = 2.51$) and moderate ($t_{50} = -2.49, p < 0.01, d = 0.83$) social fear groups. Children in the moderate social fear group were also reported as showing greater social inhibition at age 5 than children in the low social fear group ($t_{64} = -5.67, p < 0.01, d = 1.40$). Nonsocial fear trajectory groups did not differ in parent-reported social inhibition at age 5 ($F_{2, 78} = 0.04, p > 0.10$). Similar to previous findings, these results are consistent with Hypothesis 2, suggesting that high, stable social fear during toddlerhood and preschool predicted the greatest amount of social inhibition at age 5.

Latent Trajectories of Fear, Inhibitory Control, and Anxious Behaviors

In our final set of analyses, we used hierarchical regression models to test the hypothesis that levels of inhibitory control at age 2 moderated links between fear trajectory groups and

children's anxious behaviors at age 5. Fear trajectory groupings, rather than continuous fear variables, were included in these analyses given the indication of the LCGA models that heterogeneity in fear and fear processes existed across groups. Analyses focused only on age 5 behaviors, tested as outcomes in separate models, so that all models tested unique longitudinal outcomes. To create a more stringent test of the longitudinal contributions of social and non-social fear to age 5 outcomes, social and non-social fear were tested as simultaneous predictors of child outcomes. A 4-step model was used for each outcome measure: sex of child and age 2 fearfulness were entered into the first step as covariates. Main effects for social fear group (dummy coded; Aiken & West, 1991), nonsocial fear group (dummy coded) and inhibitory control were entered in the second step. The interactions between dummy codes for nonsocial fear groups and inhibitory control were entered in the third step. Interactions between dummy codes for social fear groups and inhibitory control were entered in the fourth step. Interactions between social fear groups and inhibitory control were entered last given hypothesized associations between social fear and inhibitory control for children's outcomes. The interactions between inhibitory control and fear groups were considered significant if a significant change in R^2 resulted from the addition of the interaction terms (Step 3 for nonsocial fear, Step 4 for social fear). Moderation analyses are illustrated in Figure 2.

The change in R^2 suggested that nonsocial fear groups and inhibitory control did not interact to predict anxious behaviors with peers ($\Delta R^2 = 0.06, p > 0.05$) or parent-reported inhibition ($\Delta R^2 = 0.03, p > 0.05$) at age 5. However, a significant change in R^2 in the final step of the model predicting socially anxious behaviors with peers suggested an interaction between social fear group and inhibitory control predicting anxious behaviors at age 5 ($\Delta R^2 = 0.10, p < 0.05$). Probing this interaction at low ($-1 SD$) and high ($+1 SD$) levels of inhibitory control revealed that when levels of inhibitory control were low, neither the low social fear group ($B = -0.18, SE(B) = 0.46, p > 0.10$) nor the high social fear group ($B = -0.11, SE(B) = 0.52, p > 0.10$) differed from the moderate fear group in age 5 anxious behaviors with peers. However, when levels of inhibitory control were high at age 2, the high social fear group showed more anxious behaviors with peers at age 5 ($B = 2.05, SE(B) = 0.62, p < 0.01$) than did the moderate group³. The low and moderate social fear groups did not differ in anxious behaviors with peers at high levels of inhibitory control ($B = -0.17, SE(B) = 0.43, p > 0.05$).

For the model predicting parent reported social inhibition at age 5, a nonsignificant, change in R^2 suggested that neither nonsocial fear group ($\Delta R^2 = 0.00, p > 0.05$) nor social fear group ($\Delta R^2 = 0.02, p > 0.05$) interacted with inhibitory control to predict childhood social inhibition. Rather, the main-effects only model in Step 2 suggested that social fear groups (High: $B = 0.21, SE(B) = 0.12, p < 0.10$, Low: $B = -0.55, SE(B) = 0.10, p < 0.01$) and inhibitory control ($B = 0.11, SE(B) = 0.04, p = 0.01$) were independent predictors of parent-reported social inhibition at age 5. Similar to the results of the one-way ANOVA, parents reported more social inhibition in the high social fear group and less social inhibition in the low social fear group relative to the moderate group. Similarly, greater inhibitory control at age 2 was associated with greater parent-reported inhibition at age 5. Thus, results were

consistent with the expectation that high levels of inhibitory control and high social fear predicted greater numbers of socially anxious behaviors at age 5, although these effects were compounded only for observed behaviors with peers.

Discussion

We addressed three primary aims in the current work. First, we identified trajectories of development for social and nonsocial fear between 2 and 5 years of age. Consistent with the hypotheses that social and nonsocial fear would follow distinct developmental trajectories across toddlerhood and preschool, social and nonsocial fear trajectories were unrelated, underscoring their roles as unique scientific constructs that reflect distinct emotion processes early in life.

Second, we tested whether early trajectories of social and nonsocial fear predicted children's socially anxious behaviors at ages 2 and 5. Greater anxious behaviors, based on criteria for Social Anxiety Disorder, were derived from both observational and parent-report measures. Overall, trajectories of high, stable social fear across preschool and early childhood predicted greater numbers of socially anxious behaviors at both 2 and 5 years of age. Trajectories of nonsocial fear did not predict anxious behaviors, underscoring the importance of distinguishing between social and nonsocial fear development in association with putative risk for social anxiety early in life.

Finally, we tested whether early inhibitory control moderated links between trajectories of fear and socially anxious behaviors at age 5. Social fear and inhibitory control made independent contributions to children's social behaviors at age 5 and interacted to predict behaviors in the laboratory. Children showed greater anxious behaviors with peers when levels of both social fear and inhibitory control were high. Such findings suggest that combined propensities for overcontrol and high levels of social fear may be detrimental. Again, nonsocial fear was unrelated to children's anxious behaviors at age 5.

Distinguishing Trajectories of Social and Nonsocial Fear

Extending previous work dissociating types of fear in children, we found little overlap between developmental trajectories of social and nonsocial fear between 2 and 5 years of age. Social fear groups reflected stable individual differences in severity, rather than shape, of developing social fear. This finding is consistent with previous work that identified four trajectories of social fear between 6 and 36 months of age (Brooker et al., 2013): stable, high social fear; steeply increasing social fear; normative, slowly increasing social fear; and decreasing social fear. Notably, by age 36 months, levels of social fear in the decreasing group were not different from those in the normative group (i.e., slowly increasing social fear). Thus, it is reasonable to expect, given the first age of assessment in the current work, that only three patterns of developing social fear would be visible. Together, these studies suggest that differences in the shape of social fear development may occur during infancy, while differences in social fear during preschool and early childhood are associated largely with severity.

In contrast, preschool and early childhood appear to be an important time for the development of individual differences in nonsocial fear. This was evident in two primary ways. First, levels of nonsocial fear were largely uncorrelated across nonadjacent assessments. This suggests a high degree of change over time, particularly for periods of more than 12 months. Although occasional suggestions arise that temperament traits, such as fear, should always evidence high levels of continuity, leading theorists have long agreed that the expression of temperament evolves dynamically across the life span, with less continuity expected during periods of developmental change (Goldsmith et al., 1987). Notably, the period of developmental change elucidated here was not apparent in prior work, which largely focused on nonsocial fear during the first year of life (Scarr & Salapatek, 1970).

We also found that independence among trajectory groups was not fully achieved until age 4. Research on emerging emotions in infants has suggested that social fear can be reliably elicited earlier than nonsocial fear (Kagan, Kearsley, & Zelazo, 1978). This developmental sequence may be adaptive in that it promotes the development of an attachment relationship and infant safety early in life (Sroufe, 1977). As such, it may be the case that the critical periods of development for social and nonsocial fear are also distinct. While this claim cannot be validated by a single study, our work suggests that this possibility be considered in future research.

Social, but not Nonsocial, Fear Trajectories Predict Children's Socially Anxious Behaviors

High, stable levels of social fear across early childhood were associated with greater dysregulated fear, more anxious behaviors during free play with peers, and more parent-reported social inhibition. No such associations were found for nonsocial fear. Notably, outcome measures were derived through separate data collection methods and included different ages of assessment. Socially anxious behaviors were selected as developmentally-appropriate correlates of diagnostic criteria for Social Anxiety Disorder, which has shown the most robust associations with early fearfulness. Accordingly, dysregulated fear, anxious behaviors during early peer play, and greater parent-reported social inhibition have each been linked to an increased risk for Social Anxiety Disorder (Buss, 2011; Chronis-Tuscano et al., 2009; Coplan et al., 1994). Importantly, despite some evidence for elevated symptoms (Buss et al., 2013), children in the current study are quite young and largely without clinical diagnoses. Thus, our findings suggest that differentiating levels of early social and nonsocial fear may help to refine predictions of risk rather than identify the presence of clinical symptoms. This, of course, is preferable given our larger goal of informing programs of targeted prevention and intervention.

We also note that a substantial proportion of children were classified as low in social or nonsocial fear over time. These children showed the lowest levels of dysregulated fear at age 2 and parent-reported inhibition at age 5. Although this suggests minimal levels of anxiety risk in low-fear children, our data do not offer insight about other developmental outcomes for these children. For example, low levels of fear have been associated with greater early risk for externalizing problems (Colder, Mott, & Berman, 2002). Investigating putative

outcomes associated with low levels of fearfulness may be an important avenue for future research.

Additionally, it will be important to understand how additional distinctions between social and nonsocial fear can help to refine current measures of fear. As previously mentioned, literatures on both behavioral inhibition and dysregulated fear have largely composited social and nonsocial fear measures to produce a single outcome measure. Our findings, along with previous work (Dyson et al., 2011), raise the possibility that slopes of dysregulated fear produced by measures of fear in only social contexts would differ from dysregulated fear assessed in only nonsocial contexts. More importantly, our results suggest that slopes of dysregulated fear in social contexts may be of greater consequence for the development of social anxiety over time. Thus, this is another potentially important avenue for future research.

Inhibitory Control Moderates Links between Social Fear and Anxious Behaviors

We found that inhibitory control moderated associations between trajectories of social fear and anxious behaviors at age 5. Greater inhibitory control at age 2 predicted more anxious behaviors with peers at age 5 when coupled with stable, high levels of social fear. Unexpectedly, moderation was not observed for parent-reported anxious behaviors. Although a small correlation was present between parent-reported inhibition and observed anxious behaviors during kindergarten, these constructs are clearly non-redundant. Parental reports of child behavior may reflect broader characterizations of children's behaviors relative to observational measures (Seifer, Sameroff, Barrett, & Krafchuk, 1994). It is possible that our laboratory assessment highlights the difficulty that high fear children have initiating interaction with new groups of peers rather than an overall absence of peer relationships. Indeed, although fearful preschoolers are generally less likely to engage in social activities, parents do report engagement in structured, dyadic play with a single friend (Coplan, DeBow, Schneider, & Graham, 2009).

Our findings lend support to prior assertions that the nature and context in which control is exerted is important for child outcomes (Cole et al., 1994; Eisenberg, Smith, Sadovsky, & Spinrad, 2004). Optimal outcomes appear to rely on the flexible modulation of emotion and behavior across contexts in a way that balances highly-restricted and highly impulsive behaviors (Bonanno & Burton, 2013; Ryan & Deci, 2006). Our work extends theoretical distinctions by suggesting that when more “automatic” tendencies for over-control are coupled with stable, high levels of fear, risk for internalizing problems is compounded in young children. An important implication of this is that interventions targeted at enhancing self-control may be detrimental, rather than helpful, for highly fearful children. This idea has been noted previously (Moffitt et al., 2011), but is infrequently discussed.

Limitations

Despite its contributions, the current study is not without limitations. Profiles of early social and nonsocial fear development were based on parent-report questionnaires. Given that, as previously asserted, parental-report measures may not fully correspond to observed behaviors, analyses conducted with observational data may suggest somewhat different

trajectories of fear development. Discrepancies due to differences in measurement and their implications for child outcomes will be important to determine in future research.

Similarly, analyses are based on a moderately-sized sample. Developmental scientists continue to balance conducting multi-trait, multi-method assessments in smaller samples with collecting less-intensive approaches in larger samples. Clearly, our work prioritizes the former approach. Concerns about sample size can be at least partially subdued by the use of multiple fit indices to determine the correct LCGA model. At least one study has reported that as sample sizes approach 100 participants, such as in ours, the likelihood of correctly selecting a 3 versus 2 class model ranges from 80% to 91% for individual indices. Moreover, simulations suggest that small sample sizes more frequently contribute to the selection of too few rather than too many classes (Yang, 2006). Thus, although we maintain confidence in the latent classes reported here, it is possible that smaller classes exist in the population that have not yet been identified.

In addition, the current sample is one of low risk for psychopathology, and the current work does not include clinical outcomes for the children described as putatively at risk according to levels of fear and inhibition. Initial diagnoses of Social Anxiety Disorder tend to occur during adolescence (Burke, Burke, Regier, & Rae, 1990), making it difficult to predict the proportion of children in the current sample who will develop disorder. As such, the degree to which the current results generalize to high-risk individuals is unknown.

Finally, the measures in the current study differ somewhat from the work by Dyson and colleagues (2011). Although such discrepancies are occasionally viewed unfavorably, we view this as a strength of the current work. The agreement across both sets of findings regarding social fear provide a *conceptual* replication without reliance on specific measures and assessments.

Conclusions

In sum, levels of social fear uniquely predicted individual differences in children's socially anxious behaviors measured via observations and parent report across a three-year period. Moreover, social fear, but not nonsocial fear, interacted with early inhibitory control to predict socially anxious behaviors, such that trajectories of high social fear coupled with greater inhibitory control appeared to put children at greatest risk for anxious behaviors by age 5. While additional work is needed, our results suggest that measures that distinguish social fear from other types of fear will be most useful for identifying children who are at high risk for developing problems with social anxiety. These findings expand on theoretical and empirical work that elucidates trajectories of early risk and move us closer to identifying specific profiles of risk for anxiety problems in young children.

Part 2

**Kindergarteners' Self-Reported
Social Inhibition and Observed
Social Reticence: Moderation
by Adult-Reported Social
Inhibition and Social Anxiety
Disorder Symptoms**

Kindergarteners' Self-Reported Social Inhibition and Observed Social Reticence: Moderation by Adult-Reported Social Inhibition and Social Anxiety Disorder Symptoms

Abstract

Prevention of later anxiety problems would best be accomplished by identifying at-risk children early in development. For example, children who develop Social Anxiety Disorder (SAD) may show social withdrawal in the form of social inhibition (i.e., shyness with unfamiliar adults and peers) at school entry. Although the use of children's perceptions of their own social inhibition would provide insight into early risk, the utility of young children's self-reports remains unclear. The current study examined whether children deemed more extreme on social inhibition or social anxiety by adult report provided self-report of social inhibition that related to observed social reticence in the laboratory. Participants included 85 kindergarten children (36 female, 49 male), their parents, and their teachers. Moderation analyses revealed that children's self-reported social inhibition related significantly to observed social reticence under the conditions of high parent-reported social inhibition, high teacher-reported social inhibition, and high SAD symptoms. These results suggest that the most inhibited children are aware of their behavior and can report it in a meaningful way as young as kindergarten age.

Keywords

Shyness; social inhibition; anxiety; self-report

The great prevalence of social anxiety and its precursors (e.g., shyness, social inhibition) demands accurate assessment early in development to aid in the prevention of these problems. Social anxiety is one of the more prevalent anxiety problems facing children and adolescents (Beesdo, Knappe, & Pine, 2009), affecting upwards of 7.5% of 2- to 5-year-old children (Franz et al., 2013), and social withdrawal, the broader category in which shyness and social inhibition reside, is the most frequent dysfunctional behavior in the internalizing spectrum identified by parents (Achenbach, 1995). The transition to kindergarten is a salient period for the recognition of these problems as children face new social challenges, such as interacting with perhaps the largest group of peers some children have encountered, making and managing friendships, and working with peers in classroom tasks (Early et al, 2002).

Although parents and teachers are usually relied upon for the assessment of problematic behaviors (Mash & Hunsley, 2007), children may contribute to the early identification of their own risk for anxiety. Historically, informant discrepancies between adults and children have called into question the utility of young children's self-reports, resulting in weighting adult reports more heavily (De Los Reyes and Kazdin, 2005; DiBartolo, Albano, Barlow, & Heimberg, 1998). Rarely have these reports been examined in relation to a more objective assessment, such as observation of social reticence, which is crucial in understanding the potential contribution of child reports. Moreover, the function of children's self-reports in the context of ratings by other reporters remains relatively unknown. Recent theory and empirical work suggests the importance of understanding meaningful differences in discrepancies that have been observed between children and other informants and methods (i.e., observation) (Achenbach, 2011; De Los Reyes, 2011). The current study addresses these gaps by examining the relation of kindergarteners' self-reported social inhibition to observed social reticence in the context of parent- and teacher-report of social inhibition as well as symptoms of Social Anxiety Disorder from a parent interview.

Social Inhibition

Although Social Anxiety Disorder (SAD; also, Social Phobia) is most commonly diagnosed in adolescence, an increasing body of literature suggests that risk for SAD can be identified much earlier in development (Biederman et al., 2001; Hirshfeld-Becker et al., 2007). Dispositional risk for SAD may first be shown by infants and toddlers demonstrating high levels of inhibited temperament (also, fearful temperament or behavioral inhibition; Kagan, Reznick, Clarke, Snidman, & Garcia-Coll, 1984), which is at least partly heritable and biologically based, and is manifested behaviorally as reacting to novelty with wariness, hesitance, and avoidance (Kagan et al., 1984). In school age children, this disposition is typically assessed as social inhibition (also, shyness), which is withdrawn or avoidant behavior in the presence of unfamiliar people (Rubin, Coplan, & Bowker, 2009). Like inhibited temperament, social inhibition is conceptualized as coming from anxiety-based processes within the child, which can be differentiated from withdrawal resulting from external influences (e.g., peer rejection) or lack of interest in social interactions ("social disinterest;" Coplan & Armer, 2007; Rubin et al., 2009). Although inhibition to a variety of stimuli (objects, people, situations) is linked to SAD diagnosis and symptoms (Biederman et al., 2001; Buss et al., 2013; Hirshfeld-Becker et al., 2007), social inhibition is particularly relevant to risk for SAD (Van Ameringen, Mancini, & Oakman, 1998).

Common survey measures of social inhibition and shyness ask about inhibited behavior demonstrated with both unfamiliar peers and adults (e.g., Armstrong, Goldstein, & The MacArthur Working Group on Outcome Assessment, 2003), although some measures focus exclusively on peers (Coplan, Prakash, O'Neil, & Armer, M, 2004). When assessed observationally, the behavioral manifestation of social inhibition has been termed "social reticence" and is demonstrated by watching and hovering near peer activity without interacting (Rubin et al., 2009). Reticent behavior, more than other types of solitary activity, has been theorized to reflect approach-avoidance conflict indicative of anxiety in the presence of social novelty (Asendorf, 1990). Indeed, reticence, but not solitary-passive or solitary-active play, has been related to observed and mother-reported anxiety, hovering, and

wariness (Coplan, Rubin, Fox, Calkins, & Stewart, 1994). Social inhibition and social reticence fall under the larger umbrella of social withdrawal (Rubin et al., 2009). This superordinate term also includes “anxious solitude,” which indicates withdrawal behaviors with familiar peers (Gazelle, Workman, & Allan, 2010), but this latter aspect of social withdrawal is not the focus of the current study.

Although social inhibition and social reticence are not inherently problematic, their links to psycho-social indicators of functioning suggest that identifying socially inhibited children for intervention may be important at the beginning of formal schooling, especially because such behaviors are present prior to school entry (Coplan et al., 1994). Social inhibition is linked with SAD, as well as other internalizing, academic, and peer relationship problems (Coplan & Armer, 2007; Coplan, Findlay, & Nelson, 2004; Rubin et al., 2009; Rubin, Wojslawowicz, Rose-Krasnor, Booth-LaForce, & Burgess, 2006), and demonstrates moderate stability from preschool through early adulthood (Rubin et al., 2009; Coplan et al., 1994). Accurate identification of social inhibition, however, remains a difficult task. Because information often varies across sources, conclusions about whether socially avoidant behaviors are problematic for a child may depend upon the informant (De Los Reyes & Kazdin, 2005). Child self-report would provide an expedient assessment of social inhibition and may be particularly predictive of diagnosis and treatment gains should prevention or intervention be sought (Brown-Jacobsen, Wallace, and Whiteside 2011; Panichelli-Mindel, Flannery-Schroeder, Kendall, & Angelosante, 2005). The role of child self-report in the context of other available reporters remains unclear, especially for younger children. Theory and empirical work on informant discrepancies support efforts to gain a more nuanced understanding of children’s self-reports of social inhibition.

Informant Discrepancies

Broadly speaking, discrepancies between parent- and child-reports of internalizing problems such as anxiety and social inhibition occur frequently (De Los Reyes & Kazdin, 2005; Edelbrock, Costello, Dulcan, Conover, & Kala, 1986; Reuterskiold, Öst, & Ollendick, 2008) and in patterns that appear similar across cultures (Cosi, Canals, Hernandez-Martinez, & Vigil-Colet, 2010; Rescorla et al., 2013; Salbach-Andrae, Klinkowski, Lenz, & Lehmkuhl, 2009). The direction of discrepancies has varied across studies: some find that children report higher levels than parents (Edelbrock et al., 1986; Karver, 2006), and others find the opposite pattern (DiBartolo et al., 1998; DiBartolo & Grills, 2006; Kemper, Gerhardstein, Repper, & Kistner, 2003). A variety of sample characteristics (e.g. community versus clinic, age, etc.) might account for why parents report higher levels of child internalizing symptoms than children self-report in some samples, and why for other samples the reverse pattern is found. For example, research suggests that in community samples, children tend to report higher levels than parents of internalizing problems (Cantwell, Lewinsohn, Rohde, & Seeley, 1997), whereas in clinic samples, the results have been mixed. Some research indicates that children report higher levels (Edelbrock et al., 1986), but other research indicates that children report lower levels of internalizing problems than parents (Ivens & Rehm, 1988).

Explanations to account for informant discrepancies have relied primarily on one of two perspectives: 1) discrepancies are the result of inaccurate reporting or measurement error (Dadds, Perrin, & Yule, 1998; DiBartolo et al., 1998), and 2) discrepancies represent meaningful differences due to the unique information that informants bring to the assessment, arising because of individual perspectives on particular behaviors in specific contexts (Achenbach, 2011; De Los Reyes, 2011; De Los Reyes & Kazdin, 2005). The former explanation might be invoked to suggest that when young children's reports do not match those of other reporters, they are inaccurate and should be disregarded. The latter explanation is a more recently pioneered perspective on how discrepancies can provide meaningful information for the assessment of socioemotional and clinical problems, due to the different kinds of information that are provided by different informants. De Los Reyes and Kazdin (2005) proposed the Attribution Bias Context Model as a theory-based framework within which to understand informant discrepancies. In this model, parent and child characteristics as well as the context of the behavior relate to variability among reporters. Furthering this theory, De Los Reyes (2011) has argued that informant agreements/discrepancies tend to be stable over time and provide valuable information about the development and maintenance of child psychopathology.

Empirical work supports this position. Discrepancies have been found to relate to characteristics like response bias tendencies (DiBartolo et al., 1998; Stokes, Pogge, Wecksell, & Zaccario, 2011) and psychopathology (De Los Reyes & Kazdin, 2005; Hughes & Gullone, 2010; Youngstrom, Findling, & Calabrese, 2004) in children and parents, and to predict poor treatment outcomes for 7- to 16-year-old children and adolescents (De Los Reyes, Alfano, & Beidel, 2009). Specifically within the anxiety spectrum, the behavioral consequences of different kinds of problems and the contexts in which those behaviors occur might result in different levels of report by different observers. For instance, Brown-Jacobsen and colleagues (2011) found that parents reported higher levels of separation anxiety disorder but children (ages 7 – 18 years) reported higher levels of generalized anxiety disorder (GAD). The behavioral consequences of separation anxiety might have been more salient for parents than children, and vice versa for GAD.

Although evidence suggests that informant discrepancies are the result of meaningful differences in the data contributed by different informants, there remains a question about which informant's report will drive decisions about what constitutes clinically significant concerns, particularly in settings where diagnostic decisions are important. Parent-child disagreement may result in parent-report being weighted more heavily than children's concerns (DiBartolo et al., 1998; Hawley & Weisz, 2003; Kramer et al., 2004; Loeber, Green, & Lahey, 1990). Child-reported social inhibition, however, might offer useful information about potential areas of clinical concern because parents, and even teachers, may not be privy to all contexts in which this behavior occurs. Indeed, convergence between child- and parent-report of anxiety symptoms has been shown to predict both clinician diagnosis and treatment response better than parent-report alone (Brown-Jacobsen et al., 2011; Panichelli-Mindel et al., 2005).

Some research suggests that self-report by younger, versus older, children correlates more highly with parent-report about the child (Choudhury, Pimental, and Kendall, 2003).

However, other research shows better agreement with older than younger children (Grills & Ollendick, 2003; Edelbrock et al., 1986; Reuterskiold et al., 2008) and suggests further evidence may be needed. Specifically, future research might examine children's self-reports in the context of other reporters who see children's behavior across contexts (i.e., both parents and teachers) to understand the nature of convergence or divergence, as suggested by calls for more nuanced understanding of informant discrepancies (De Los Reyes, 2011). In order to understand whether children can contribute to the identification of their own risk for later anxiety at an age when early intervention may be most beneficial, we need to understand the role of children's self-reported social inhibition early in childhood among other reporters.

Research in this area has not commonly used a methodology able to evaluate how reports from multiple informants relate to a distinct, empirical criterion, such as observation. The few notable exceptions that do exist suggest that children, parents, and teachers, as well as convergence among adult reporters, contribute unique information about problem behaviors and their salient contexts (De Los Reyes, Henry, Tolan, & Wakschlag; 2009; DiBartolo & Grills, 2006). Cobham and Rapee (1999) examined the accuracy with which mothers and their 5- to 14-year-old children predicted the proximity with which children would approach a large dog and how much subjective fear children would experience. They found that children and their mothers were equally accurate in predicting how close the children would approach, but that children's predictions of subjective ratings of fear were more accurate in relation to what they actually experienced than their mothers' predictions. Notably, no effects of age existed, suggesting that children at the beginning of formal schooling were equally accurate in predicting their own anxious behavior as older children. No studies have examined multiple reports of social inhibition or SAD symptoms, and how children's self-reports may converge with these, in relation to an observational criterion, which would more clearly indicate the usefulness of children's self-reports in identifying risk for later SAD.

Recent work points to the utility of using moderation analyses to understand convergence or divergence among reporters in line with theory on informant discrepancies. Using polynomial regression analyses, Laird and De Los Reyes (2013) showed that examining the interaction between parent and adolescent report of adolescent-parent conflict, adolescent puberty, and adolescent rule-breaking behavior more precisely identified distinct combinations of reports that related to adolescent depression and antisocial behavior, as compared to using difference scores. In their study, interaction terms accounted for significant variance in adolescent antisocial behavior and depression, above and beyond parent and adolescent reports individually. As one example, adolescent-reported rule-breaking behavior predicted higher levels of antisocial behavior in the context of high, rather than low, parent-reported rule-breaking behavior. We suggest that such an examination of the interactions between child report, on the one hand, and adult reports of social inhibition and interview responses about SAD symptoms, on the other, in relation to observation of social reticence may most appropriately highlight the relevance of child report.

The Current Study

The present study aimed to understand the relation between kindergartners' self-reported social inhibition and laboratory-observed reticence in the context of other reporters' assessments. Specifically, we hypothesized that self-reported social inhibition would relate most strongly to observed reticence when parents and teachers also reported high levels of social inhibition and when parents endorsed a greater number of symptoms of SAD on a clinical interview. In other words, we expected that children who, by adults' perspectives, are shy and inhibited, would be aware of their social inhibition. This investigation contributes to the extant literature in several ways. First, little is known about the self-report of social inhibition in children as young as kindergarten age. Given that adjustment to formal schooling may highlight proneness to social and emotional difficulties and be an opportune time for prevention and early intervention, it is important to understand whether children's self-reports contribute useful information to identification of these problems at this age. Second, although much research has compared children's self-reports to parent-report of adjustment difficulties and diagnostic symptoms, relatively few studies have examined these reports in relation to observational measures. Our focus on the confluence of reports in relation to observed social reticence contributes to the validation of children's self-reports and the growing area of informant discrepancies. We examined the relation between children's self-reported social inhibition in the context of both parents' and teachers' reports of children's social inhibition, as well as in the context of symptoms of SAD, as assessed by parent clinical interview.

Method

Participants

Participants came from a larger longitudinal study ($n = 111$) of risk for anxiety-spectrum problems across early childhood (Buss et al., 2013). In the larger study, children were assessed at ages 2, 3, 4, and in the kindergarten year. Families were originally recruited through direct mailings based on birth announcements published in local newspapers. The current study focuses on the 85 children (36 [42%] female) whose families participated in at least one aspect of the kindergarten assessment. Children ranged from 61.14 to 80.53 months of age ($M = 70.49$ mo, $SD = 4.07$ mo) at the time of the first kindergarten assessment. This sample was predominantly (95.3%) European American (1.2% African American, 1.2% Asian American, 1.2% Hispanic/Latino, and 1.2% not reported) and was, on average, middle class (Hollingshead Index $Mean = 48.12$) but represented the range of socioeconomic status (SES) ($Range = 17 - 66$).

Procedure

All procedures occurred under campus IRB oversight. Families who participated in the larger longitudinal study were contacted shortly before their children entered kindergarten to assess their interest in participating in a multi-part assessment throughout the kindergarten year. When a parent agreed to participate, laboratory staff scheduled an initial laboratory visit (the first of two) for the child and parent during the fall of the kindergarten year. Staff mailed a consent form and battery of questionnaires (including a parent-report measure of

the child's social inhibition) to be completed by the parent prior to the visit (typically within one week), at which children would provide self-report on their social inhibition. Specifically, the child completed the Berkeley Puppet Interview (BPI; Measelle, Ablow, Cowan, & Cowan, 1998), during which she or he reported on socially inhibited behaviors. The parent(s) accompanying the child remained in another room during the interview so as not to influence the child's report, but the child was able to ask for breaks to check in with the parent. Children received a small prize after completing the interview. Children also participated in several tasks that are not included in the current study. Parents also provided consent to contact the child's kindergarten teacher.

In the spring of the kindergarten year, teachers who expressed interest in participating in the study provided consent and completed a questionnaire about participants' social-emotional adjustment, including social inhibition. Also in the spring, parents provided separate consent for children to participate in a laboratory peer-visit, in which groups of 3–4 same-sex participants engaged in a 15-minute free play episode as part of the activities under the Play Observation Scale (POS; Rubin, 2001). Children were provided with a variety of activities and instructed to play "however you like."

In the summer, and after the child reached age 6, a subset of parents ($n = 51$; based on the goals of the larger study from which these data were derived; Buss et al., 2013) were invited to complete a semi-structured interview about their children's anxiety symptoms after the child's 6th birthday. Participants were selected based upon indicators of heightened risk for Social Anxiety Disorder (e.g., observed fear/withdrawal and parent report in toddlerhood or in kindergarten). Although this putatively restricts variability and creates a relatively homogenous subsample, it also functions to provide a conservative test of the impact of SAD symptoms as a moderator, such that having a high score in this distribution requires being relatively anxious even among anxiety-prone children.

Measures

Children's self-reported social inhibition—During the BPI, the experimenter introduced the child to two identical plush dog puppets (used and recommended by the authors of the BPI) named Iggy and Ziggy, who offered contrasting statements about a particular behavior and then asked the child, "How about you?" The child could answer the question by verbally providing a statement or pointing to a puppet. The puppets alternated in terms of which one spoke first and which one offered positively versus negatively valenced items in order to avoid the child forming an alliance with one puppet. The BPI has previously been shown to be a reliable and valid measure, with subscales relating to similar scales reported by parents and teachers (Measelle et al., 1998). Questions about a variety of behaviors were asked, although the Social Inhibition scale was the focus of the current study. Responses to the items ("When I meet new kids, I'm not shy"/"When I meet new kids, I am shy;" "When I'm around kids I don't know, I get quiet"/"When I'm around kids I don't know, I don't get quiet;" "It makes me nervous and shy to ask other kids to play"/"It doesn't make me nervous to ask other kids to play;" "I worry if other kids will like me"/"I don't worry if other kids will like me;" "When I meet new grown-ups, I'm not shy"/"When I meet new grown-ups, I am shy;" "When I'm around people I don't know, I don't feel

scared”/”When I’m around people I don’t know, I feel scared”) were scored on a 1 to 7 scale, with direct agreement with a puppet scored as 2 (choosing the response not indicative of social inhibition) or 6 (choosing the response indicative of social inhibition), embellished responses scored as 1 or 7 for the appropriate direction (e.g., “I never/always do that”), tempered responses (e.g., “I don’t get very quiet”/”I’m kind of quiet”) scored as 3 or 5, and neutral responses (e.g., “I do both of those things”) that did not change after an additional prompt scored as 4. Raters established inter-rater reliability on practice cases prior to coding participants and double-scored 20% of cases throughout coding to prevent drift (ICC = .98). Each coder remained blind to the other’s scores when completing reliability coding. When discrepancies became apparent after comparing reliability scoring on a particular case, coders met to discuss the source of discrepancies to maximize agreement on future cases. The 6 items comprising the social inhibition scale demonstrated internal consistency that was somewhat low (alpha = .64). We examined scale alphas when individual items were deleted as well as a principle components analysis (PCA) of items. These analyses suggested that one item (“When I’m around kids I don’t know, I get quiet”/”When I’m around kids I don’t know, I don’t get quiet”) did not inter-relate with the other items as well as the others. Specifically, two components emerged in the PCA (explaining 37.42% and 17.68% of the variance, respectively). The other five items loaded at or above .50 on the first component, and this item loading at .32 on the first component and at .79 on a second component. This item was dropped, and the remaining five items demonstrated a somewhat higher alpha (.67). A second PCA revealed that all items loaded at or above .48 on a single component explaining 43.72% of the variance. The alpha for the current study is consistent with internal consistency found with kindergarteners in the validation study of the BPI (alphas = .63 to .78, Measelle et al., 1998). Therefore, the mean of the remaining five items comprised the final variable of self-reported social inhibition.

Parent and teacher report of social inhibition—During the kindergarten year, mothers and teachers completed the Social Inhibition scale of the McArthur Health Behavior Questionnaire (HBQ; Armstrong, et al., 2003), which has been found to be a valid and reliable measure of symptoms and impairments in functioning in 4–8 year-old children. The three items assessing social inhibition (e.g., “Shy with other children”) were scored on a 3 point Likert-style scale (0 = *rarely applies*, 1 = *applies somewhat*, 2 = *certainly applies*). The mean of items was computed for parents (alpha = .77) and teachers (alpha = .69).

Mothers also completed the Child Social Preference Scale (CSPS; Coplan, Prakash et al., 2004), which differentiates between shyness/social inhibition and social disinterest. This 11-item measure asks parents to read items reflecting isolation from peers and rate how much their own child shows the behavior on a 1 (*not at all*) to 5 (*a lot*) scale. The current study utilized the Shyness subscale (7 items; e.g., “My child seems to want to play with other children, but is sometimes nervous to”), which has previously been shown to be internally consistent (alpha = .86) and to relate to observed social reticence (Coplan, Prakash et al., 2004). Internal consistency in the current study was similarly high (alpha = .87). The mean of items comprised the final score.

The parent-report HBQ Social Inhibition scale and CSPS Shyness scale were correlated ($r[75] = .51, p < .001$), and a principal components analysis suggested they comprised one

component that explained 75.15% of the variance in the measures (each loading = .87). This principal component was used as the final measure of *parent-reported social inhibition*. Because only the HBQ was available from teachers, the mean of HBQ items comprised *teacher-reported social inhibition*.

Parent interview for social anxiety symptoms—Select parents ($n = 51$) were interviewed with the Anxiety Disorders Interview Schedule (ADIS) Child Version (Silverman & Albano, 1996). The current study utilizes responses to the Social Anxiety Disorder portion of the interview, which establishes evidence for three criteria of the disorder: (1) fear of social/performance situations, (2) avoidance of or marked distress when faced with these situations, and (3) interference of these problems with the child's functioning. Interviewers were trained to administer the interview by a licensed clinical psychologist, with whom they established adequate reliability ($\kappa = .80$ across criteria [rather than individual questions or the overall diagnosis] of all assessed disorders, including SAD) on practice cases prior to interviewing participants. The licensed clinical psychologist reviewed 20% of video-recorded interviews to ensure fidelity to the interview and reliable scoring, and interviewers double-scored 10% of each other's cases while blind to original scoring to ensure high inter-rater reliability ($\kappa = .97$). The current study used a count (0–3) of the number of SAD criteria met.

Observation of social reticence—Reticence was scored using the guidelines established in the Play Observation Scale (Rubin, 2001). Each 10-second epoch of the 15-minute free play was scored by trained coders for a participant's predominant type of play. Reticent behaviors were scored when the child engaged in unoccupied (e.g., staring into space, wandering without purpose) or onlooking (watching other children's activities without joining in) behavior, suggesting the child was interested in other children's activities but did not join in. This follows both theory (Asendorpf, 1990) and empirical work (Coplan et al., 1994; Coplan et al., 2004; Rubin et al., 2002) linking the aggregate of these two specific behaviors to social approach-social avoidance conflict, social inhibition, and constructs pertinent to children's anxiety-spectrum development. Coders maintained adequate inter-rater reliability throughout coding (% agreement [total agreements divided by total observations being compared] = .93, $\kappa = .61$ [see Feinstein & Cicchetti, 1990 for disadvantages associated with kappa as a measure of reliability when data include a disproportionate number of zero values], calculated on 10% of cases with each contributing 80–90 observation points). The final measure of *social reticence* resulted from taking the proportion of codable epochs (90% of all possible epochs) in which the child's predominant behavior was unoccupied or onlooking. This measure of reticence has been theorized to reflect social approach-social avoidance conflict (Asendorpf, 1990) and shown to be related to temperamental inhibition and risk for later anxiety-spectrum problems (e.g., Coplan et al., 1994; Rubin, Burgess, & Hastings, 2002; Rubin et al., 2009) and has previously been used to validate other reports of social functioning (e.g., Rubin & Clark, 1983).

Results

Missing Data

Of the 85 families who participated in the kindergarten assessment, 2 did not have parent-report, 31 did not have teacher-report, 11 did not have children's self-report, and 15 did not have observed reticence, resulting in 17.65% of these observations missing. *T*-tests performed between those who had complete data versus those who did not revealed no differences in socioeconomic status or non-missing kindergarten measures ($t_s < 1.70, p_s > .05$). A non-significant Little's MCAR test ($\chi^2_{[42]} = 50.63, p > .05$) suggested that missingness was consistent with the missing completely at random pattern. Following current guidelines for modern approaches to handling missing data (e.g., Graham, 2009), multiple imputation was used to impute missing data. All kindergarten measures as well as child gender (included as an auxiliary variable [Graham, 2009] so that effects of gender on imputed variables could be most accurately determined) were included in the algorithm, and data were imputed across 20 imputations. All analyses, with one exception noted below, use this imputed data set ($n = 85$ for all variables), with each variable's imputations averaged into a single variable to facilitate the computation of model fit statistics and probing of interactions.

Given that only a subset of participants completed the ADIS based on pre-selected criteria, ADIS scores were not imputed. Rather, primary analyses involving the ADIS used this reduced sample ($n = 51$). Compared to mothers who were not interviewed, mothers who completed the ADIS interview had higher scores on the principal component of parent-reported social inhibition (interviewees: $M = 0.22, SD = 1.03$; non-interviewees: $M = -0.32, SD = 0.77; t = -2.63, p = .010$), and children of interviewed mothers were scored higher on social reticence from the peer visit ($M = 1.06, SD = 0.06$) compared to children of mothers who were not interviewed ($M = 1.04, SD = 0.03$). This is not surprising given that interviewees were chosen based on children demonstrating increased risk for anxiety on parent-report and observational measures. They did not differ on teacher-reported ($t = -0.38, p = .704$) or self-reported social inhibition ($t = -1.41, p = .164$), nor did they differ on the demographic characteristics of SES ($t = -0.10, p = .920$) or gender ($\chi^2 = 2.01, p = .157$).

Preliminary Analyses

Descriptive statistics were computed prior to imputation and are presented in Table 1. Observed social reticence was somewhat skewed (skew = 2.57), so it was subjected to a square root transformation, which decreased the skew (skew = 2.30). No other transformations further reduced skew. Bivariate relations, assessed with imputed variables, are also presented in Table 1. Notably, self-reported social inhibition did not relate to the other sources at the bivariate level. Parent and teacher report had a moderate relation. Possibly, differences in the size of bivariate relations among reporters was due to shared method variance attributable to parents and teachers completing the same questionnaire. Recall, however, that parents completed an additional questionnaire that was used in creating a principal component. Parent-reported social inhibition related fairly substantially to observed social reticence. Expectedly, parent-reported social inhibition and Social Anxiety Disorder criteria derived from the ADIS were also related. Primary study variables

did not relate to SES, child age, or child gender, so these variables were not considered further.

Moderation Analyses

The interactions between self-reported social inhibition and each of the other sources in relation to observed social reticence were tested in multiple regression analyses. Given the significant associations among potential moderators, they were tested in separate models. Following Laird and Des Los Reyes (2013), quadratic effects for children's self-reported social inhibition and adult reports (parent- and teacher-report, SAD symptoms from parent interviews in relevant analysis) were included in their respective models. If they were not included, unmodeled quadratic effects could then influence the interaction term (Cohen, Cohen, West, & Aiken, 2003; Ganzach, 1997). Specifically, when predictors are correlated (as they are in our study), their quadratic terms will be correlated with the interaction term. It is possible that when the true relation between a predictor and outcome is curvilinear and this is not modeled, a spurious interaction effect is detected. Modeling the variance associated with quadratic effects parses it from the interaction term, allowing for the detection of an interaction effect that does not overlap with this variance.

Variables were centered at their means prior to creating interaction and quadratic terms. All terms were entered simultaneously. Significant interactions were probed by recentering the moderator at standard values (-1 and $+1$ SD) in addition to the mean and examining the simple slope for self-reported social inhibition. Notably, no quadratic effects emerged as significant for children's self-reports, so only linear simple slopes were examined. Cohen's f^2 and squared semi-partial correlations (sr^2) are included as measures of effect size for models and individual coefficients, respectively.

A summary of the regression analyses is presented in Table 2, and simple slopes of significant interactions are presented in Figure 1. In Model 1 ($R^2 = .53$, $F[5, 79] = 17.77$, $p < .001$, $f^2 = 1.13$), parent-reported social inhibition moderated the relation between children's self-reported social inhibition and observed social reticence, and this interaction added significant variance to what the model predicted in social reticence ($\Delta R^2 = .04$, $F[1, 79] = 7.31$, $p = .008$, $f^2 = 0.04$). Specifically, children's self-reports did not relate to observation at low values of parent-report ($\beta = -0.02$, $t = -0.18$, $p = .860$, $sr^2 = .0002$), but they did relate at mean (Table 1) and high values ($\beta = 0.40$, $t = 3.43$, $p = .001$; $sr^2 = .070$) of parent-reported social inhibition. Given that parent-report related so strongly to observed reticence at the bivariate level, it was important to determine whether children's self-reported social inhibition contributed to the strength with which parent-report related to social reticence. Therefore, we re-probed this interaction to determine what effect child self-report had on the relation between parent-reported social inhibition and observed reticence. Although significant across levels, the association between parent-reported social inhibition and observed reticence increased from low ($\beta = 0.29$, $t = 2.39$, $p = .019$, $sr^2 = .034$) to mean ($\beta = 0.50$, $t = 5.95$, $p < .001$, $sr^2 = .211$) to high ($\beta = 0.71$, $t = 6.62$, $p < .001$, $sr^2 = .261$) values of children's self-reported social inhibition, indicating that the strength of parent report seemed to also improve as it converged more strongly with child self-report, and that

the highest levels of social reticence occurred when both reporters indicated high levels of social inhibition.

In Model 2 ($R^2 = .20$, $F[5, 79] = 3.98$, $p = .003$, $f^2 = 0.25$), teacher report acted as a significant moderator, and this interaction added significant variance to what the model predicted in social reticence ($\Delta R^2 = .13$, $F[1, 79] = 12.38$, $p = .001$; $f^2 = 0.15$). Probing of the interaction revealed that self-reported social inhibition did not relate to observed social reticence at low ($\beta = -0.16$, $t = -1.08$, $p = .282$, $sr^2 = .012$) or mean values (Table 1) of teacher report, but it did relate at high values ($\beta = 0.56$, $t = 3.62$, $p = .001$, $sr^2 = .133$).

In Model 3 ($R^2 = .19$, $F[5, 44] = 2.00$, $p = .098$, $f^2 = 0.23$), a significant interaction also occurred between self-reported social inhibition and SAD symptoms, and this interaction added significant variance to what the model predicted in social reticence ($\Delta R^2 = .08$, $F[1, 44] = 4.11$, $p = .049$, $f^2 = 0.09$). Self-reported social inhibition did not relate to observed reticence at low ($\beta = -0.08$, $t = -0.37$, $p = .714$, $sr^2 = .003$), or mean values of SAD symptoms (Table 1) but it related to observation at high ($\beta = 0.70$, $t = 2.36$, $p = .023$, $sr^2 = .103$) SAD symptoms. These results suggest that when other reporters endorse higher levels of children's social inhibition, children's reports of their own social inhibition more strongly related to observed social reticence.

Discussion

The current study aimed to understand the extent to which and under what conditions kindergarteners' self-reported social inhibition related to observed social reticence. Specifically, we examined bivariate relations and also focused on severity of social inhibition and SAD symptoms contributed by other reporters (parents and teachers) as moderators of this relation.

In bivariate relations, children's self-perceptions of social inhibition did not relate to other informants' reports of social inhibition or SAD symptoms. This is consistent with previous work demonstrating low associations between children's self-reports and parent-report of psychological symptoms and adjustment (De Los Reyes & Kazdin, 2005). The current study augments these findings by focusing on children at the beginning of formal schooling. Parent- and teacher-report, on the other hand, related to each other. It is possible that parents' reports correlated more highly with teachers' reports due to shared method variance, as they completed one questionnaire in common. However, parent-reported social inhibition was a principal component representing shared variance between two questionnaires, one of which teachers did not complete, and parent-report related most highly to observed social reticence. These two results suggest it may not have been simply shared method variance that determined higher agreement between the adult-reporters than between either of them and children's interview responses. More complex analyses suggest more nuanced relations among these constructs.

Moderation occurred such that children's self-reported social inhibition related to observed social reticence at higher levels of parent- and teacher-reported social inhibition and parent-reported social anxiety symptoms. In other words, when adults perceived children to be

higher in risk for social anxiety as indicated by higher ratings of social inhibition, or higher in current symptoms of social anxiety, children's self-perceptions were reflected in their observable behavior. This appears to reflect a confluence of agreement about which children are the most socially inhibited. Recent research has suggested that this type of congruence may most strongly indicate psychopathological processes (Laird & De Los Reyes, 2013). In addition to psychopathological processes, another cause of congruence may stem from children's awareness of adults' concerns about their socially inhibited behavior. Self-awareness may be a consequence of exposure to parents' and teachers' discussions of their social inhibition.

Questions exist in the literature as to the validity of children's self-reports of psychological symptoms and adjustment, especially at younger ages (De Los Reyes & Kazdin, 2005; DiBartolo et al., 1998). The current study suggests that some children as young as kindergarten age can recognize when they are socially inhibited. This is important for the identification of children at risk for anxiety-spectrum problems both within research and clinical contexts. Specifically, some of the children who are most at risk seem to be able to report their internal experiences of anxiety-based social withdrawal relatively accurately, suggesting their reports may be useful for early identification of prevention targets. However, given that high levels of self-reported social inhibition by themselves did not relate to higher levels of observed social reticence, not all at-risk children may be captured by self-report. It will be important for future work to determine whether other moderators strengthen the relation between self-report and observation for these other children.

Another way to interpret these results is in the framework of informant discrepancies. In the theoretical Attribution Bias Context model delineated by De Los Reyes and Kazdin (2005), discrepancies are understood to reflect the influence of the context of the behavior as well as individual characteristics that contribute to reporting. Rather than reflecting measurement error or unreliability, the extent of agreement or disagreement is meaningful and may be modeled to understand problem behavior. As a statistical approach to empirically test the meaning of convergence versus divergence of reports, Laird and De Los Reyes (2013) used interaction terms to understand how one informant's report relates to an outcome in the context of another person's report. In their study, parent-adolescent congruence in externalizing behaviors related to higher levels of adolescent antisocial behavior. The current study found similar results, but within the internalizing domain. Congruence related to observed social reticence, whereas discrepancies related to lower reticence. The extent of congruence related meaningfully to observed social reticence, above and beyond each individual informant.

The importance of this may best be seen when considering self- and parent-report of social inhibition in relation to observed social reticence. Given the substantial bivariate correlation between parent-reported social inhibition and observed social reticence, it would be reasonable to question whether children's self-reports can augment information provided solely by parents. Given the absence of a bivariate relation between children's self-reports and observed social reticence and the existence of a significant interaction between child- and parent-report, the contribution of children's self-reports is likely not additive, but multiplicative. Indeed, in addition to parent-report providing a context in which child self-

report related meaningfully to observation, child-report influenced the strength with which parent-report related to observation. Parent-report was most highly associated with observed social reticence when children also reported high levels of social inhibition. In other words, across levels of children's self-report, parent-report may be very helpful in identifying socially reticent children who may be at risk for anxiety problems, but it is *most* helpful when child-report also converges. This is consistent with previous work showing that parent-child convergence predicted clinicians' anxiety diagnoses and anxiety treatment outcomes more strongly than parent-report alone (Brown-Jacobsen et al., 2011; De Los Reyes et al., 2009). This may reflect that congruence among reporters depends on social inhibition, which originates internally, being externalized and measurable not only by adults, but also by objective observers. Similarly to the conclusions drawn by Laird and De Los Reyes (2013) in the realm of externalizing problems, we suggest that reports of social inhibition (and perhaps anxious behavior more broadly) should not be relied upon from only one informant or only considered additively. Rather, they should be interpreted in the context of each other. We note, however, that unlike studies in which the primary aim is to quantify informant discrepancies and use them to predict a psychological outcome, the current study focused on the relation between children's self-reports and an observable outcome, in the context of severity as provided by other reporters.

Certainly, results from the current study should be interpreted in light of some methodological limitations. The existence of missing data was not ideal. Although we used modern approaches to dealing with missing values, this does not replace a more complete data set. Participants in the current study were recruited from the community, so generalizability to clinical populations may be limited. Although this was purposeful so we could assess variation in risk for later problems, replication of these results with clinically-referred anxious children may be informative for understanding the utility of using young children's self-reports in a clinical setting. Relatedly, we limited our examination of SAD symptoms to children selected for increased risk for anxiety based on previous assessments. Although this is helpful in the sense that being "high" in SAD symptoms meant being extreme among other children seemingly at-risk for anxiety, it is unknown whether the moderating effect of SAD symptoms would be replicated in a clinical sample. These results should be interpreted for SAD symptoms identified among anxiety-prone children, and not for a general or clinical population. Further, the current sample represented a mostly European American, middle class population. Investigation of these relations in more diverse samples is necessary before generalizing to other populations. Teacher-report and one measure of parent-report of social inhibition included only three items each, which may have limited variability in responses. Assessments of social inhibition, social reticence, and SAD symptoms took place at various time points across the kindergarten year. Future studies that examine all constructs at the same time point may minimize any ambiguity about how this timing may have affected results.

The literature would benefit from future studies that address these limitations as well as other interesting issues. For example, following children further into the school years may elucidate whether children whose self-reports related to their observed behavior are indeed at greater risk of developing symptoms of anxiety disorders and related problems. Moreover,

studies examining how children's self-perceptions of social withdrawal can be incorporated into the development of intervention and prevention programs that target children's social withdrawal are needed to assess the applicability of these findings. Finally, our measure of observed social reticence remained somewhat skewed in its distribution, even after statistical transformation. Therefore, this should be considered in interpreting results.

In summary, these results suggest that it may be important to consider the severity of social inhibition and anxiety-spectrum problems in evaluating children's self-reports of their behavior. Although not all children perceive their shyness in a manner consistent with other observations, children most at risk for social anxiety may be adequate reporters of anxiety as young as kindergarten age.





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