J Psychopathol Behav Assess (2011) 33:171–177
DOI 10.1007/s10862-010-9194-5

The Moderating Effect of Anxiety on Development in Atypically Developing Toddlers

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Published online: 3 July 2010

Abstract In typically developing children, researchers have found that anxiety disorders are associated with poorer intellectual abilities (Davis et al. Journal of Psychopathology and Behavioral Assessment 30:43–51, 2008). The aim of the current study was to examine the impact anxiety symptoms had on the developmental quotients of toddlers. A total of 170 toddlers ranging in age from 17 to 37 months were selected for inclusion in this study, all of whom were at risk for or had a developmental delay. Two factors indicative of behavioral symptoms of anxiety from the *Baby and Infant Screen for Children with aUtIsm Traits-Part2* were utilized as the independent variables and the total developmental quotient from the *Battelle Developmental Inventory, 2nd Edition* was utilized for the dependent variable. Examination of results revealed that atypically developing toddlers with symptoms of anxiety had significantly lower developmental quotients when compared to toddlers without any anxiety symptoms. A discussion of the implications and limitations of this study are included.

Keywords Anxiety · Toddlers · Development · Atypically developing

Of all childhood psychiatric disorders, researchers have found that anxiety disorders are the most prevalent and frequently diagnosed (Kashani and Orvaschel 1990; Kessler et al. 2005a, b). Given that symptoms of anxiety disorders in children can impede development in specific areas, research on the effects of anxiety in young populations is important. For example, researchers have shown that socialization is negatively impacted by the presence of anxiety in children (Bryant and Cheng 2005; for a review see Davis et al. 2009). Of particular importance is the potential impact symptoms of anxiety may have on young children in meeting intellectual and developmental milestones in areas such as adaptive, personal/ social, communication, cognitive, and motor skills. As a result, in the present study, the impact of "anxiety" (operationalized as *avoidance* and *anxious behaviors*) on atypically developing toddlers' developmental quotients is examined.

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Impact of Anxiety on Intellectual Functioning

Further research on the effects of anxiety at a very young age is warranted. Research that has been conducted has primarily focused on the impact of anxiety on intelligence and academic achievement in children. For example, Hodges and Plow (1990) examined a group of inpatient children, ages 6 to 13 years in regards to their psychiatric diagnoses and their cognitive functioning. Intellectual ability was found to be significantly lower in children who were diagnosed with an anxiety disorder compared to children diagnosed with conduct disorder, oppositional defiant disorder, and mood/depressive disorders (Hodges and Plow 1990). A limitation of their study, however, was that comorbidity was not taken into account, thus children could be in more than one diagnostic category and exclusion criteria eliminated any children with an Autism Spectrum Disorder (ASD), Intellectual Disability (ID), or "organic brain syndrome." In contrast, other researchers have found that achievement and intelligence quotient (IQ) scores were not significantly lower for children diagnosed with an anxiety disorder compared to children diagnosed

with other psychiatric disorders (Zimet et al. 1994). Zimet et al. (1994) conducted their analyses on a group of children with a similar mean age as the Hodges and Plow (1990) sample and included the same exclusion criteria; however, they used participants from both inpatient and outpatient facilities and only made primary diagnoses (i.e., ignoring the issue of comorbidity in a different way). As a result, the discrepant findings were likely the result of numerous methodological limitations: ignoring comorbid diagnoses, lack of mutually exclusive groups, and lack of attention to the severity of anxiety disorders (e.g., receiving impatient vs. outpatient treatment; Davis et al. 2008).

As a result, Davis et al. (2008) conducted a study aimed at reconciling previously contradictory results of the effects of anxiety on achievement and intellectual ability, while eliminating many of the methodological limitations of previous studies. Upon replicating the methodologies of previous studies (mainly through group assignment; i.e., Hodges and Plow 1990; Zimet et al. 1994), Davis et al. were able to replicate the discrepant results as well. Finally, extending the literature, Davis et al. also made a comparison between children with pure anxiety-disorders (i.e., no comorbidity) and those with no-diagnosis (eliminating the methodological limitation of comorbidity and having mutually exclusive groups). It was concluded that anxiety-disordered children had significantly lower IQs than the control children (Davis et al. 2008). Although Davis and colleagues demonstrated anxiety disorders were generally no more impairing than many other disorders, they also showed that children with anxiety disorders were intellectually impaired compared to children with no diagnosable disorders.

Subsequently, Davis et al. (2010c) conducted a study to examine if the presence of self-reported symptoms of anxiety (i.e., looking dimensionally at anxiety instead of simply categorically) predicted IQ, but also examined whether maternal reports of inattention mediated lower scores on intelligence tests. Theoretically, Davis et al. (2008) and Davis et al. (2010c) hypothesized that anxiety could impact intellectual ability in several different ways, but in particular anxiety could lead to increased inattention which could lead to difficulty both in interfacing with the testing and also in learning the actual material to begin with. In other words, anxiety would interfere with the child's ability to attend and subsequently perform well on the test, but also interfere with the child's ability to focus, attend, and learn the material in class prior to being tested. Davis et al. (2010c) findings were consistent with previous research (Davis et al. 2008; Hodges and Plow 1990) in that symptoms of anxiety significantly predicted impairment in IQ. Furthermore, their hypothesis regarding the impact of inattention was partially supported as symptoms of inattention partially mediated the association between anxiety and intellectual functioning. As of yet, however, the effects of anxiety on intellectual functioning have not been examined in younger children (e.g., toddlers) or in those with other special needs—a group in which many anxiety problems are frequently even more pronounced.

Anxiety in Developmentally Disabled Populations

Anxiety occurs at a higher frequency in children diagnosed with developmental disabilities (i.e., autistic disorder) compared to those without the same diagnosis (Gillott et al. 2001). For example, one of the most common comorbid conditions over the lifetime in individuals diagnosed with an autism spectrum disorder (ASD) was specific phobia (Leyfer et al. 2006). Evans et al. (2005) examined differences in the fears of children diagnosed with either ASD, Down syndrome, a chronological age matched control group, and a mental age matched control group. Children with ASD were more fearful of certain places and situations and had more medically related fears. In regards to repetitive behaviors (i.e., behaviors associated with Obsessive Compulsive Disorder; OCD) Gillott et al. (2001) found that children diagnosed with autistic disorder scored the highest on measures of OCD and separation anxiety. Furthermore, researchers have reported a comorbidity rate of 37% between ASD and OCD (Leyfer et al. 2006). Given the higher rates of anxiety in those children with developmental disorders, an important question to examine is the extent intellectual and developmental impairments are more greatly associated with the developmental disorder or comorbid disorders—in this case anxiety.

As mentioned, Davis et al. (2010c) found that inattention partially mediates the relationship between anxiety and intellectual functioning in typically developing children. Similarly, symptoms of inattention in atypically developing children are problematic as well. Matson et al. (2009a) examined the behavioral symptoms of atypically developing toddlers in regards to comorbid psychopathology. Symptoms associated with inattention and impulsivity were endorsed by parents and caretakers more frequently than other behavioral symptoms of psychopathology. Examples of commonly endorsed items included concentration problems, always being on the go, restless, noncompliance with demands, problems sustaining attention in tasks or play activities, and poor concentration (Matson et al. 2009a). In addition, Matson et al. (2009b) conducted a similar type of investigation with toddlers diagnosed with an ASD. Consistent with the findings previously mentioned, behavioral symptoms associated with inattention and impulsivity were the most frequently endorsed symptoms according to parent or caregiver reports. However, the degree to which these inattentive and impulsive symptoms were more

indicative of the ASD diagnosis versus comorbid disorders was not examined.

Purpose

Given anxiety has been found to impact intellectual functioning in children, the present study examined these effects in a much younger age group—toddlers. In addition, studies to date have examined the impact of anxiety on typically developing children. Given that the impact has been established in that group, this study also examined the impact of anxiety on atypically developing children. The onset of anxiety-associated impairment has yet to be explored in this population because previous studies of this nature have excluded children who were not typically developing (Hodges and Plow 1990; Zimet et al. 1994). Therefore, the aim of the present study was to further explore the impact of anxiety on intellectual ability (e.g., Davis et al. 2010c, 2008; Hodges and Plow 1990) by examining a significantly younger age group (i.e., 17 to 37 months) and only those toddlers who were atypically developing.

Furthermore, the present study incorporates not only the behavioral symptoms of anxiety in toddlers, but also accounts for the severity of such symptoms (i.e., a dimensional comparison). Based on previous findings, it was hypothesized that symptoms of anxiety in toddlers would have an inverse relationship to their developmental quotients. Thus, more severe anxiety symptoms would be associated with more developmental difficulties in toddlers (Davis et al. 2008, 2010c; Hodges and Plow 1990). The term "anxiety" in the current study is defined by behavioral symptoms: avoidant behavior and anxiety/repetitive behavior as measured using the *Baby and Infant Screen for Children with aUtIsm Traits-Part2 (BISCUIT-Part2;* see Measures for a description*)*.

Method

Participants

One hundred seventy participants were selected for inclusion in this study. All participants included were enrolled in a state-funded early intervention program for children at-risk for a developmental disability. EarlySteps is Louisiana's Early Intervention System under the Individuals with Disabilities Education Act, Part C, which provides services to infants and toddlers and their families from birth to 36 months. Children qualify for these services if they have a developmental delay or a medical condition likely to result in a developmental delay. Exclusion criteria for this study eliminated any infant or toddler with a diagnosis of Autistic Disorder (AD). The children ranged in age from 17 to 37 months (M= 26.40 months, SD=4.69). Within this sample, 72.9% were male. The participants were 35.3% African American, 53.5% Caucasian, 1.8% Hispanic, and 8.8% identified as "other" or did not report.

Measures

Baby and Infant Screen for Children with aUtIsm Traits (BISCUIT; Matson et al. 2007). The *BISCUIT* is a three-part measure that is utilized for children between the ages of 17 and 37 months. The battery assesses for symptoms of autism spectrum disorders (ASD), symptoms of comorbid psychopathology, and challenging behaviors. For the purposes of this study, data from the *BISCUIT-Part2*, which assesses for symptoms of comorbid psychopathology were utilized.

The BISCUIT-Part2 assesses for symptoms of the most commonly occurring comorbid conditions, including attention-deficit/hyperactivity disorder, tic disorder, obsessive compulsive disorder, specific phobia, and eating/feeding difficulties. The *BISCUIT-Part2* includes 57 items, which parents and/or caretakers rate as follows, 0="not a problem or impairment, not at all;" 1="mild problem or impairment;" 2="severe problem or impairment;" or X="does not apply or don't know." An exploratory factor analysis of the 57 items revealed a five factor solution including Tantrum/Conduct Behavior, Inattention/Impulsivity, Anxiety/Repetitive Behavior, Avoidance Behavior, and Eating Problems/Sleep (Matson et al. 2010). Reliability analyses have revealed that the *BISCUIT-Part2* has good reliability. That is, the item-scale correlations ranged from .30 to .70 with a mean of .51. (Matson et al. 2009c). The internal consistency was excellent with a coefficient of .96 (Matson et al. 2009c). Of particular interest for this study were the factors of *Avoidance Behavior* and *Anxiety/Repetitive Behavior*, as items loading onto these two factors are thought to be representative of symptoms of anxiety (Davis et al. 2010b).

Battelle Developmental Inventory, 2nd Edition (BDI-2; Newborg 2005*)*. The *BDI-2* is an informant and observation-based measure designed to assess developmental skills from birth to 7 years 11 months. This measure contains 450 items that reflect five domains, which include, personal/social, adaptive, motor, communication, and cognitive. Of interest for this study is the toddler's total *developmental quotient* (DQ), which is comprised of the five aforementioned domains. To reflect skill level, items are scored as 0="no ability in this skill," 1="emerging ability," or 2="ability at this skill." Psychometric investigations on the *BDI-2* have revealed excellent internal consistency for the total scale (α=.98–.99). Test-retest and

interrater reliability were also excellent (ranging from .90 to .99). Criterion related validity was examined, with correlations at acceptable levels (.78 for the total score; Newborg 2005)

Procedures

Toddlers ages 17–37 months who were enrolled in Louisiana's EarlySteps program were included in this study. The parents or caretakers of these toddlers were interviewed by qualified personnel certified to conduct assessments and who provided services for the State of Louisiana's Early Steps Program. The assessors were certified or licensed in their respective disciplines which included occupational therapy, physical therapy, social work, speech-language pathology, education, or psychology. Prior to the administration of the *BISCUIT*, all administrators attended full-day training on child developmental disorders, scale development, and administration specific to the measures used for this study. The *BISCUIT* and *BDI-2* were administered to a parent or other significant caregiver along with other developmental measures as part of the assessment protocol for the early intervention program. The items were read aloud by the assessor, while the informant read along. Informants' (i.e., parents or caretakers) relationships to the participants in the study were as follows: mothers (85.30%), grandmothers (4.12%), fathers (2.35%), foster mothers (2.35%), adoptive mothers (1.76%), great-grandmothers (0.59%), legal guardians (0.59%), family interpreter (0.59%), aunts (0.59%), and 1.76% of the informants relationships were not specified. The administered assessment protocol took approximately 120 min to complete. Approval for this study was obtained from the institutional review boards from both the university and the office for citizens with developmental disabilities.

Statistical Analyses

Preliminary analyses (i.e., *t*-tests) were conducted to determine if demographic variables were significantly related to the dependent variable score (i.e., total developmental quotient). Results indicated that ethnicity, age, and gender were not significantly related to the dependent variable; thus demographic variables were excluded from subsequent analyses.

Next, using multiple regression, a moderation analysis was conducted to examine if avoidant behavior and anxiety/repetitive behavior (i.e., anxiety) interacted in some systematic way to predict the outcome variable, total DQ. To determine if the relationship between two variables changed as a function of a third moderating variable (i.e., anxiety), Baron and Kenny (1986) suggested that if both the predictor and moderator were continuous variables, then a product variable approach should be taken. Also, to eliminate problems of multicolliniarty, it has been suggested to mean center the variables used in the analyses (Smith and Sasaki 1979). Then, after using this product variable approach, a significant interaction (i.e., interaction effect) is referred to as the modifier or moderator (Cleary & Kessler, 1982). Thus, following these moderation analysis practices, the two predictors (i.e., avoidant behavior and anxiety/repetitive behavior) were mean centered to reduce potential issues of multicollinearity. Next, a product interaction term was created by multiplying the mean centered predictor variables. The two predictors (i.e., avoidant behavior and anxiety/repetitive behavior) were entered as a block in the first step of the regression analysis. The interaction term was then entered in the second step of the regression analysis.

Results

In Table 1, basic psychometric information for the study variables are reported, as well as inter-correlations between constructs. In the moderation analysis, the final two stage model was significant [$F(3,166)=9.56$, $p<.01$] and explained 15% of the variance in total DQ. As predicted, both avoidant behavior ($\beta=-.40$, $p<.01$) and anxiety/repetitive behaviors ($\beta=-.22$, $p<.01$) significantly predicted total DQ. Also, as predicted, the interaction between avoidant behavior and anxiety/repetitive behaviors was also significant ($\beta=.31$, $p<.01$). As such, the severity of anxiety as measured by the interaction of avoidant behavior and anxiety/repetitive behavior was found to moderate the relationship between atypically developing toddlers and their total DQ. Table 2 includes the results of the moderation analysis.

This relationship is graphically represented in the interaction between avoidant behavior and anxiety/repetitive behavior in their prediction of total DQ in Fig. 1 (using a +/− 1 standard deviation approach). As shown, respondents who scored low on both avoidant behavior and anxiety/repetitive behavior were predicted to have the highest total DQ. Interestingly, for respondents who scored high on avoidant behavior, the impact of being low or high on anxiety/repetitive behaviors appears minimal. However, respondents who were low on avoidant behavior were predicted to have substantially different total DQ scores depending on if they were low or high on anxiety/repetitive behavior.

Discussion

The goal of the present study was to extend the findings of the impairment from anxiety on intellectual or developmental

Table 1 Mean (SD) of endorsement, internal consistency of variable, and correlations between variables

Variable	Mean (SD)	Internal consistency (Alpha)	Avoidant behavior	Anxiety/repetitive behavior	Total developmental quotient
Avoidant Behavior	.85 (1.34)	.83	1.00	–	–
Anxiety/Repetitive Behavior	.78 (1.37)	.82	.31*	1.00	–
Total Developmental Quotient	93.03 (17.16)	.98–.99	−.28*	−.21*	1.00

*$p<.01$

functioning observed in older, typically developing children to atypically developing toddlers. Thus, we sought to determine if the presence of anxiety moderated the toddlers' development, as measured by their developmental quotients on the *BDI-II*. Analyses confirmed that symptoms of anxiety moderates development in toddlers. The form of anxious symptomatology seemed important in these atypical toddlers and infants. While both predictors, Avoidance Behavior and Anxiety/Repetitive Behavior, significantly and negatively predicted DQ scores, the interaction was also interesting. As predicted, fewer anxiety symptoms were associated with higher DQ scores and more severely rated anxiety symptoms in the two scales were associated with lower DQ scores. Interestingly though, those who were higher in Avoidance Behavior seemed only minimally affected by the impact of additional Anxiety/Repetitive Behavior symptoms. This highlights the clear impact of avoidant anxious behavior. In many ways, this mirrors the findings of Davis et al. (2008) in that anxiety is intellectually, or in this case developmentally, impairing; however, it extends those findings by pointing to key differences in the types of anxious symptomatology which may be most associated with impairment.

Although the moderation analysis was significant, generalizability of the results may be limited for a number of reasons. First, parents or caretakers served as the informants for the current study. While demographic information was provided for the toddlers, the same information was not available for the adult respondents (i.e., parents and caretakers). Only information pertaining to the informant's relationship to the toddlers was available to the authors. Thus, what were not accounted for in the current study were possible response differences according to the demographic characteristics (e.g., age, income) of the informants or the interplay of these demographic variables. Therefore, future studies of this kind would benefit from collecting more detailed demographic information on the parents or caretakers serving as informants to determine if responses differ on various demographic variables of interest and need to be controlled for in subsequent analysis.

Unfortunately, it remains for researchers conducting longitudinal studies to determine if these anxiety symptoms are indicative of future anxiety disorders (including which ones) and if these DQ scores are able to predict stable intellectual impairment. Along these lines, an additional limitation of the study is the atypical sample. These toddlers and infants were initially referred for concerns

Table 2 Results of final moderation regression analyses

	β
Step 1	
Avoidant Behavior	−.40*
Anxiety/Repetitive Behavior	−.22*
Step 2	
Avoidant X Anxiety/Repetitive	.31*
Total R^2	.15*
ΔR^2	.05*
F	9.56*
df	(3, 166)

*$p<.01$

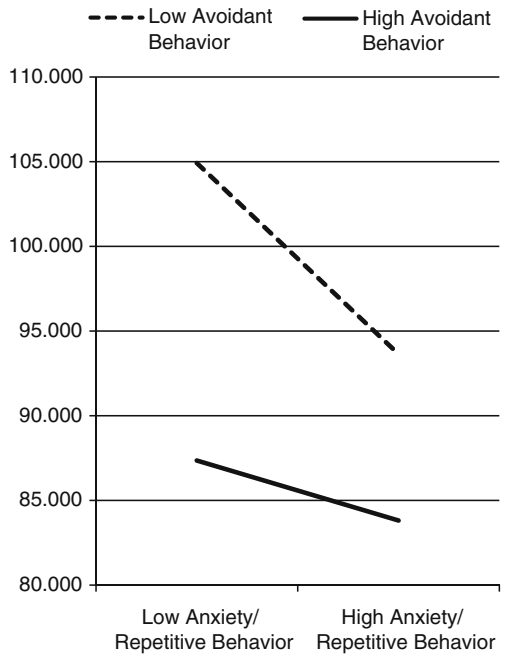

Fig. 1 Significant interaction model of avoidant behaviors and anxiety/repetitive behaviors on Total Developmental Quotient (DQ)

about "atypical development." Although they were not subsequently diagnosed with an ASD, the fact that they were referred may set them apart from other children in the population. Even so, it is intriguing to speculate that the differences observed may to some degree be explained by early anxiety symptomatology itself—initial problems with social avoidance, behavioral inhibition, etc. and the associated DQ impairment. Similar linkages of social problems, avoidant behavior, and anxiety to early variables of this type (e.g., behavioral inhibition) are well established in the literature (for a review see Davis et al. 2009). Future research should attempt to further tease apart anxiety's effects on DQ using typically developing and atypically developing children. At present, however, it seems that the effects of anxiety on development and DQ may happen very early and be very serious. Moreover, researchers should investigate DQ and IQ scores at known periods of greater and lesser anxiety across the lifespan (cf. Davis et al. 2010b) to see if there are noticeable changes in ability or if scores remain stable. Such research might begin to answer whether periods of anxiety merely interfere with intellectual and developmental assessment as opposed to reflecting actual longstanding impairment.

Even so, and as stated by Davis et al. (2008), etiological statements regarding the impairment observed should be made cautiously. Several possibilities exist for the developmental and intellectual differences found in this and other studies. 1) Children with lower DQ scores may be prone to developing more anxiety symptoms. In support of this hypothesis, a study of similarly young children found more severe anxiety symptoms in autistic children than in children with pervasive developmental disorder-not otherwise specified (PDD-NOS) or control children, and the children with PDD-NOS had more anxiety than controls (Davis et al. 2010a). These differences in anxiety symptoms along with presumably more developmental impairment from ASD might support this hypothesis. 2) Alternatively, children with anxiety may be prone to impairment in development and intellectual ability, or at least the measurement of those abilities. It has been hypothesized that anxiety can have insidious effects on children—denying them social and intellectual experiences over time which may, in turn, result in the impairments observed (Davis 2009; Davis et al. 2009). However, it may only be that a child's anxiety interferes with the accurate assessment and observation of development and intellectual ability. 3) Finally, children may have underlying factors that contribute jointly to anxiety and developmental or intellectual impairment. A single underlying variable or cluster of diatheses may predispose a child to both anxiety and intellectual or developmental impairment—for example problems with inattention as observed in Davis et al. (2010c).

Such considerations highlight the limitations of current research, but in all likelihood point to issues of equifinality and multifinality with children arriving at their current developmental state through various pathways and, in turn, likely continuing on in life branching off along other developmental trajectories. As such, children may present at the time of assessment with any of the hypothesized etiologies. In fact, support of this notion comes from the similar impairment observed in children with anxious/repetitive symptoms and avoidant symptoms. To date, the exact mechanisms responsible for anxiety's observed effects on developmental and intellectual abilities remains unclear—a conclusion which highlights the need for continued research in this area and continued study and modification of our best treatments (Moree and Davis 2010) given the number of children impacted.

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