

Aggressive Behavior in Adolescents with Fetal Alcohol Spectrum Disorders

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ABSTRACT

Behavioral studies of fetal alcohol spectrum disorders (FASD) have indicated that aggression is common amongst alcohol-exposed adolescents, and that it appears to become more prevalent with age in that population. Such studies have documented the presence of aggression as a behavioral outcome, but have not provided detailed information regarding its presentation, including whether it is proactive or reactive in nature and under which circumstances it arises. Consequently, there is a lack of a theoretical framework within which to understand aggression in FASD. The current research comprised two studies. In Study 1, comorbid developmental disorders that are typically associated with aggression were examined in alcohol-exposed and non-exposed boys and girls. The results indicated a higher prevalence of disruptive behavior disorders, and conduct disorder in particular, amongst the alcohol-exposed boys, and highlighted a significant association between prenatal alcohol exposure and an aggressive subtype of conduct disorder. Based on these findings, Study 2, a multiple-case study, examined the aggressive behaviors of 6 alcohol-exposed and non-exposed adolescents and their classmates. The descriptive study incorporated naturalistic observation, behavior reports, and self-report measures. The results indicated a high prevalence of aggressive behavior amongst the alcohol-exposed boys, both at home and at school. The self-report measure indicated a high prevalence of both reactive and proactive aggression. The current research adds to the limited understanding of aggression in FASD, and attempts to address the methodological flaws of previous studies. The results emphasize the aggressive quality of comorbid disruptive behaviors in children with FASD, and open avenues for future investigations using larger samples.

GENERAL INTRODUCTION

The effects of prenatal alcohol exposure on the developing fetus are well established and exist along a continuum of physical abnormalities and behavioral and neurocognitive deficits (Spadoni, McGee, Fryer, & Riley, 2007). These deficits, in their severest form, were collectively termed *fetal alcohol syndrome (FAS)* by Jones and Smith (1973) to denote a triad of characteristics that are used today by dysmorphologists as the basis of FAS diagnoses. The three defining features of FAS are growth deficiency (often manifested as below average height and microcephaly), evidence of central nervous system disorders, and a distinctive set of craniofacial anomalies (Hoyme et al., 2005).

The term *fetal alcohol spectrum disorders (FASD)* has been coined recently as a non-diagnostic umbrella term for the range of deficits resulting from prenatal alcohol exposure (Koren, Nulman, Chudley, & Looock, 2003). FASD refers collectively to FAS and to diagnoses of children who lack some or all of the characteristic facial anomalies of FAS, and who have been labeled as having either *partial fetal alcohol syndrome (PFAS)* or *alcohol-related neurobehavioral disorder (ARND)*; Hoyme et al., 2005).¹

In the Western world, FAS is the leading preventable cause of mental retardation amongst children (Burd, Klug, Martsolf, & Kerbeshian, 2003). Because many children exposed to alcohol prenatally do not meet the criteria for FAS, it is vital that a behavioral phenotype for the other FASD be developed to assist in diagnosing alcohol-exposed children who lack the distinctive facial characteristics and/or growth deficits typical of FAS. Accurate diagnosis is important for appropriate interventions to be put into place, so that children with FASD have the potential to lead more productive lives than would otherwise be possible.

Increased aggression has been identified, in both human and animal studies, as a consequence of prenatal alcohol exposure (Jacobson, Jacobson, Sokol, & Chiodo 1998; Kelly, Day, & Streissguth, 2000; Mattson & Riley, 2000; O'Leary et al., 2010). I will explore aggression in FASD by, first, reviewing various studies that have been conducted with the aim of quantifying behavioral problems in children and adolescents with FASD. I will then review literature on other developmental disorders that both (a) present with aggressive behaviors, and (b) are commonly comorbid with FASD. Those reviews serve as a foundation

¹PFAS is characterised by the presence of two alcohol-related facial anomalies and one of the following deficits in alcohol-exposed individuals: small head circumference, growth retardation, or some degree of cognitive and/or behavioural dysfunction. ARND is characterised by significant cognitive impairment but a lack of facial anomalies. Heavy alcohol exposure (HE) is characterised by a history of heavy prenatal alcohol exposure without the presence of alcohol-related facial anomalies or growth retardation (Jacobson et al., 2008).

for the current research, which aimed to determine the unique characteristics of aggression in FASD and which comprised two studies. The first study examined the presentation of disruptive behavior disorders in alcohol-exposed and non-exposed adolescents. The second study provided an in-depth investigation of aggression within a small sample of adolescent boys, some with FASD and some without. The research aims to add to the literature by providing detailed, descriptive findings of aggression following prenatal alcohol exposure. Identifying and understanding behavioral outcomes of prenatal alcohol exposure, such as increased aggression, is important for at least two reasons. First, such identification and understanding can assist in developing a comprehensive behavioral profile of FASD. Second, maladaptive behaviors contribute significantly to a range of secondary disabilities and adverse life outcomes (Rasmussen, Andrew, Zwaigenbaum, & Tough, 2008; Streissguth et al., 2004).

Behavioral Profile of FASD

Several studies document a range of poor behavioral outcomes in children and adolescents on the FASD continuum. In their review of teratogenic effects of alcohol on brain structure and behavior, Mattson et al. (2001) suggested that children with FASD are at high risk for maladaptive behaviors that interfere with functioning in several spheres of life (e.g., home, school, and social environments).

At home, children and adolescents with FASD often have difficulty performing activities of daily living and, as a result, are often highly dependent upon their caregivers (Streissguth, Sampson, & Barr, 1989). Mothers of alcohol-exposed children have also reported that their children present with high rates of physical and emotional irritability, inappropriate emotional responses to punishment, and stubborn and sullen demeanors (Kelly et al., 2000; Streissguth et al., 1989). At school, teachers frequently report the presence of poor academic performance, disruptive classroom behaviors, and restlessness and poor concentration and attention (Brown et al., 1991; Steinhausen & Spohr, 1998; Streissguth, Barr, Bookstein, Sampson, & Carmichael Olson, 1999).

In addition to cognitive changes, social functioning is a domain greatly affected by prenatal alcohol exposure. Maladaptive behaviors, such as an inability to act tactfully, to respond to social cues, to consider consequences of actions, to form lasting relationships, and to respect social norms, are reported frequently and have been shown to persist into adulthood (Carmichael Olson, Feldman, Streissguth, & Gonzales, 1992; Kelly et al., 2000; Roebuck, Mattson, & Riley, 1999). Importantly, researchers have found similar levels of

behavioral deficits related to social functioning in children exposed to high and moderate levels of alcohol, suggesting that such deficits resulting from prenatal alcohol exposure occur regardless of the presence or absence of facial dysmorphism (Mattson & Riley, 2000; Sood et al., 2001).

The consistent finding that individuals with FASD have particularly poor social skills suggests that their adaptive functioning (i.e., their ability to function independently as social beings) is greatly compromised (Kaemingk & Paquette, 1999). An important implication of poor adaptive functioning in FASD individuals is an increased risk of secondary disabilities and adverse life outcomes, particularly because deficits in social skills can persist throughout life (Rasmussen et al., 2008; Streissguth et al., 2004).

In one of the hallmark longitudinal studies of FASD, Streissguth et al. (2004) documented several adverse life outcomes experienced by a sample of 415 alcohol-exposed individuals (age range = 6-51 years). Researchers administered the Life History Interview (LHI; Kienhorst, De Wilde, Diekstra, & Wolters, 1991) to a close relative or caretaker of each participant, and coded the results into five distinct negative outcomes: inappropriate sexual behaviors, disrupted school experiences, trouble with the law, confinement, and alcohol/drug problems. Forty-eight percent of the adolescent participants (mean age = 16 years) displayed inappropriate sexual behaviors, with promiscuity and inappropriate sexual advances being reported most commonly. The average age at onset of these behaviors was 9.6 years, and the prevalence increased with age. In terms of disrupted school experiences, more than half of the sample had been suspended from school at least once, and 29% had been expelled. The most common reasons for the latter were difficulty getting along with peers and disruptive classroom behavior.

Because numerous independent researchers in the United States have reported a high prevalence of alcohol-exposed individuals in the criminal justice system (see, e.g., Fast & Conry, 2004; Page, 2001), it is not surprising that 60% of the adolescents and adults in Streissguth et al.'s (2004) sample had come into contact with the law. The most frequent reasons for this contact were for charges of assault, crimes against other persons, and domestic violence. Linked to frequent contact with the law was a high prevalence of confinement, with 35% of the adolescent sample ($n = 161$) having been incarcerated.

Finally, Streissguth et al. (2004) found that almost one-third of the adolescent sample ($n = 162$) had alcohol or drug problems, with an average age at onset of 13 years. Overall, results relating to all five negative outcomes can be linked to deficits in adaptive functioning. Hence, these data provide evidence supporting the proposal that adaptive functioning in

individuals with FASD is not delayed but is arrested completely around the age of 7 years (Streissguth et al., 1991; Thomas, Kelly, Mattson, & Riley, 1998).

Aggression in FASD

Of the wide range of social deficits documented in FASD research, aggression is one of the outcomes that have been described least well. This lack of description occurs despite the fact that aggression has been shown to persist across a range of social situations and, therefore, that it impacts negatively on adaptive functioning and life outcomes (e.g., Streissguth et al., 2004). The literature has identified aggressive behavior as part of an overall behavioral profile of FASD, but to my knowledge there are no extant studies that aimed to examine aggression in FASD specifically.

Studies that have quantified aggression in children and adolescents with FASD have done so by using various behavior checklists. The Child Behavior Checklist (CBCL; Achenbach, 1991), for example, has been administered to FASD samples in order to determine the prevalence of a range of maladaptive behaviors, including increased aggression (Mattson & Riley, 2000; Roebuck et al., 1999; Thomas et al., 1998). In their study, Mattson and Riley (2000) administered the CBCL to the parents of 55 alcohol-exposed children and 33 non-exposed controls (mean age = 8.8 years, range = 4.0-16.5 years). Their results indicated that the most significant difference in reported problematic behaviors between exposed and non-exposed children were those that could be characterized on the externalizing scale, which measures aggressive and delinquent behaviors, among others. Differences in reported behaviors that could be characterized on the internalizing scale, which measures anxiety, depression, and withdrawal, were only marginally significant. There were no significant differences in externalizing behaviors between children with FAS and exposed non-dysmorphic children. These results suggest that aggressive behaviors are a significant behavioral outcome of prenatal alcohol exposure, and that they exist regardless of whether facial dysmorphism is present or not. Of particular relevance for the current study is that, in Mattson and Riley's sample, the scores obtained on the aggression scale by the alcohol-exposed children were sufficiently high to be considered clinically significant.

In another FASD study that used the CBCL, Sood et al. (2001) administered the instrument to 501 parents of alcohol-exposed children (mean age = 6.9 years) who had been exposed to varying amounts of alcohol prenatally. The results indicated significant differences between moderate-to-heavily exposed and non-exposed children in terms of aggression and delinquency. Post-hoc tests also revealed a significant between-group

difference for non-exposed children versus those with low levels of alcohol exposure. These results are consistent with the findings of other FASD studies (e.g., Mattson, Schoenfeld, & Riley; 2001; Riley & McGee, 2005) in suggesting that non-dysmorphic FASD diagnoses are also associated with behavioral problems. Sood et al. (2001) added to the literature, however, by suggesting that a dose-response relationship exists between prenatal alcohol exposure and externalizing behaviors: In their sample, the prevalence of aggressive behavior increased with higher levels of alcohol exposure. These results were later supported by O'Leary et al. (2010), who suggested a dose-response relation between prenatal alcohol exposure and aggression in children who were exposed to either moderate or heavy levels of alcohol during pregnancy.

In addition to parent behavior checklists, FASD researchers have administered teacher rating forms (Brown et al., 1991; Steinhausen & Spohr, 1998; Jacobson et al., 2006) and youth self-report forms (Alati et al., 2006; O'Callaghan et al., 2007) to provide further evidence for social and behavioral deficits following prenatal alcohol exposure. None of the studies mentioned above focused on aggression exclusively, however.

In summary, although the findings from previous studies strongly suggest that aggression is a behavioral outcome of FASD, they do not indicate, for instance, contexts within which aggression is most common or other details pertaining to home or classroom displays of aggression. A gap in the literature therefore exists with regard to the nature of aggression in FASD, the contexts within which it occurs, and the mechanisms underlying it.

Social Information Processing Deficits and Aggression

One variable that may aid in explaining the relation between prenatal alcohol exposure and social skills deficits, such as aggression, is an impairment in social information processing. A large body of research focuses on the ways in which children process and utilize social information and, therefore, how a breakdown in such processing may result in social difficulties (Crick & Dodge, 1994; Dodge & Price, 1994). According to Crick and Dodge (1994), processing of social information comprises multiple stages; it entails encoding and interpreting social cues successfully, clarifying goals, accessing responses and making decisions, and, finally, enacting behavior. Dodge and Crick (1990) hypothesized that when social information is processed in such a stepwise manner, the outcome is socially appropriate behavior. However, when the process is deficient or biased, the result may be deviant social behavior. Research suggests that the behavioral outcome tends towards aggression when the breakdown in processing is the result of a hostile attribution bias. In

such cases, children perceive, incorrectly, that peer intentions are malicious or hostile and, as a result, act aggressively in response (Card & Little, 2006; Dodge, 1980).

Although numerous FASD studies have documented, via both teacher and caregiver reports and correlated neuropsychological testing, the presence of social skills deficits (Brown et al., 1991; Olson, Schilling, & Bates, 1999; Riley & McGee, 2005), few studies have aimed specifically at assessing, directly, social information-processing skills of children exposed to alcohol prenatally. In their study, McGee et al. (2009) used a paradigm based on Crick and Dodge's (1994) multi-stage processing model to assess the social information processing skills of children (aged 7-11 years) with and without histories of heavy prenatal alcohol exposure. Alcohol-exposed children displayed deficient processing at all stages; in particular, they generated a higher proportion of aggressive responses than non-exposed participants when faced with a group social scenario. Similarly, O'Connor, Paley, Keil, and Bernier (2008) found that alcohol-exposed children made significantly more hostile attributions than non-exposed children when presented with a social situation. Importantly, the hostile attribution biases correlated positively with an aggressive response style. The results of such studies, therefore, provide insight into a possible mechanism underlying aggressive behavior in children and adolescents with FASD.

Aggression and Comorbid Developmental Disorders

Although aggression has been reported in children and adolescents exposed to alcohol prenatally, it is not a behavioral sign exclusive to FASD. Instead, aggression is part of the clinical presentation of several other developmental disorders. For instance, children with attention-deficit/hyperactivity disorder (ADHD) are also reported to present with increased aggression (Connor, Chartier, Preen, & Kaplan, 2010; Harty, Miller, Newcom, & Halperin, 2009). Similarly, aggression is a key behavioral component of conduct disorder (CD; Dougherty et al., 2007) and oppositional defiant disorder (ODD; Connor, Steeber, & McBurnett, 2010). Determining the unique characteristics of aggression in alcohol-exposed individuals is complicated by the fact that FASD has an estimated comorbidity rate of 70% with ADHD, and frequently presents with CD-like symptoms (Bhatara, Loudenburg, & Ellis, 2006; Disney et al., 2008; Nash et al., 2006).

Because of the overlap between FASD and other developmental disorders, it is important to determine whether FASD aggression is a primary outcome related to prenatal alcohol exposure or whether it is secondary to comorbid disorders such as ADHD and CD. To do so, it is necessary to distinguish, based on qualitative features, the type of aggression

seen in adolescents with FASD from that seen in other developmental disorders. The social information processing deficit model described by Crick and Dodge (1994) may serve as a useful framework for understanding the unique characteristics of FASD aggression. As mentioned, a breakdown in social information processing may result in deviant social behavior. In most conceptions of CD and ODD, aggressive behavior is characterized as being predatory in nature and, therefore, intentional and malicious (Vitaro, Gendreau, Tremblay, & Oligny, 1998). In such cases, it can be argued that deficits in social information processing yield aggression that is primarily predatory or proactive in nature. In contrast, if prenatal alcohol exposure results in hostile attribution biases, then adolescents with FASD are likely to exhibit a predominantly reactive or defensive form of aggression.

The distinction between proactive and reactive aggression was first described by Hartup (1974), and has its theoretical roots in the frustration-aggression model (Berkowitz, 1962) and in social learning theory (Bandura, 1973). *Reactive aggression* is described as a defensive response to a real or perceived provocation or threat (Novick Brown, Connor, & Adler, 2012), whereas *proactive aggression* is deliberate and goal-oriented (Dodge, Lochman, Harnish, Bates, & Pettit, 1997).

Several measures have been developed with the aim of measuring, and distinguishing between, proactive and reactive aggression in children and adolescents (Dodge & Coie, 1987; Raine et al., 2006). To my knowledge, however, such measures have not been used to examine reactive and proactive aggression in alcohol-exposed adolescents. Despite this fact, the results presented by Dodge and Coie (1987) provide support for a reactive form of aggression in FASD: They found that hostile attribution biases in social information-processing correlated positively with reactive aggression but not with proactive aggression.

Although studies have not been conducted on reactive and proactive aggression in FASD, previous research has compared the presentation of disruptive behaviors that are typically associated with aggression in participants with FASD to that in participants with other developmental disorders. Results from this research have been inconsistent, however. For example, Coles et al. (1997) found that children with ADHD scored significantly higher on measures of delinquency and aggression than alcohol-exposed children, and also performed more poorly on measures sensitive to the presence of CD. In contrast, Nash et al. (2006) found that children with FASD had higher rates of externalizing behaviors than ADHD participants. The behaviors that most significantly differentiated the two groups included lack of guilt, cruelty, lying or cheating, and stealing, several of which are criteria for a Diagnostic and Statistical Manual of Mental Disorders (DSM-IV; APA, 1994) diagnosis of

CD. These researchers did not examine aggression specifically. Finally, Disney et al. (2008) found that prenatal alcohol exposure, even at low levels, significantly predicted symptoms of CD in children with FASD, even when controlling for parental psychiatric disorders and externalizing behaviors. In addition to providing conflicting results, the above-mentioned studies provide no insight into the unique characteristics of FASD aggression.

Bullying Behavior in FASD

A key distinction between reactive and proactive aggression is the intrinsic motivation underlying aggressive acts (Raine et al., 2006). Hence, one way to investigate the unique sources and manifestations of aggression in FASD is to examine bullying behaviors. Bullying is conventionally defined as a repetitive proactive behavior that has an underlying motivation or intention to do harm (Guerin & Hennessy, 2002). If aggression in alcohol-exposed children and adolescents is reactive (i.e., angry outbursts in response to provocation or frustration), then, logically, they should not evince the kind of aggressive bullying behavior that is proactive (i.e., goal-oriented and with no preceding provocation or anger; Dodge et al., 1997).

Unfortunately, however, there is little research that provides a detailed examination of bullying in FASD. Of the studies that have identified bullying behaviors in FASD, the data have merely quantified its presence as a behavioral outcome. For instance, Streissguth et al. (1989) found that 53% of their FASD sample ($N = 92$) aged 12 to 42 years ($M = 18.4$) presented with teasing and bullying behavior. Streissguth, Randels, and Smith (1991) reported almost identical data: 50% of the adolescents and adults with FASD in their sample ($N = 40$) presented with bullying behavior.

Previously published studies have also suggested that bullying behavior is not limited to children with dysmorphic features of FAS. For instance, Greenbaum (2000) reported that bullying was one of 12 CBCL items that differentiated children with ARND from non-exposed controls, and Nash et al. (2006) reported that children with FASD scored higher than children with ADHD and than non-exposed controls on a CBCL item measuring bullying, meanness, and cruelty to others. None of these studies addressed whether the bullying behavior evident in the alcohol-exposed participants was proactive or reactive in nature.

In contrast to these results, Page (2001) suggested that children with FASD are not bullies, but are, instead, vulnerable to being bullied. Based on her experiences interacting with alcohol-exposed youth in the juvenile justice system, she argued that FASD adolescents are easy targets for exploitative relationships. Gang leaders, for example, use the lack of

judgment and concern for consequences evident in alcohol-exposed adolescents to their advantage. Similarly, Smith-Thiel et al. (2011) argued that school-aged children with FASD are at risk of victimization in the form of bullying, name-calling, and other forms of school abuse. They argued that this is particularly the case when a child has the facial features of FAS.

A possible explanation for these seemingly contradictory results is that the behaviors characterized as being bullying in nature were being reported by observers rather than by the exposed individuals. That is to say, in all of the above-mentioned studies, the presence of bullying behaviors was reported by parents, caregivers, and teachers, but never by the participants themselves. Recent trends in bullying research stress the importance of understanding self-perceptions of bullying (Guerin & Hennessey, 2002). As mentioned previously, motivation is key to distinguishing reactive and proactive aggression; however, motivation is a concept that is of importance to the initiator of aggression but that may be obscure or difficult to comprehend by observers (Coles et al., 1997; Raine et al., 2006). It is therefore possible that parents and teachers report frequent bullying behavior amongst adolescents with FASD because of the number of fights in which these adolescents are involved; these parents and teachers might miss the fact that fighting may be a response to frustration, or even to being bullied.

Gender Differences in Aggression and Bullying

If factors such as reactive versus proactive aggression and bullying are to aid in determining the unique characteristics of aggression in FASD, then gender differences in the presentation of those factors need to be taken into account. Historically, research has focused on direct forms of aggression, which refer to physical assaults and verbal attacks, such as name-calling. Such forms of aggression are more common amongst boys (Hyde, 1984). More recently, however, researchers have begun considering a wider range of aggressive behaviors and have acknowledged that aggression may also be indirect in nature (Björkvist, Lagerspetz, & Kaukiainen, 1992). Such aggression is covert and aims to hurt another through sabotage, rejection, and damaging of the target's social relationships. This form of aggression has been termed indirect aggression (Feshbach, 1969), but is also commonly referred to as relational (Crick & Grotpeter, 1995) or social aggression (Rivers & Smith, 1994). In contrast to direct aggression, the covert form is more typical of girls (Björkvist, 1994; Crick, 1997). This well-established sex difference appears to extend into bullying behavior (Van der Wal, de Wit, & Hirasing, 2003).

The gender differences in aggression described above are well documented for non-clinical samples; little research exists for clinical samples, however. In their study, Connor et al. (2003) found no significant gender differences in reactive and proactive aggression in a clinical sample of children diagnosed predominantly with disruptive behavior disorders. There was, however, a trend toward more severe and intense aggression in boys than girls.

Although no published studies focus exclusively on aggression and bullying in FASD samples, several have provided support for the trends mentioned above. For example, Disney et al. (2008) found that male gender and prenatal alcohol exposure were associated with higher levels of conduct disorder symptoms and, therefore, with proactive aggression. The interaction between alcohol exposure and gender did not reach significance, however. In addition, Rasmussen et al. (2010) found that alcohol-exposed girls tended to display more internalizing problems than alcohol-exposed boys.

In summary, in typically-developing children, direct aggression is more common amongst boys and indirect aggression is more common amongst girls. When examining the underlying motivation, both reactive and proactive aggression are more common amongst boys. However, when examining clinical samples, the established differences become less clear. Determining gender differences in aggression in FASD samples is further complicated by the fact that only physical aggression can be distinguished using observational techniques (Bjorkvist, 1994). In addition, measures of reactive and proactive aggression, such as that developed by Raine et al. (2006), were developed and normed using male samples only.

Aggression in Context

To have a complete understanding of aggression in FASD, it is important to recognize that aggression does not occur in isolation but rather exists within certain social contexts. According to Novick Brown et al. (2012), biological impairments resulting from prenatal alcohol exposure are not the only factors that predispose adolescents with FASD to aggression: The interaction between the impairments and the environments in which children are raised is also critical. Research in non-clinical samples has indicated that adverse home environments predispose youth to aggression and violence (Raine, 2002). Similarly, FASD research has indicated that maladaptive behaviors can result from an interaction between neurocognitive deficits, on the one hand, and abusive and non-nurturing home environments, on the other (Streissguth & O'Malley, 2000).

In the life history study discussed previously, Streissguth et al. (2004) argued that a stable and nurturing home environment is the most influential protective factor when

considering adverse life outcome in FASD. However, research has shown that children with FASD are subjected to negative and unpredictable care giving environments at a disproportionate rate (Coggin, Timler, & Olswang, 2007). Additionally, these children present with high rates of environmental risk factors, such as single-parent homes, poverty, exposure to violence, and risk of abuse (O'Connor, Hogan, & Findlay, 2002). Carmichael Olson, Oti, Gelo, and Beck (2009, p. 237) describe the twinning of these phenomena as "double jeopardy."

The context within which aggression occurs is a particularly important consideration in South Africa. The Western Cape province of this country has one of the highest FASD prevalence rates in the world (May et al., 2007), and also one of the highest rates of violent crime (Department of Community Safety Annual Performance Plan, 2012). One study examining the effects of community violence on children living in Cape Town reported that 82% percent of the sample ($N = 104$) had been witness to violence (Ward et al., 2001). This high rate of exposure to violence is significant in the context of FASD, as exposure to community violence has been associated with externalizing behaviors (Lynch, 2003), aggression (Barbarin, Richter, & de Wet, 2001), and bullying behavior at school (Baldry, 2003).

Summary and Rationale

Behavioral studies of FASD have indicated that aggression is common amongst alcohol-exposed adolescents and appears to become more prevalent with age. To date, studies of aggression in FASD have documented its presence as a behavioral outcome but have not provided detailed information regarding its presentation, including whether it is proactive or reactive in nature and under which circumstances it arises. As a result, there is a lack of a theoretical framework within which to understand aggression in FASD. Furthermore, previous research has identified a range of comorbid developmental disorders that are typically associated with aggression and frequently present with FASD; however, no studies have examined the relationship between such comorbid disorders and aggression in alcohol-exposed individuals. As such, it remains unknown whether aggression displayed by alcohol-exposed individuals is qualitatively different from that seen in non-exposed individuals with similar developmental disorders.

In addition to there being limited findings regarding aggression in FASD, the studies that have been conducted have tended to rely on behavior checklists. Data from these instruments are based on adult observations of behaviors; they do not provide insight into the

nature of, and motivation underlying, the behavior. Furthermore, to my knowledge, no published studies have obtained detailed self-report data on aggression and bullying in FASD samples. Previous research is limited further by the fact that studies have not incorporated naturalistic observation of FASD adolescent behavior, despite numerous researchers citing a need for observational data.

The current research comprised two separate studies. Both aimed to add to the literature by addressing gaps in knowledge regarding the relationship between prenatal alcohol exposure and developmental disorders that are typically associated with aggressive behavior. In addition, the research aimed to describe the presentation and motivation underlying aggression in a sample of alcohol-exposed adolescent boys. That is to say, the research aimed to provide rich descriptions of aggressive behavior by combining behavioral measures of aggression with self-report data and with observational data.

STUDY 1

As discussed previously, aggression is well recognized as a clinical feature of several developmental disorders, including ADHD, CD, and ODD. In addition, aggression is consistently reported in studies exploring the behavioral profile associated with such disorders (e.g., Jensen et al., 2007; Loeber, 2000). In studies of CD, in particular, the high prevalence of aggressive behavior has resulted in the recognition of an aggressive subtype of the disorder (Nock, Kazdin, Hiripi, & Kessler, 2006).

Because disruptive behavior disorders such as those mentioned above are frequently comorbid with FASD, determining the unique contribution of prenatal alcohol exposure to aggressive behavior in alcohol-exposed children is complex. FASD researchers who have examined comorbid diagnoses in alcohol-exposed children have shown that prenatal alcohol exposure is associated with higher levels of disruptive behaviors (e.g., behavioral signs associated with CD), even after statistically controlling for potential confounding variables such as parental psychiatric and substance abuse disorders (Disney et al., 2008). No FASD research has, however, been conducted focusing particularly on the aggressive features of comorbid developmental disorders.

Based on the findings of previous FASD research, the current study aimed to examine disruptive behavior disorders that are frequently comorbid with FASD and that are typically associated with aggression. The study, therefore, aimed to determine whether such behaviors (a) present significantly more frequently in alcohol-exposed children than in non-exposed

children and,(b) increase as prenatal alcohol exposure increases. Furthermore, the study aimed to determine whether the aggressive subtype of CD presented more frequently amongst the alcohol-exposed participants than non-exposed participants. Additionally, this is the first study to examine the prevalence of the aggressive subtype of CD in alcohol-exposed children.

I explored these research aims by testing the following hypotheses:

- (1) Children exposed to alcohol prenatally will present with significantly more DSM-defined disruptive behavior disorders.
- (2) Amongst the alcohol-exposed participants, the number of disruptive behaviors will increase with alcohol-exposure.
- (3) The alcohol-exposed participants will present with significantly more aggressive CD symptoms than the non-exposed participants.
- (4) The alcohol-exposed boys will present with significantly more aggressive CD symptoms than the alcohol-exposed girls.

Methods

Design

The current study featured two cohorts of children who are participating in ongoing studies of the effects of prenatal alcohol exposure on development. The study took the form of a quasi-experiment and was longitudinal in nature. Because the study aimed to determine between- and within-group differences in disruptive behavior disorders within each sample, the behaviors of the alcohol-exposed participants were analyzed according to diagnostic group. Researchers remained blind to the diagnosis of each participant during test administration, except for the most severe cases of FAS, where facial dysmorphism was evident.

Participants

Two samples of children were recruited for the study: Sample A consisted of 91 Coloured (mixed race) children living in the Western Cape. The mothers of the participants were recruited into the large prospective longitudinal study within which the current study is nested at a local maternity clinic during pregnancy, between July 1999 and January 2002. Each mother was informed about the risks of prenatal drinking to the fetus and to herself, and each was advised to stop or reduce drinking as much as possible. All of the drinking mothers were also offered a referral for an intervention aimed at reducing drinking during pregnancy.

Sample B consisted of 70 Coloured children who were recruited between May 2005 and September 2006 as part of a retrospective study of the effects of prenatal alcohol exposure on development. Thirty-seven of the participants were older siblings of participants from the prospective Cape Town Longitudinal Cohort Study, described here as Sample A (Jacobson et al., 2008). The remaining 33 participants were recruited at an elementary school in rural Cape Town where there is known to be a high incidence of alcohol abuse amongst local farm workers during pregnancy (Jacobson et al., 2011; Dodge et al., 2009; Meintjes et al., 2010).

At the time of recruitment, the mothers in both samples were interviewed regarding their alcohol consumption during pregnancy using a timeline follow-back approach (Jacobson, Chiodo, Jacobson, & Sokol, 2002). This approach is used to determine the incidence and amount of alcohol consumed on a day-by-day basis. Alcohol consumption was then converted into a measure of ounces of absolute alcohol (oz AA). Any child whose mother reported consuming at least 1 oz AA per day (equivalent to two standard drinks per day), or who reported at least two episodes of binge drinking (at least four drinks per occasion), during the first trimester of pregnancy was invited to participate in the study and was considered a heavy drinker. A control mother (i.e., one who reported consuming less than 0.05 oz AA per day on average and who reported no binge drinking) who booked at the midwife obstetric unit at roughly the same gestational weeks was recruited for each drinking mother. All of the children were examined in a FAS diagnostic clinic for growth and FAS anomalies using a standard protocol (Hoyme et al., 2005) by two expert FAS dysmorphologists who initially examined each child independently and subsequently reached agreement regarding FAS diagnosis (Jacobson et al., 2011). The diagnoses were based on established criteria described by the Institute of Medicine (Stratton, Howe, & Battaglia, 1996). A case conference was subsequently conducted by the primary researchers and the two US dysmorphologists to determine FAS and PFAS diagnoses.

Materials

The participants and their mothers and teachers were administered the following measures. In Sample A, the behavioral measures were administered 10 years after initial recruitment as part of the continuous assessment of the participants' development. In Sample B, the measures were administered shortly after recruitment. Table 1 provides a summary of the measures used.

Table 1.

Summary of Measures Administered in Study 1

Measure	Completed By	Reference
Maternal DBD	Mothers	Pelham & Murphy (1987)
Teacher DBD	Teachers	Pelham & Murphy (1987)
K-SADS-PL	Mothers	Kaufman et al. (1996)
WISC-III & WISC-IV	Participants	Wechsler (1991; 2004)
Hollingshead Scale of Social Class	Mothers	Hollingshead (1975)
Maternal alcohol consumption data	Mothers	Jacobson et al. (2002)
AUDADIS-IV	Mothers	Grant, Dawsin & Hasin (2001)

Note. DBD = Disruptive Behavior Disorders Rating Scale; K-SADS-PL = KiddieSADS Present and Lifetime Version; WISC = Wechsler Intelligence Scale for Children; AUDADIS-IV = Alcohol Use Disorder and Associated Disabilities Interview Schedule-IV.

Disruptive Behavior Disorders Rating Scale (DBD). The DBD is a behavior checklist used to identify clinically relevant problem behaviors in children and adolescents (Pelham, Gnagy, Greenslade, & Milich, 1992; Pelham & Murphy, 1987). This 45-item scale is based on the DSM-III-R (APA, 1987) criteria for ADHD, CD, and ODD, and is available in parent and teacher versions. Data from both versions were obtained for Sample B; data from the teacher version only were obtained for Sample A.

The instrument asks respondents to indicate whether problem behaviors occur in certain situations and, if so, to rate the severity in a Likert fashion from ‘not at all’ to ‘very much.’ The clinical significance of the reported behaviors is determined by the number of symptoms (i.e., the number of items which are rated as ‘very much’), or by the severity (i.e., how the total score compares to normative data).

Regarding the scale’s psychometric properties, the DBD has well-established validity and reliability. When translated into Afrikaans and administered to South African teachers and parents, the DBD has been shown to measure the same constructs in South African children as in Western children (Meyer et al., 2004). The scale has also been administered successfully to children exposed prenatally to alcohol (Jacobson et al., 2011; Kodituwakku et al., 2006).

In this study, data from the DBD were used to determine whether the participants met the diagnostic criteria for disruptive behavior disorders that are typically associated with aggression. In addition, the data were used to determine whether the alcohol-exposed

participants were diagnosed with such disorders significantly more frequently than the non-exposed participants.

Kiddie-SADS Present and Lifetime Version (K-SADS-PL). The K-SADS-PL is a structured interview used to assess the severity of problem behaviors as well as present and lifetime status of Axis I psychiatric diagnoses in children (Kaufman, Birmaher, Brent, Rao, & Ryan, 1996). The interview is available in parent and child versions and is able to generate 32 diagnoses based on DSM-III-R and DSM-IV criteria. Based on the number of reported symptoms, diagnoses are scored as definite, probable (75% of symptom criteria met), or not present. Data from the parent version were obtained for Sample A.

Regarding the measure's psychometric properties, the K-SADS-PL has well-established reliability and validity. In particular, the test-retest reliability coefficients for CD and ODD are in the excellent range (Kaufman et al., 1997). The parent version of the interview has been used in previous FASD research (Burden et al., 2010; Fryer et al., 2007). In addition, the measure has been used to assess psychiatric status in samples of South African children (Seedat, Nyamai, Njenga, Vythilingum, & Stein, 2004; Suliman, Kaminer, Seedat, & Stein, 2005).

In this study, the K-SADS-PL was used in conjunction with the DBD to determine whether the participants in Sample A met the diagnostic criteria for disruptive behavior disorders that are typically associated with aggression.

Wechsler Intelligence Scale for Children-Third Edition and Fourth Edition. The general intellectual functioning of the participants in Sample A was measured at a testing session during the 9-year follow-up visit using the Wechsler Intelligence Scale for Children-Fourth Edition (WISC-IV; Wechsler, 2004). IQ scores for the Sample B participants were calculated based on seven WISC-III subtests (Similarities, Arithmetic, Digit Span, Symbol Search, Coding, Block Design, Picture Completion), as well as WISC-IV Matrix Reasoning. Both versions of the WISC are used widely as measures of children's intellectual abilities, and have well documented validity and reliability for both clinical and non-clinical samples (Strauss, Sherman, & Spreen, 2006; Wechsler, 2004). The WISC has been used previously as a measure of intelligence in FASD research in this South African cohort (e.g., Burden et al., 2009; Dodge et al., 2009; Jacobson et al., 2011).

The WISC subtests used here were translated into Afrikaans by a clinical psychologist whose first language is Afrikaans. IQ was estimated from these subtests using Sattler's (1992) formula for computing Short Form IQ; validity coefficients for Sattler Short Form IQ based on 5 or more subtests consistently exceed $r = .90$. The Junior South African

Intelligence Scale (JSAIS; Madge et al., 1981), which is available in Afrikaans and English and has been normed for South African children, had been administered to the children in the Cape Town Longitudinal Cohort at 5 years of age. Sixty-two of these children were later administered the WISC IQ test at 9 years. IQ scores obtained using the JSAIS at 5 years were strongly correlated with the 9-year WISC scores, $r = .77, p < .001$. In this study, WISC IQ was examined as a potential mediator of the effects of prenatal alcohol exposure on aggression.

Hollingshead Scale of Social Class. The social class rating of each mother was calculated using this instrument (Hollingshead, 1975). For each mother, a standardized score was computed based on four factors (gender, marital status, education, and occupation). For the mothers that were married, their partners' education and occupations were incorporated. The four factors yield a total social class score, which ranges from a minimum of 8 to a maximum of 66. Based on the total score, the mothers and their nuclear families were then determined as falling within one of five social strata: major business and professionals (total score of 55-66), medium business, minor professionals, and technicians (40-54), skilled craftsmen, clerical, or sales worker (39-30), machine operator or semi-skilled worker (20-29), and unskilled laborer or menial service worker (8-19). The data generated from this measure were used to determine social class differences between the drinking and non-drinking mothers.

Maternal alcohol consumption. As mentioned above, the mothers of the participants were interviewed at recruitment and at subsequent prenatal visits regarding alcohol consumption during pregnancy using a timeline follow-back approach (Jacobson et al., 2002). As such, the mothers in Sample A were interviewed about their drinking behaviors while pregnant with the participants. In contrast, the mothers in Sample B were interviewed retrospectively, after their pregnancies. Three alcohol-consumption variables were generated based on the results of the interviews: mean oz AA per day, mean oz AA per drinking day, and frequency of drinking days per week. The results of each measured referred to consumption across pregnancy. In this study, these variables were used to determine the relation between prenatal alcohol exposure and disruptive behavior disorder diagnoses.

Alcohol Use Disorder and Associated Disabilities Interview Schedule-IV (AUDADIS-IV). This structured diagnostic interview was developed by the National Institute on Alcohol Abuse and Alcoholism (NIAAA). It generates data on clinical diagnoses of alcohol abuse and dependence, based on DSM-IV criteria (Grant, Dawson, & Hasin, 2001). The interview can be administered by either a lay interviewer or by a clinician. Questions

regarding alcohol abuse and dependence are structured within time frames, such that clinical diagnoses of alcohol abuse and dependence can be generated based on data from the previous 12 months, or over a lifetime. The AUDADIS-IV has been shown to be a reliable measure of alcohol abuse and dependence in both clinical samples and the general population (Grant et al., 2003; Hasin et al., 1997).

This measure was administered to the mothers of the participants by a researcher as part of the larger ongoing study of FASD at the time of recruitment. Diagnoses of alcohol abuse and/or dependence were made based on the mothers' drinking patterns over their lifetimes. The data generated from this measure were used to determine differences in lifetime drinking patterns between the drinking and non-drinking mothers

Procedure

On the day of testing, a research driver transported the mothers and children to the Child Development Research Laboratory at the UCT Health Science Campus. Before testing, all of the mothers provided written consent for participation in the research; each child also provided oral assent (see Appendix A).

Following these consent procedures, the mothers in Sample B were interviewed regarding their alcohol consumption during pregnancy. In addition, they were asked about their employment history, living conditions, marital status and current relationships, pregnancy history, and developmental history of their children. The mothers in Sample A had provided this information previously (upon recruitment during pregnancy). The parent version of the DBD was read to the mothers in both samples while at the Child Development Research Laboratory. While the mothers completed the maternal interviews and DBD reports, their children were taken to a testing room where they completed the WISC assessment according to standard procedures.

With the consent of the mothers, the children's teachers were contacted shortly after the testing day. The teachers either received a letter requesting their assistance with the research or were contacted in person by the research nurse. The teachers provided their consent before completing the teacher version of the DBD (see Appendix A).

Ethical Considerations

Ethical approval for the 9-year follow-up study (the one in which Sample A was nested) was obtained from the Wayne State University Institutional Review Board (reference number 026708B3F; see Appendix B) and the UCT Faculty of Health Sciences Research

Committee (reference number, 187/2008; see Appendix B). Similarly, ethical approval for the testing of participants in Sample B was obtained from the UCT Faculty of Health Sciences Research Ethics Committee (reference number 196/2008; see Appendix B) and from the Wayne State University IRB (reference number 099504B3F; see Appendix B). Informed consent was obtained from each mother at the time of recruitment into the study and at the subsequent visits. Similarly, teacher consent was obtained for the DBD data, and oral assent was obtained from all of the children. All mothers and children were assured of the confidentiality of their data, and were informed that their responses would be identified by code numbers only.

All of the mothers were aware that participation was voluntary and that they could withdraw their children from the study at any time. None of the procedures used in the current research or in the larger ongoing studies of FASD within which the current study is nested put the children at risk of physical or psychological harm. All of the mothers received compensation for their time and a photo of their child; the children received a small gift for their participation. Both the mothers and children were given breakfast, a snack, and lunch while at the laboratory. Referrals were made if a serious health or emotional problem was detected (e.g., visual or auditory problems, severe depression, etc.). Although there were no other direct benefits of participation in this research, a greater understanding of aggression in FASD may facilitate intervention measures that will potentially improve the long-term outcomes for children diagnosed with FASD.

Data Management and Statistical Analyses

The data were analyzed using the Statistical Package for the Social Sciences version 20 (SPSS, 2011). All decisions regarding statistical significance were made with alpha set at .05, and the appropriate effect size estimates were calculated for each significance test. Prior to conducting these tests, the distribution of the data for all variables was inspected to ensure that assumptions for parametric statistical tests were upheld.

Data analyses proceeded across several steps. First, descriptive statistics were obtained for the sample characteristics, the alcohol-related variables, and the DBD diagnoses. The comorbid diagnoses of each participant were determined based on the number of relevant symptoms reported in the parent and teacher versions of the DBD. In order for a diagnosis of inattentive ADHD to be given, 6 or more items measuring inattention needed to be rated as “pretty much” or “very much” on the parent and/or teacher DBD. Similarly, a minimum of 6 such ratings on items related to hyperactivity were required for a diagnosis of hyperactive

ADHD. If the requirements for both inattentive and hyperactive ADHD were met, then a diagnosis of ADHD combined type was given. Participants were diagnosed with ODD if they were rated as “pretty much” or “very much” on 4 or more oppositional items on either the parent or teacher version, while a diagnosis of CD was given if 3 or more items relating to conduct disordered behavior were rated as “pretty much” or “very much” on either the parent or teacher version of the DBD.

Second, primary inferential data analysis involved chi-square tests of independence. These were run for the total sample for each DBD diagnosis in order to compare the comorbid DSM-IV diagnoses of the exposed and non-exposed participants. The tests were then rerun by diagnostic group (i.e., syndromal, non-syndromal and non-exposed). In addition, the tests were run separately for boys and girls in order to determine whether there were gender differences in comorbid diagnoses. For all analyses, the outcome variables were dichotomous, and indicated whether the child met the criteria for that diagnosis or not.

Third, correlation analyses were run between the DBD diagnoses and continuous alcohol variables (viz., oz AA/ day, oz AA/drinking day, and proportion of drinking days per week). In Sample B, the measures of oz AA per day and oz AA per drinking day were subjected to log transformation for the correlation analyses in order to reduce the influence of extreme outliers. In Sample A, only the measure of oz AA per day required log transformation. In each case, Pearson correlation coefficients were calculated and significance tests were run two-tailed.

Fourth, univariate ANOVA analyses were run in order to determine whether differences in the aggressive subtype of CD existed between the exposed and non-exposed participants. Aggression scores were based on the eight DBD items that measure those behaviors. Scores on those items were included if the participant was given a rating of “pretty much” or “very much on either the teacher or parent version of the DBD.” The model was first run for the total sample, and then rerun separately for boys and girls.

Finally, regression analyses were run with the three continuous alcohol variables as the predictor variables and the aggression scores as the outcome variable. Such analyses were run in order to determine the extent to which prenatal alcohol exposure can account for aggressive behaviors.

Results and Discussion

Sample A: Cape Town Longitudinal Cohort

Table 2 presents the sample characteristics of the Sample A participants and mothers. Of the total sample of 91 participants, 63 were alcohol-exposed. Eleven (12%) of these children met criteria for FAS, and 19 (21%) for PFAS; 33 (36%) of these alcohol-exposed children were heavily exposed but did not meet criteria for FAS or PFAS and were, therefore, considered heavily exposed non-syndromal (HE). The mothers of the remaining 28 (31%) participants were recruited as controls on the basis of their averaging less than 0.5 oz AA/day and having reported no binge drinking episodes in the first trimester of pregnancy. The sample consisted of 55% boys ($n = 50$) and 45% girls ($n = 41$); the sex distribution did not differ significantly between the exposed and non-exposed groups. At the time of testing, the children ranged in age from 8 to 11 years ($M = 9.86$, $SD = 0.95$). The average age of the non-syndromal children was higher than that of the syndromal ($p < .001$) and non-exposed children ($p = .01$), however.

The mean WISC-IV IQ of the syndromal children was significantly lower than that of the non-syndromal ($p = .002$) and non-exposed children ($p = .001$). There were, however, no differences in mean IQ between the non-syndromal and non-exposed children ($p > .20$).

As can be seen in Table 2, the mothers of the syndromal children were older at the time of delivery than the mothers of the non-syndromal ($p = .02$) and non-exposed children ($p = .03$). Overall, the mothers in this cohort were poorly educated, with an average of about 9 years of education. However, the mothers of the syndromal children had significantly lower levels of education than the mothers of the non-syndromal ($p = .002$) and non-exposed children ($p < .001$). There were no differences in level of education between the mothers of the non-syndromal and non-exposed children ($p = .19$).

There was a significant between-group difference in marital status, with a greater percentage of non-drinking mothers being married. This finding is consistent with prior research showing that unmarried status is a demographic correlate of maternal drinking during pregnancy (May et al., 2008). Additionally, a low socioeconomic status (SES) is widely recognized as being correlated with prenatal alcohol exposure (Abel, 1995). This pattern was confirmed in the current data, which showed a significant between-group difference in Hollingshead social class score: mothers of the syndromal children obtained a significantly lower mean score than mothers of the non-syndromal ($p = .004$) and non-exposed children ($p < .001$).

Sixty-four (70%) of the mothers in this sample smoked during pregnancy, with 25 (27%) smoking an average of 10 or more cigarettes per day. There were, however, no between-group differences in terms of the number of cigarettes smoked per day during pregnancy. The mother of one syndromal child reported using cocaine during pregnancy, while four drinking mothers and one non-drinking mother reported using marijuana during pregnancy.

Table 2.

Sample A: Sociodemographic and Clinical Characteristics

Measure	Syndromal Non-syndromal Non-exposed			Test Statistic	<i>p</i>	ESE
	(<i>n</i> = 30)	(<i>n</i> = 33)	(<i>n</i> = 28)			
Age at testing (years)	9.4 (0.7)	10.4 (1.0)	9.8 (0.8)	9.48	<.001***	.18
Gender (% boys)	53.3	60.6	50.0	0.74	.69	.09
Participant WISC IQ score ^a	64.2 (10.8)	73.8 (13.1)	75.6 (12.0)	7.75	.001***	.15
Maternal age at delivery (years)	29.2 (7.2)	25.8 (5.7)	25.7 (3.9)	3.54	.033*	.074
Maternal education (years)	7.5 (2.8)	9.3 (2.3)	10.1 (1.4)	9.94	<.001***	.19
Maternal marital status (% married)	40.0	36.4	67.9	6.97	.031*	.28
SES ^b	15.9 (7.9)	22.3 (9.2)	25.3 (7.9)	9.53	<.001***	.18
Prenatal cigarettes per day ^c	9.1 (5.1)	7.4 (5.5)	10.1 (11.5)	0.77	.47	.025

Note. The test statistic was either *F* or χ^2 . ESE = effect size estimate, either η^2 or Phi, ^aWISC-IV full scale IQ

^bBased on Hollingshead Four Factor Index of Social Status Scale (Hollingshead, 1975). ^cConsumers only

p* < .05, *p* < .01, ****p* < .001

Table 3 summarizes data regarding maternal alcohol consumption during pregnancy. Two of the control mothers reported consuming an average of 0.01 oz AA/day. The remaining control mothers abstained from alcohol throughout pregnancy. In contrast, the mothers of the syndromal and non-syndromal children consumed an average of 1.2 oz AA/day and 0.5 oz AA/ day throughout pregnancy, equivalent to 2.4 and 1 standard drink respectively. The difference in daily consumption between the mothers of the syndromal and non-syndromal children was significant, *p* = .002. However, most drinking mothers did not drink daily, but rather concentrated their drinking on weekends. As such, on a typical drinking day, the average consumption of the mothers of the syndromal children was 3.8 oz AA, compared to 3.1 oz AA amongst the mothers of the non-syndromal children. This difference was not significant, *p* = .16.

Table 3.

Sample A: Maternal Alcohol Consumption during Pregnancy

Measure	Syndromal	Non-syndromal	Non-exposed	Test Statistic	<i>p</i>	ESE
	(<i>n</i> = 30)	(<i>n</i> = 33)	(<i>n</i> = 28)			
AA/day (oz) ^a	1.2 (1.4)	0.5 (0.5)	0.0009 (0.003)	14.82	<.001***	.25
AA/drinking day (oz) ^a	3.8 (2.2)	3.1 (2.3)	0.06 (0.2)	33.65	<.001***	.43
Frequency of drinking (days per week)	1.9 (0.2)	1.1 (0.1)	0.008 (0.004)	28.07	<.001***	.39
Alcohol dependence history ^b (%)	63.3	60.6	10.7	22.45	<.001***	.35

Note. The test statistic was either *F* or χ^2 . ESE = effect size estimate, either η^2 or Phi

AA/day = daily average alcohol consumption, AA/drinking day = average alcohol consumption per drinking day. ^aMeasured in oz AA. ^bBased on DSM-IV-TR criteria

p* < .05, *p* < .01, ****p* < .001

AUDADIS-IV interviews showed that 39 (62%) of the drinking mothers had been physiologically dependent on alcohol at some point in their lives. No difference existed between the mothers of the syndromal and non-syndromal children on this variable, *p* > .20. In contrast, only 3(11%) of the control mothers reported drinking behavior that met the DSM-IV criteria for past physiological dependence, although not during pregnancy. As shown in Table 3, the between-group difference with regard to the distribution of alcohol-dependent mothers was highly significant.

Table 4 provides a summary of the frequency of comorbid disruptive behavior disorder diagnoses in Sample A based on the maternal and teacher behavior reports. In the total sample, there was a significant between-group difference in the presence of CD; that disorder presented most commonly amongst the syndromal participants. In fact, only one non-syndromal child in Sample A was diagnosed with CD and no control children met the clinical criteria for CD. As expected, the group difference in CD was predominantly found amongst the boys. However, amongst the boys, CD was exclusive to the syndromal children, as the non-syndromal child with CD was a girl. CD was, however, not common amongst the girls, and as such, the group difference in girls was not significant.

In contrast to what was expected, there were, in the total sample, no between-group differences in inattentive, hyperactive, or combined-type ADHD. Additional ADHD analyses were run, which yielded similar results. A summary of the results can be found in Appendix C. What was surprising, and contributed to the non-significant results, was the high prevalence of ADHD diagnoses amongst the non-exposed participants. On all three measures, the prevalence of ADHD diagnoses amongst the non-exposed participants was similar to or

higher than that of the non-syndromal participants. This pattern of results remained unchanged when the ADHD diagnoses were analyzed separately for boys and girls. However, all three ADHD diagnoses were more prevalent amongst the boys and were highest, although only marginally, amongst the syndromal boys.

Table 4.

Sample A: Disruptive Behavior Disorders by FASD Diagnostic Group

Measure	Syndromal	Non-syndromal	Non-exposed	χ^2	<i>p</i>	ESE
Total sample (<i>N</i> = 91)	(<i>n</i> = 30)	(<i>n</i> = 33)	(<i>n</i> = 28)			
Inattentive ADHD	23.3	12.1	14.3	1.58	.46	.13
Hyperactive ADHD	20.0	18.2	17.9	0.05	.97	.02
Combined ADHD	16.7	6.1	14.3	1.85	.40	.14
Oppositional Defiant Disorder	20.0	6.1	7.1	3.73	.16	.20
Conduct Disorder	16.7	3.0	0.0	7.60	.022*	.29
Girls (<i>n</i> = 41)	(<i>n</i> = 14)	(<i>n</i> = 13)	(<i>n</i> = 14)			
Inattentive ADHD	7.1	0.0	7.1	0.98	.61	.15
Hyperactive ADHD	7.1	7.7	7.1	0.004	.99	.01
Combined ADHD	0.0	0.0	7.1	1.98	.37	.22
Oppositional Defiant Disorder	14.3	7.7	7.1	0.5	.78	.11
Conduct Disorder	14.3	7.7	0.0	2.11	.35	.23
Boys (<i>n</i> = 50)	(<i>n</i> = 16)	(<i>n</i> = 20)	(<i>n</i> = 14)			
Inattentive ADHD	37.5	20.0	21.4	1.63	.44	.18
Hyperactive ADHD	31.2	25.0	28.6	0.18	.92	.06
Combined ADHD	31.2	10.0	21.4	2.53	.28	.23
Oppositional Defiant Disorder	25.0	5.0	7.1	3.80	.15	.28
Conduct Disorder	18.8	0.0	0.0	6.78	.034*	.37

Note . ESE = effect size estimate, calculated using Phi

p* < .05, *p* < .01, ****p* < .001

Like the ADHD findings, the non-significant ODD results were unexpected because of the well-described prevalence of externalizing behaviors in FASD samples. In particular, the lack of ODD diagnoses amongst the alcohol-exposed boys was surprising. Once again, the prevalence of ODD amongst the non-exposed participants was similar to that of the non-syndromal children. Because the results indicated a trend towards significance, *post hoc* analyses were run, with particular interest being paid to the ODD diagnoses amongst the boys. Although there was no group difference between the syndromal and non-exposed boys,

$\chi^2(1, 58) = 1.71, p = .19$, the difference in the presence of ODD diagnoses between the syndromal and non-syndromal boys tended towards significance, $\chi^2(1, 63) = 2.97, p = .09$.

Although many of the group differences were not significant, on almost all of the measures the number of diagnoses was highest amongst the syndromal children. This pattern was particularly true for the sample of boys. Because continuous measures of prenatal alcohol exposure may be more sensitive predictors of disruptive behavior diagnoses than the categorical measures, three continuous measures of alcohol exposure were correlated with the number of disruptive behavior disorders (see Table 5).

Table 5.

Sample A: Correlations between Prenatal Alcohol Exposure and Disruptive Behavior Disorders

	AA per day (oz)		AA per drinking day (oz)		Frequency of drinking	
	<i>r</i>	<i>p</i>	<i>r</i>	<i>p</i>	<i>r</i>	<i>p</i>
Total sample (<i>N</i> = 91)						
Inattentive ADHD	.13	.24	.10	.37	.13	.24
Hyperactive ADHD	.19	.072	.10	.36	.16	.14
Combined ADHD	.11	.29	.08	.47	.07	.50
Oppositional Defiant Disorder	.28	.008**	.21	.045*	.20	.054
Conduct Disorder	.31	.003**	.25	.017*	.23	*.028
Girls (<i>n</i> = 41)						
Inattentive ADHD	.04	.78	-.09	.56	.15	.35
Hyperactive ADHD	.16	.31	.04	.79	.14	.39
Combined ADHD	-.11	.48	-.13	.40	-.11	.50
Oppositional Defiant Disorder	.25	.11	.17	.30	.17	.29
Conduct Disorder	.35	.024*	.27	.089	.26	.11
Boys (<i>n</i> = 50)						
Inattentive ADHD	.20	.18	.26	.072	.13	.36
Hyperactive ADHD	.24	.094	.18	.22	.20	.18
Combined ADHD	.24	.092	.22	.12	.17	.25
Oppositional Defiant Disorder	.32	.024*	.28	.050*	.25	.080
Conduct Disorder	.26	.073	.23	.11	.20	.16

Note . Frequency of drinking measured in days per week, *r* calculated using Pearson correlation co-efficient
p* < .05, *p* < .01, ****p* < .001

Consistent with the findings from the chi-square tests, there were significant positive correlations between measures of prenatal alcohol exposure and diagnoses of CD. However, in contrast to what was expected, the correlation was significant amongst the girls only. Inspection of the individual cases indicated that this finding was due to the high report of CD-type behaviors amongst three alcohol-exposed girls, however. Although not reaching conventional levels of significance, the correlation between oz AA/day and CD amongst the boys indicated a trend towards increased CD behavior amongst boys with higher levels of exposure.

Interestingly, ODD was the only diagnosis that showed significant or near-significant correlations with all three continuous alcohol variables within the total sample. Upon inspection of the ODD correlations, it appears that the significant findings within the total sample reflect boys' behavior, as indicated by the significant correlations between CD diagnoses and oz AA/day and oz AA/drinking day. This finding is consistent with that of the chi-square analyses.

In terms of ADHD diagnoses, the number of hyperactive ADHD diagnoses tended to increase with oz AA/day within the total sample, although not meeting conventional levels of significance. When separated by gender, it appears that this trend was predominantly due to hyperactive behaviors amongst the boys. In addition, the number of inattentive ADHD diagnoses tended to increase with oz AA/drinking amongst the boys.

Consistent with the chi-square findings, there were no significant correlations between level of prenatal alcohol exposure and number of ADHD diagnoses overall. As mentioned earlier, this lack of association was unexpected and can be accounted for by the elevated report of ADHD amongst the non-exposed participants.

In summary, the disruptive behavior disorders of a sample of alcohol-exposed and non-exposed children were analyzed in order to determine whether such disorders present more frequently in children with FASD than in non-exposed children. Analyses indicated that CD-type behaviors presented frequently following prenatal alcohol exposure, and were most common amongst syndromal boys. Furthermore, the number of CD diagnoses tended to increase with alcohol exposure. These findings are in keeping with previous FASD studies that have indicated a high prevalence of externalizing behaviors, and CD-type behaviors in particular, amongst children with FASD (Disney et al., 2008; D'Onofrio et al., 2007). In addition, the results indicated that oppositional behaviors presented frequently amongst the syndromal boys, and tended to increase with alcohol exposure.

Interestingly, in this sample the CD- and ODD-type behaviors were seen only in the

syndromal children. This finding is not consistent with previous research that has found similar levels of behavioral deficits across the FASD continuum (Mattson & Riley, 2000; Riley & McGee, 2005).

Furthermore, a diagnosis of ADHD was not unique to the alcohol-exposed children in the current sample. However, the number of ADHD diagnoses did tend to increase with alcohol exposure amongst the boys. The implications of these findings are addressed in the General Discussion.

Finally, correlational analyses indicated that oz AA/day was the strongest of the three continuous alcohol measures in terms of its ability to predict disruptive behavior disorders. This finding is relevant for future studies investigating the association between prenatal alcohol exposure and the presence of disruptive behavior disorders in adolescents.

Sample B: Cape Town Cross-Sectional Cohort

To determine whether the findings in Sample A could be replicated in another sample of alcohol-exposed children, similar analyses were run for Sample B. Table 6 presents the sociodemographic and clinical characteristics of the participants and mothers in Sample B. Of the total sample of 70 participants, 40 (57%) were alcohol-exposed. Nine (13%) of these children met criteria for FAS, 4 (6%) met the criteria for PFAS, and 27 (38%) who were alcohol-exposed but did not meet criteria for FAS or PFAS were considered non-syndromal. The remaining 30 (43%) participants were recruited as controls on the basis of their mothers averaging less than 0.5 oz AA/day and having reported no binge drinking episodes in the first trimester. The sample consisted of 43% boys ($n = 30$) and 57% girls ($n = 40$). The sex distribution did not differ significantly between the groups. At the time of testing, the children ranged in age from 8 to 13 years ($M = 10.38$, $SD = 1.19$); average age at testing did not differ between the groups.

In terms of general intelligence, the mean IQ of the syndromal children was significantly lower than that of the non-exposed children ($p < .001$), as was the mean IQ of the non-syndromal children ($p = .001$). In contrast to the Sample A data, the difference in mean IQ between the syndromal and non-syndromal children was not significant, $p = .07$.

Table 6.

Sample B: Sociodemographic and Clinical Characteristics

Measure	Syndromal	Non-syndromal	Non-exposed	Test Statistic	<i>p</i>	ESE
	(<i>n</i> = 13)	(<i>n</i> = 27)	(<i>n</i> = 30)			
Age at testing (years)	9.9 (1.2)	10.7 (1.2)	10.4 (1.1)	1.92	.16	.054
Gender (% boys)	30.8	44.4	46.7	0.98	.61	.12
Participant WISC IQ score ^a	59.9 (12.2)	66.4 (9.9)	76.4 (10.4)	12.98	<.001***	.28
Maternal age at delivery (years)	26.7 (6.2)	24.6 (5.4)	24.9 (5.8)	0.59	.56	.017
Maternal education (years)	6.8 (2.8)	6.8 (2.3)	8.7 (1.9)	5.83	.005**	.15
Maternal marital status (% married)	30.8	48.1	70.0	6.29	.043*	.30
SES ^b	15.1 (7.4)	15.3 (5.5)	19.7 (8.1)	3.51	.035*	.095
Prenatal cigarettes per day ^c	8.7 (5.4)	12.4 (7.9)	10.9 (6.3)	0.97	.39	.042

Note. The test statistic was either *F* or χ^2 . ESE = effect size estimate, either η^2 or Phi

^aBased on seven WISC-III subtests and Matrix Reasoning from the WISC-IV, ^bBased on Hollingshead Four Factor Index of Social Status Scale (Hollingshead, 1975). ^cConsumers only

p* < .05, *p* < .01, ****p* < .001

As Table 6 shows, there were no between-group differences with regard to maternal age at time of delivery. Overall, the mothers in the cohort were poorly educated, with an average of 7.62 years of education; only three had completed high school. The non-drinking mothers had significantly higher levels of education than the mothers of the syndromal (*p* = .02) and non-syndromal children (*p* = .003).

There was a significant between-group difference in marital status. The difference was, however, predominantly due to the low number of married mothers within the syndromal group. There was also a significant between-group difference in SES: Both the mothers of the syndromal (*p* = .050) and non-syndromal children (*p* = .020) obtained significantly lower Hollingshead social class scores than the non-drinking mothers.

Most mothers (*n* = 47, 67%) smoked during pregnancy, with 27 (39%) smoking an average of 10 or more cigarettes per day. There were, however, no between-group differences in terms of the number of cigarettes smoked per day during pregnancy. None of the mothers reported using cocaine or methaqualone (“mandrax”) during pregnancy; one drinking mother reported using marijuana during pregnancy.

Table 7 summarizes data regarding maternal alcohol consumption during pregnancy. With one exception, all control mothers abstained from alcohol throughout pregnancy. The alcohol consumption of that one exception was negligible, i.e., she reported consuming 0.05 oz AA/day on average. In contrast, the mothers of the syndromal and non-syndromal children

consumed an average of 2.8 oz AA/day and 2.4 oz AA/ day throughout pregnancy, equivalent to roughly 5.5 and 5.0 standard drinks respectively. Unlike the pattern seen in Sample A, the difference in daily consumption between the mothers of the syndromal and non-syndromal children was not significant, $p > .20$. Daily alcohol consumption in Sample B was more than double that of the drinking mothers in Sample A. Furthermore, on a typical drinking day, the mothers of the syndromal and non-syndromal children consumed roughly 12 standard drinks per day.

Eighty-three percent of the drinking mothers ($n = 33$) had been physiologically dependent on alcohol at some point in their lives. In this regard, there were no significant differences between the mothers of the syndromal and non-syndromal children, $p > .20$. In contrast, 13% of the control mothers ($n = 4$) reported drinking behavior that matched the DSM-IV criteria for past physiological dependence, although not during pregnancy. As shown in Table 7, the between-group difference in the presence of alcohol dependence was highly significant. This finding is consistent with the result reported for Sample A.

Table 7.

Sample B: Maternal Alcohol Consumption during Pregnancy

Measure	Syndromal	Non-syndromal	Non-exposed	Test Statistic	p	ESE
	($n = 13$)	($n = 27$)	($n = 30$)			
AA/day (oz) ^a	2.8 (2.5)	2.4 (2.4)	0.002 (0.008)	16.81	<.001***	.33
AA/drinking day (oz) ^a	6.1 (3.5)	6.0 (5.2)	0.007 (0.2)	23.90	<.001***	.42
Frequency of drinking (days per week)	2.8 (0.2)	2.7 (0.2)	0.01 (0.008)	42.84	<.001***	.56
Alcohol dependence history ^b (%)	90.9	80.0	13.0	31.69	<.001***	.73

Note. The test statistic was either F or χ^2 . ESE = effect size estimate, either η^2 or Phi

AA/day = daily average alcohol consumption, AA/drinking day = average alcohol consumption per drinking day. ^aMeasured in oz AA. ^bBased on DSM-IV-TR criteria

* $p < .05$, ** $p < .01$, *** $p < .001$

Table 8 summarizes the participants' comorbid disruptive behavior disorders, as reported on the maternal and teacher DBD reports. Within the total sample, there was a significant between-group difference in CD diagnoses. Post-hoc analyses indicated no difference between the syndromal and non-syndromal children, $\chi^2(1, 40) = 0.10$, $p > .20$. This result suggests that CD, as a comorbid disorder, is not exclusive to children who meet criteria for a syndromal diagnosis. Closer inspection of the results suggested that the group difference

was primarily due to effects found for the alcohol-exposed boys. In addition, CD was prevalent across the FASD continuum amongst the boys, $\chi^2(1, 16) = 1.33, p = .25$.

The analysis also detected significant between-group differences in the distribution of inattentive and combined ADHD. Interestingly, these group differences were found amongst girls only. For boys, all three ADHD subtypes presented frequently amongst the non-exposed boys, resulting in non-significant group differences. Amongst the girls, post-hoc analyses indicated that inattentive and combined ADHD presented significantly more frequently amongst the syndromal than non-syndromal girls, $\chi^2(1, 24) = 4.85, p = .03$, and $\chi^2(1, 24) = 5.71, p = .02$, respectively. In keeping with previous research (e.g., O'Malley & Nanson, 2002), hyperactive ADHD was not a significant feature of the alcohol-exposed children, and the presence of this form of the disorder was not contingent upon either gender or group status.

As Table 8 shows, between-group analyses of the distribution of ODD diagnoses did not reach conventional levels of significance. Post-hoc analyses indicated that the distribution of ODD diagnoses did not differ between the syndromal and non-syndromal participants, $\chi^2(1, 40) = 0.11, p > .20$, but that this difference was significant between the syndromal and non-exposed participants, $\chi^2(1, 43) = 2.41, p = .012$. These results suggest that (a) ODD tends to present significantly more frequently amongst alcohol-exposed children, but that (b) ODD-type behaviors are not exclusive to syndromal children, but rather exist across the FASD spectrum. When the groups were split by gender, the analysis detected similar trends for boys and girls. However, the number of boys in Sample B who were diagnosed with ODD ($n = 12$) was twice that of the girls ($n = 6$). This pattern of data is consistent with the established preference for externalizing behaviors amongst boys (see, e.g., Carlson, Tamm & Gaub, 1997).

Table 8.

Sample B: Disruptive Behavior Disorders by FASD Diagnostic Group

Measure	Syndromal	Non-syndromal	Non-exposed	χ^2	<i>p</i>	ESE
Total sample (<i>N</i> = 70)	(<i>n</i> = 13)	(<i>n</i> = 27)	(<i>n</i> = 30)			
Inattentive ADHD	53.8	33.3	10.0	9.67	.008**	.37
Hyperactive ADHD	38.5	25.9	13.3	3.48	.18	.22
Combined ADHD	38.5	18.5	6.7	6.51	.039*	.31
Oppositional Defiant Disorder	38.5	33.3	16.7	3.03	0.22	.21
Conduct Disorder	30.8	25.9	3.3	7.19	.027*	.32
Girls (<i>n</i> = 40)	(<i>n</i> = 9)	(<i>n</i> = 15)	(<i>n</i> = 16)			
Inattentive ADHD	55.6	13.3	0.0	12.60	.002**	.56
Hyperactive ADHD	33.3	20.0	6.2	3.03	.22	.28
Combined ADHD	33.3	0.0	0.0	11.17	.004**	.53
Oppositional Defiant Disorder	33.3	13.3	6.2	3.37	.19	.29
Conduct Disorder	11.1	13.3	6.2	0.45	.80	.11
Boys (<i>n</i> = 30)	(<i>n</i> = 4)	(<i>n</i> = 12)	(<i>n</i> = 14)			
Inattentive ADHD	50.0	58.3	21.4	3.86	.15	.36
Hyperactive ADHD	50.0	41.7	35.7	0.29	.87	.09
Combined ADHD	50	41.7	14.3	3.19	.20	.33
Oppositional Defiant Disorder	50.0	50.0	28.6	1.43	.49	.22
Conduct Disorder	75.0	41.7	0.0	11.25	.004**	.61

Note. ESE = effect size estimate, calculated using Phi

p* < .05, *p* < .01, ****p* < .001

In summary, the results indicated a greater prevalence of CD and of inattentive and combined-type ADHD in alcohol-exposed children than in non-exposed children. Amongst the exposed children, CD was common across the FASD continuum, whereas ADHD was more prevalent amongst syndromal children. CD tended to present frequently amongst alcohol-exposed boys, but not girls, whereas between-group in ADHD were accounted for by the syndromal girls. ODD diagnoses were more prevalent amongst alcohol-exposed boys than non-exposed boys, and presented regardless of FASD diagnosis. In almost all analyses, the proportion of diagnoses was highest amongst the syndromal children, although the difference between syndromal and non-syndromal was not always significant. However, the high prevalence in syndromal children suggested an increase in disruptive behavior disorder with increased alcohol exposure. Correlation analyses were, therefore, run to determine whether this stood true for Sample B (see Table 9).

As expected, prenatal alcohol exposure (as captured by all three continuous measures) correlated positively with the presence of diagnoses of inattentive ADHD. For oz AA/day and oz AA/drinking day, the correlations were highly significant. Closer inspection of the results indicated that the positive correlation applied to both boys and girls, although it was stronger amongst the girls. Similarly, prenatal alcohol exposure correlated positively with the presence of diagnoses of combined ADHD, although this was as a result of the prevalence of ADHD amongst the boys. In contrast to what was expected, there was a significant correlation in the total sample between alcohol exposure and hyperactive ADHD; this correlation only tended toward significance when the sample was split by gender, however. These findings suggest that children with greater prenatal alcohol exposure present with more hyperactive and inattentive symptoms

In keeping with the significant between-group differences in CD diagnoses, strong positive correlations existed between prenatal alcohol exposure and CD amongst the boys. Hence, the correlations provide further evidence for the prevalence of CD-type behaviors in alcohol-exposed boys and suggest that, although these behaviors are present in boys with lower levels of exposure, they become more prevalent in more heavily exposed boys. Finally, the correlations between alcohol exposure and ODD fell short of conventional levels of significance, but suggested a trend towards increased ODD-type behaviors with increased alcohol exposure.

Together, the results of the correlational analyses provide further evidence for an increased presence of disruptive behavior diagnoses in alcohol-exposed children relative to their non-exposed counterparts. Furthermore, these findings suggest that continuous measures of alcohol exposure may be more sensitive predictors of disruptive behavior disorders than the categorical measures of diagnostic/non-diagnostic groups.

Table 9.

Sample B: Correlations between Prenatal Alcohol Exposure and Disruptive Behavior Disorders

	AA per day (oz)		AA per drinking day (oz)		Frequency of drinking	
	<i>r</i>	<i>p</i>	<i>r</i>	<i>p</i>	<i>r</i>	<i>p</i>
Total sample (<i>N</i> = 70)						
Inattentive ADHD	.40	.001***	.37	.001***	.28	.017*
Hyperactive ADHD	.25	.034*	.28	.020*	.12	.31
Combined ADHD	.32	.006**	.34	.005**	.18	.13
Oppositional Defiant Disorder	.19	.12	.23	.055	.10	.39
Conduct Disorder	.26	.033*	.33	.005**	.18	.13
Girls (<i>n</i> = 40)						
Inattentive ADHD	.51	.001***	.46	.003**	.40	.010**
Hyperactive ADHD	.25	.12	.28	.086	.15	.36
Combined ADHD	.25	.13	.28	.086	.15	.35
Oppositional Defiant Disorder	.19	.23	.23	.16	.11	.51
Conduct Disorder	.02	.91	.10	.56	.04	.81
Boys (<i>n</i> = 30)						
Inattentive ADHD	.37	.046*	.37	.042*	.24	.20
Hyperactive ADHD	.28	.14	.27	.15	.12	.52
Combined ADHD	.46	.010**	.48	.007**	.30	.11
Oppositional Defiant Disorder	.13	.34	.25	.18	.12	.52
Conduct Disorder	.50	.005**	.60	<.001***	.46	.011*

Note . *r* calculated using Pearson correlation co-efficient

p* < .05, *p* < .01, ****p* < .001

In addition to quantifying particular comorbid diagnoses in FASD, the current study aimed to investigate disruptive behavior disorders as a means of understanding aggressive behavior in alcohol-exposed children. Because aggression is a behavioral sign that presents frequently in ADHD, ODD, and CD, one might argue that alcohol-exposed children should present with increased aggression because these disorders are so frequently comorbid with FASD. However, the current study aimed to confirm this hypothesis by examining behaviors in keeping with the aggressive subtype of CD. Based on the finding that there were between-group (exposed versus non-exposed) differences in CD diagnoses amongst boys, as well as strong positive correlations between the presence of CD and levels of prenatal alcohol

exposure, it was hypothesized that the symptoms of CD that are associated with aggression will be more prevalent amongst the alcohol-exposed boys than non-exposed boys. Table 10 presents a list of the eight DBD items that measure behavior in keeping with the aggressive subtype of CD. Scores on these items were examined for Sample B only.

Table 10.

DBD Items Measuring the Aggressive Subtype of Conduct Disorder

Item number	Description
5	Often initiates physical fights with other members of his or her household
6	Has been physically cruel to people
20	Often initiates physical fights with others who do not live in his or her household
31	Has forced someone into sexual activity
32	Often bullies, threatens, or intimidates others
36	Has been physically cruel to animals
40	Has stolen while confronting a victim (e.g., mugging, purse snatching, armed robbery)
45	Has used a weapon that can cause serious physical harm to others

Table 11 presents results from the ANOVAs comparing mean scores on these eight items for each of the three groups. The analyses were first run across the total sample, and then across boys only, and across girls only. The only significant result was the between-group comparison in boys. Post-hoc analyses of those data indicated that syndromal boys presented with significantly more aggressive CD behaviors than non-syndromal boys, $F(1, 16) = 5.86, p = 0.03$, and non-exposed boys, $F(1, 18) = 5.86, p = 0.03$. The analysis detected no difference between the non-syndromal and non-exposed boys, $F(1, 26) = 0.02, p > 0.20$. These results highlight the aggressive quality of CD amongst syndromal boys. Taken together with the results presented above, it is of interest to note that CD was observed in exposed boys regardless of whether they met criteria for FAS or for PFAS, but that the aggressive subtype of CD was found exclusively in syndromal boys.

Table 11.

DBD Scores for Aggressive Subtype of Conduct Disorder

	Syndromal (<i>n</i> = 13)	Non-syndromal (<i>n</i> = 27)	Non-exposed (<i>n</i> = 30)	<i>F</i>	<i>p</i>	η^2
Total sample (<i>N</i> = 70)	0.5 (1.0)	0.3 (0.7)	0.2 (0.6)	0.91	.41	.027
Girls (<i>n</i> = 39)	0.2 (0.4)	0.3 (0.9)	0.2 (0.8)	0.12	.88	.007
Boys (<i>n</i> = 30)	1.3 (1.5)	0.2 (0.4)	0.2 (0.4)	4.88	.016*	.27

p* < .05, *p* < .01, ****p* < .001

Because the results presented above suggested that continuous measures of prenatal alcohol exposure were stronger predictors of behavioral outcomes than categorical groups of diagnosis/non-diagnosis, I ran regression analyses to examine the association between the continuous measures of alcohol exposure and the mean scores on items measuring the aggressive subtype of CD. Table 12 presents the results of these analyses. As expected, prenatal alcohol exposure was not a significant predictor of the aggressive subtype of CD amongst the girls. In contrast, the regression model featuring oz AA/day as predictor of aggressive-subtype CD behaviors in boys was significant, $F(1, 30) = 4.93, p = 0.04$, accounting for 15% of the variance in the outcome. Similarly, the model featuring oz AA/drinking day as a predictor of aggressive-subtype CD behaviors in boys just missed conventional levels of significance, $F(1, 30) = 3.93, p = 0.057$, and was able to explain 12% of the variance in the outcome.

These results, in conjunction with the ANOVA results, emphasize the aggressive nature of CD amongst alcohol-exposed syndromal boys. In particular, they highlight the aggressive tendencies of alcohol-exposed boys, a behavioral outcome that has been reported in many FASD studies using behavior checklists, but that has not examined before in the context of comorbid disorders.

Table 12.

Linear Regression for Prenatal Alcohol Exposure and Aggressive CD Behaviors

Measure	<i>F</i>	<i>p</i>	<i>r</i> ²
Total sample (<i>N</i> = 70)			
Absolute alcohol per day (oz)	2.16	.15	0.032
Absolute alcohol per drinking day (oz)	2.20	.14	0.032
Frequency of drinking (days per week)	0.22	.64	0.003
Girls only (<i>n</i> = 40)			
Absolute alcohol per day (oz)	0.032	.86	0.001
Absolute alcohol per drinking day (oz)	0.19	.67	0.005
Frequency of drinking (days per week)	0.032	.86	0.001
Boys only (<i>n</i> = 30)			
Absolute alcohol per day (oz)	4.93	.035*	0.15
Absolute alcohol per drinking day (oz)	3.93	.057	0.12
Frequency of drinking (days per week)	1.29	.27	0.044

p* < .05, *p* < .01, ****p* < .001

Summary and Conclusion

This study examined the presence and nature of comorbid diagnoses in two samples of alcohol-exposed and non-exposed children (named here Sample A and Sample B). The aim was to determine whether children exposed to alcohol prenatally present with significantly more disruptive behavior disorders that are typically associated with aggression, and if so, to determine whether the number of diagnoses increased with alcohol exposure. The results generally indicated consistency between the samples in terms of the sociodemographic and clinical characteristics as well in terms of the main findings regarding between-group comparisons. As expected, there was some variability between the samples; however, the small sample sizes need to be considered when interpreting the results.

In Sample A, CD was highlighted as a behavioral disorder that presented frequently amongst alcohol-exposed boys and that was a feature of syndromal boys in particular. CD did not present more frequently in non-syndromal boys than in non-exposed boys, however. This finding could be accounted for by the tendency for CD diagnoses to increase with alcohol exposure amongst the boys. Similar results were found for ODD. An implication of these findings is that they question the extent to which these diagnoses exist to a similar degree

across the FASD continuum, as previously suggested.

The results regarding ADHD disconfirmed a priori predictions. Numerous previous FASD studies have reported a high incidence of ADHD amongst alcohol-exposed children (e.g., Brown et al., 1991; Coles, 2001; Coles et al., 1997; Jacobson et al., 2011). In Sample A, however, neither group status (FAS/PFAS, HE, Control) nor level of prenatal alcohol exposure predicted the presence of any of the ADHD subtypes. However, there was a trend for boys in this sample to show a higher level of inattentive ADHD.

Also, the high prevalence of ADHD amongst the non-exposed children contributed to the lack of a significant group difference in ADHD diagnoses between the exposed and non-exposed children. In developed-economy, high-income countries, the prevalence of ADHD in typically developing children under the age of 18 years is reported to range between 3% and 10%, with a worldwide prevalence of 5.9% (Polanczyk et al., 2007; Swanson et al., 1998). However, two studies of ADHD prevalence in South African children estimated the prevalence rate to be 12.6% (Peltzer, Cherian, & Cherian, 1999) and 19.7% (Meyer et al., 2004), respectively. Of methodological importance is that the latter study used the DBD as a diagnostic tool. With these prevalence statistics in mind, the fact that ADHD was detected quite frequently in the current sample of non-exposed children is understandable.

Furthermore, teacher-reported ADHD symptoms need to be considered in light of the South African school context. In study 2 of this research, classroom observation sessions were conducted within six classrooms at four Cape Town schools. The class sizes ranged from 42 to 53 students per class, with a mean class size of 47 students ($SD = 4.8$). In all six classes, the students shared desks and chairs. The cramped and under-resourced classroom conditions were not conducive to learning and appeared to foster disruptive and disobedient behavior.

In Sample B, CD was once again highlighted as a behavioral disorder that presented frequently in alcohol-exposed boys. However, in contrast to the findings in Sample A, in Sample B CD was not found exclusively in syndromal boys, but rather presented across the FASD continuum. When examining possible explanations for this finding, an age effect can be ruled out, as the mean age of the boys in Sample A ($M = 9.98$, $SD = 0.98$) did not differ from that of the boys in Sample B ($M = 10.30$, $SD = 1.22$), $t(80) = -1.28$, $p = .20$. Similarly, the boys in the two samples presented with comparable maternal and sociodemographic characteristics. However, as mentioned previously, the mean daily alcohol consumption of the drinking mothers in Sample B was more than twice that reported by the drinking mothers in Sample A. Because the boys in Sample B were exposed to significantly more oz AA/day

($M = 1.40$, $SD = 2.44$) than the boys in Sample A ($M = 0.53$, $SD = 0.58$), $t(80) = -2.42$, $p = .02$, this difference in alcohol exposure may account for the higher prevalence of diagnoses across the disorders in Sample B. However, if this explanation is to be considered, it must be acknowledged that retrospective reports of alcohol consumption are often higher than those collected prospectively (Jacobson et al., 2002). As such, the difference in reported consumption may be a product of the methodology.

In terms of ODD in Sample B, the results indicated a greater number of ODD diagnoses amongst the alcohol-exposed children than non-exposed children across the FASD continuum. The prevalence of ODD was higher in boys than in girls. These results are in the predicted direction given that they are consistent with other FASD studies that have acknowledged the presence of ODD-type behaviors amongst alcohol-exposed children (e.g., Burd et al., 2003; Rasmussen et al., 2008; Way & Rojahn, 2012).

In contrast to Sample A, diagnoses of inattentive and combined-type ADHD presented more frequently in alcohol-exposed children than in non-exposed children in sample B. This result is more consistent with the previous FASD research than the Sample A result was. However, the post-hoc finding that the group difference was as a result of the higher prevalence of ADHD amongst the exposed girls than non-exposed the girls was unexpected. Although the number of boys diagnosed with ADHD was greater than that of the girls, the prevalence of ADHD diagnoses did not differ by FASD diagnostic group.

It is interesting that inattentive ADHD, but not hyperactive ADHD, presented more frequently in alcohol-exposed children. In their study, O'Malley and Nanson (2002) argued that children with FASD are more likely to present with the inattentive subtype of ADHD. Furthermore, they argued that the alcohol-exposed children with inattentive ADHD were likely to present with comorbid CD. This finding was confirmed in the current study. With this finding in mind, Nash et al. (2006) argued that behaviors such as lying and cheating, cruelty, and a lack of guilt are what differentiate alcohol-exposed children with ADHD from non-exposed children with ADHD. This finding is particularly relevant to the current study for two reasons: First, it provides further evidence for the co-occurrence of CD and ADHD in alcohol-exposed children, and, second, it calls attention to the unique features of comorbid disruptive behavior disorders in alcohol-exposed children by highlighting the aggressive, oppositional, and antisocial nature of their presentations.

Finally, the results of the aggressive-subtype CD analyses are significant in light of the fact that studies, like that of Nash et al. (2006), have begun to explore qualitative differences in the presentation of disruptive behavior disorders in children with FASD. In the

current study, the aggressive subtype of CD presented exclusively in the alcohol-exposed boys (and, in particular, syndromal boys) in Sample B. This finding not only emphasizes the aggressive nature of comorbid CD in boys with FASD, but also questions how the presentation of such disorders evolves with increasing alcohol exposure. With the Streissguth et al. (2004) life history study in mind, an implication of this finding is that boys with the highest levels of prenatal alcohol exposure not only present with more disruptive behaviors but also display behaviors that are more socially unacceptable and more detrimental in terms of possible life outcomes.

In conclusion, the current study addressed a knowledge gap regarding the prevalence and nature of disruptive behavior disorders in alcohol-exposed children. The observed data indicated a consistent and relatively high prevalence of CD diagnoses in alcohol-exposed boys. In addition, I argued that ODD tends to increase with alcohol exposure amongst the boys across the FASD continuum. The prevalence of ADHD amongst children with FASD was inconsistent between Sample A and Sample B, but the trend in the results appeared to indicate an increase in inattentive ADHD diagnoses within alcohol-exposed children compared to non-exposed children. To my knowledge, this is the first FASD study that has examined such disorders in South African children. Furthermore, it is the first study to illustrate the prevalence of the aggressive subtype of CD in children with FASD, and, by doing so, has highlighted the aggressive quality of comorbid disorders in alcohol-exposed children. The findings of this study are significant because they have drawn attention to an aspect of the behavioral profile of FASD that needs further investigation.

STUDY 2

Study 1's results showed a higher prevalence of comorbid diagnoses of ADHD and CD in alcohol-exposed children than non-exposed children within two samples. Both disorders are frequently associated with aggressive behavior. In addition, the number of such comorbid diagnoses increased with alcohol exposure. Importantly, prenatal alcohol exposure correlated significantly with the aggressive subtype of CD. In combination, these results suggest that aggressive behavior is an integral aspect of the behavioral profile of FASD. Little is known about the nature of aggression within alcohol-exposed children, however.

As mentioned previously, FASD studies have acknowledged aggression as a behavioral outcome but have not conducted in-depth investigations of aggressive behavior following prenatal alcohol exposure. Other limitations of previous studies, such as the use of behavior checklists in the absence of associated observational data, have been acknowledged (see e.g., Jacobson & Jacobson, 2003; Olswang, Svensson, & Astley, 2010) but have yet to be addressed. Furthermore, although Study 1 suggested there might be a higher prevalence of ADHD and CD diagnoses in alcohol-exposed children than in non-exposed children, such disorders are not exclusive to children with FASD. A knowledge gap exists, therefore, with regards to whether aggression displayed by alcohol-exposed children is qualitatively different from that displayed by non-exposed children.

By building on the findings of Study 1, Study 2 aimed to determine whether aggression was a primary behavioral outcome of prenatal exposure to alcohol in a small sample of adolescent boys by providing rich descriptions of the boys' aggression. These descriptions were based on information from their mothers and teachers, from the participants themselves, and on data from naturalistic observation of the boys' interactions with peers. Hence, I aimed to provide a comprehensive description of aggression in adolescent boys with FASD.

Study 2 only explored aggression in boys for several reasons. First, Study 1 indicated a significant positive correlation between the aggressive subtype of CD and prenatal alcohol exposure in boys only. Second, some of the data were collected via naturalistic observation of behavior and would, therefore, only provide insight into direct or overt aggression, which has been shown to be displayed predominantly by boys (Hyde, 1984). Finally, the measure of reactive and proactive aggression was developed and has been normed for boys only (Raine et al., 2006).

Using the behavior reports in conjunction with other sources of data, Study 2 aimed to distinguish, indirectly, between aggression evident in adolescents with FASD from that evident in other developmental disorders by determining whether the aggression in FASD was reactive or proactive in nature. Study 2 also aimed to incorporate the contextual factors (e.g., stability of the home environment, and parental substance abuse) that have been shown to correlate directly with aggressive behavior in FASD samples.

Study 2, therefore, tested the following hypotheses:

(1) Adolescent boys exposed to alcohol prenatally will display significantly more aggressive behaviors than non-exposed boys when measured on a range of behavioral checklists, as well as through naturalistic observation.

(2) The aggression evident in the boys with FASD will be qualitatively different to that of other developmental disorders (i.e., it will be predominantly reactive rather than proactive in nature).

Methods

Design

This study used a multiplecase-study approach. Each participant was analyzed as an individual case, wherein the demographic, developmental, and contextual variables of each participant were described in relation to the presentation of aggressive behaviors. The aim of this design was to provide an in-depth and descriptive account of aggression by combining quantitative and qualitative analyses. The study was longitudinal in nature, as several measures, such as the maternal alcohol consumption data and FASD diagnoses, were collected previously as part of the larger ongoing longitudinal study of FASD. Because the current study included naturalistic observation of behavior, the aggression observations were collected by a researcher blind to the diagnosis of each participant during sample selection, test administration and behavior observation, except for the most severe cases of FAS, where facial dysmorphology was evident.

Participants

The sample consisted of six Coloured boys who are participating in the ongoing longitudinal study of FASD, described previously as Sample B in Study 1. Five of the boys were recruited via snowball sampling (they are older siblings of participants from Sample A), and one was recruited at an elementary school in rural Cape Town. The sample size was limited by several factors, including the total number of boys in Sample B, the number of

boys in that sample who attended school, and consent from the principals of those schools. As indicated in Study 1, 30 of the participants in Sample B were boys. Of that number, only 15 remained in school in the Cape Town area. The principals of the schools those boys attended were contacted and informed about the research. Four of the ten principals were willing to allow their schools, and students, to participate in the study. The remaining principals declined to participate. As a result, the sample was limited to six participants, three of whom attended the same school, and, therefore, lent itself to a multiple case-study approach.

The mothers of the six participants were recruited into the larger ongoing study, as described in Study 1, and were interviewed using the timeline follow-back approach. Because the boys were participating in the larger study, agreement was previously reached regarding their FASD diagnoses.

Materials

The participants and their teachers were administered the following measures of aggression at their respective schools on the day of testing. Data regarding the participants' comorbid developmental disorders and general intellectual functioning, maternal alcohol consumption during pregnancy, and sociodemographic characteristics were collected previously, as described in Study 1. Table 13 provides a summary of the measures collected previously as well as those that were administered as part of the current study.

Table 13.

Summary of Measures in Study 2

Measure	Study	Completed By	Reference
Maternal DBD	Study 1	Mothers	Pelham & Murphy (1987)
Teacher DBD	Study 1	Teachers	Pelham & Murphy (1987)
WISC-III and WISC-IV	Study 1	Participants	Wechsler (1991; 2004)
Hollingshead Scale of Social Class	Study 1	Mothers	Hollingshead (1975)
Maternal alcohol consumption data	Study 1	Mothers	Jacobson et al. (2002)
AUDADIS-IV	Study 1	Mothers	Grant, Dawson, & Hasin (2001)
Teacher Report Form (TRF)	Study 2	Teachers	Achenbach & Rescorla (2001)
RPQ	Study 2	Participants	Raine et al. (2006)
Direct Observation Form (DOF)	Study 2	Aggression Researchers	McConaughy & Achenbach (2009)

Note. Study column indicates the study in which the measures were administered; DBD = Disruptive Behavior Disorder Rating Scale; WISC = Wechsler Intelligence Scale for Children; AUDADIS-IV = Alcohol Use Disorder and Associated Disabilities Interview Schedule; RPQ = Reactive-Proactive Aggression Questionnaire.

The DBD, WISC, Hollingshead scale, AUDADIS-IV and maternal alcohol consumption data were used in Study 1 and were, therefore, described previously. In addition to these measures, Study 2 incorporated three measures of aggression, which were administered at the participants' schools.

Teacher Report Form (TRF). The TRF forms part of the Achenbach System of Empirically Based Assessment (ASEBA; Achenbach & Rescorla, 2001), a comprehensive assessment tool for measuring children's behaviors in certain problem areas. The purpose of the TRF is to obtain teachers' perceptions of a child's academic performance, adaptive functioning, and problem behaviors over the 2 months prior to reporting. The TRF consists of 113 Likert-type items that form three broad scales (Internalizing Problems, Externalizing Problems, and Total Problems). The 34 items that make up the Externalizing Problems scale are of particular interest here and can be divided into the following subscales: social problems, attention problems, delinquent behavior, and aggressive behavior. The TRF takes about 10-15 minutes for the teacher to complete. Furthermore, the TRF shares many of its items with other measures in the ASEBA, allowing for comparison of results on different measures.

The TRF has good test-retest and inter-rater reliability, as well as evidence for the validity of the items (Achenbach et al., 2008; Ashburner, Ziviani, & Rodger, 2008). The ASEBA is a widely used measure of assessment, and the TRF has been used in several FASD studies (Mattson, & Riley, 2000; Sood et al., 2001; Jacobson et al., 2006). Furthermore, the TRF has been used in previous South African studies examining classroom behaviors in samples of Afrikaans-speaking children (e.g., Engelbrecht, 2005).

Reactive-Proactive Aggression Questionnaire (RPQ). The RPQ (Raine et al., 2006) is a self-report measure of aggression featuring 23 Likert-type items (see Appendix D). Factor analysis of the scale indicates that 11 items load on a factor that can be labeled 'reactive aggression,' and that the other 12 items load on a factor that can be labeled 'proactive aggression.' The scale was validated in a study of 334 adolescent boys aged 16 years. The authors suggest that reactive aggression at age 16 years is characterized uniquely by participants' impulsivity, hostility, social anxiety, and lack of close friends. Although this scale has not been widely used in research studies, the above-mentioned characteristics are common in FASD. The RPQ was, therefore, chosen to aid in testing the hypothesis that reactive rather than proactive aggression is more prevalent in adolescent boys diagnosed with FASD.

The RPQ was a convenient measure as it required no training for administration and only took a few minutes to complete. Because the participants are predominantly Afrikaans-speaking, the RPQ was translated into that language by a native speaker of Afrikaans and then back-translated into English by another native speaker of Afrikaans in order to check the quality of the translation. To avoid a Hawthorne effect during test administration, the RPQ was administered to all of the boys in the participants' classes (mean number of boys in each class = 15.71, $SD = 8.32$).

Direct Observation Form (DOF). The DOF (McConaughy & Achenbach, 2009) forms part of the ASEBA and is used to obtain ratings of problem behaviors through naturalistic observation. Each participant is observed for three to six sessions, each lasting 10 minutes. During each session, the observer writes a running narrative of the participant's behavior. At the end of each session, the observer uses the DOF to rate the participant's behavior on 89 Likert-type items. Like the other measures of the ASEBA, each item loads on either the Internalizing or Externalizing scale and is further identified with a syndrome scale. The DOF is a useful observational tool because 63 of its items correspond to items on the TRF, allowing for multi-method comparisons of behavior (Achenbach & Rescorla, 2001).

To my knowledge, the DOF has not been used in previous FASD studies or in South African developmental research studies. Researchers in the United States have, however, provided evidence for the reliability of observations on the DOF, as well as for the validity of DOF scores through correlation with teacher-reported problems (Reed & Edelbrock, 1983). This observation tool was selected because the narrative provided descriptive data of the aggression displayed by each participant, while the item scores provided further evidence for aggression identified on the TRF. To ensure the reliability of the observations, two observers were present at each observation session and independently completed the DOF observation. As recommended by the DOF developers, the co-observer was a postgraduate student with a Master's level degree in psychology. In addition, she had previous research experience with schools in the Western Cape. Prior to the school observations, she was trained to use the DOF manual and given guidelines for rating DOF problem items.

Procedure

The investigators from the larger ongoing study within which this one was nested provided information regarding which schools potential participants attended. The researcher then contacted the principals of those schools and explained the purpose of the research and what would be required of the schools involved. Each school received proof of ethical

approval for the research as well as a letter informing the teachers about various aspects of the research (see Appendix E). Four of the 10 school principals indicated an interest in the research and provided permission to conduct the research at their schools.

Once the researcher obtained consent from the school principals, she contacted the class teachers of the six participants and provided them with parent consent forms, which were sent home with each child (see Appendix A). All of the children who belonged to the same classes as the target children received the form. Once the class teachers collected all of the completed parent consent forms, the school principals indicated which week would be suitable for data collection and provided both researchers with permission to be on the school property and be present during class time for that week.

Before data collection began, the researcher and co-observer studied the DOF recording and rating procedures and conducted practice observation sessions of four anonymous children with the consent of their school principals. At that time, they conducted one 10-minute observation session of each practice participant. As part of the DOF training procedure, the researcher then calculated Inter-Observer Agreement (IOA) for the four practice cases. As recommended by the DOF developers, the Percent Agreement Index was used to calculate IOA (Hintze, 2005). This method involves counting the total number of item agreements and dividing that by the total number of item agreements and disagreements. The mean IOA for the problem items rated during the four practice observations was 80.6%, while the mean IOA for on-task ratings was 92.5%. According to Hintze (2005), this is an acceptable level of IOA.

During each week of data collection, the researcher was present at the participants' school for 4 days. On the first day, she was introduced to the participant's class as a student teacher and spent several hours in the classroom with the children, ensuring they were aware of her presence. On the second day, she once again spent time with the participant's class, by attending their classes and being present at recess. The aim of her attendance on the second day was to allow the children to become accustomed to her presence and to answer any questions they had regarding her presence at the school. She also briefed the class teacher on the purpose of the research and informed them that she was blind with regard to the diagnosis of their student. After obtaining teacher consent, the researcher then administered the TRF (see Appendix A). The participants' class teachers were chosen to complete the TRF because the school principals indicated that these teachers had the most frequent contact with the participants and would, therefore, be able to provide the most descriptive and accurate account of the participants' behavior at school.

On the third day of data collection, the researcher administered the RPQ to the participant and all of his male classmates. Before the boys completed the RPQ, she administered an assent form, which explained the purpose of the questionnaire (see Appendix A). Once the boys had provided their assent, the researcher provided instructions for the questionnaire. In all schools, except for the special education school, the boys completed the questionnaire independently during class time. At that time, the researcher was available to answer any questions the children had regarding the items. The RPQ was administered individually to each boy at the special education school, as the children were unable to read the questionnaire. In order to complete the questionnaire, the boys' class teacher went through each item with each child, ensuring that they understood the question and circled the desired answer to each item accordingly. For many of the items, the boys provided appropriate examples of the behavior in question, indicating their understanding of the items. All of the children in the participants' classes received a small gift once the completed questionnaires had been collected.

Finally, on the fourth day, the researcher and co-observer conducted the observation of the participant. On that day, there were three 10-minute observation sessions, two during class time and one during recess. The type of classroom activity varied between the participants and sometimes changed within a single observation period. The observations of each participant were spread across the school day so as to obtain data from a range of interactions.

During the observation sessions, behavior observations of the target participant were conducted according to the standardized DOF procedures set out by McConaughy and Achenbach (2009). Before conducting each observation, the researcher and co-observer familiarized themselves with the DOF problem items. Once the session began, each observer independently wrote a running narrative description of the participant's behavior in 1-minute intervals, taking note of the participant's interactions with teachers and peers. In the last 5 seconds of each 1-minute interval, each observer rated the participant's behavior as being either on-task or off-task. On-task behaviors were those considered appropriate or expected within a certain situation. On-task behaviors in a classroom setting, for example, include listening to a teacher's directions, working on the assigned task, or reading off the board. Off-task behaviors were those considered counter-productive and requiring redirection, for example, doodling in a workbook, looking around the classroom, and disrupting classmates (McConaughy & Achenbach, 2009).

Immediately after completing the 10-minute observation, each observer independently rated the participant's behavior according to the 89 problem items. Each item was rated according to the presence and duration of a problem behavior. An item was rated 0 if a problem behavior was not evident during the 10-minute observation period. An item was rated 1 if a behavior had a slight or ambiguous occurrence. A problem behavior that had a definite occurrence within the 10-minute period was rated 2 or 3, depending on the intensity and duration of that behavior. Behaviors that had a moderate frequency and presented for fewer than 3 of the 10 minutes were rated 2, whereas behaviors that were present for more than 3 minutes were rated 3. The recorded narrative descriptions of behavior were used to aid in determining the duration and frequency of a behavior, and therefore the rating of the problem items. The 4-day process was repeated at each school for each participant.

Ethical Considerations

Ethical approval for this study was obtained from the UCT Psychology Department Research Ethics Committee, the UCT Faculty of Health Sciences Research Ethics Committee (reference number 250/2011; see Appendix B), the Western Cape Education Department (reference number 20110708-0021; see Appendix B), and the Wayne State University Institutional Review Board (reference number 026708B3F; see Appendix B). Informed consent was obtained from each mother at the time of recruitment into the larger study within which this one is nested. Because the aggression measures used in the current research fell outside of the larger study, parent and teacher consents were also obtained for the school observation, aggression questionnaire, and teacher reports. In addition, assent was obtained from all the participants and their classmates before the aggression questionnaire was administered. At that time, confidentiality was assured and the children were informed that their responses would be identified by unique code numbers only. The children were also informed that participation was voluntary and that they could withdraw from the research at any time without negative consequences. None of the procedures used in the current study put the children at risk of physical or psychological harm. While there were no direct benefits of participation, all of the children received a small gift for their participation.

Data Management and Statistical Analyses

Because of the descriptive and exploratory nature of this study and the small number of participants, the scope for inferential statistical analysis was limited. Descriptive statistics for the sample's sociodemographic and clinical characteristics were created using

SPSS version 20 (SPSS, 2011). Statistical analyses were performed on the DOF and TRF problem items using the ASEBA ADM software. For each of these measures, a syndrome score for aggression was calculated based on the sum of the scores on all items measuring aggression. The aggression score for each participant was then plotted on a graph developed by Achenbach and colleagues (Achenbach & Rescorla, 2001). The raw scores were then converted to percentiles following normative databases provided by the test manual. In addition, the various syndrome scores of the alcohol-exposed participants were plotted against those of the non-exposed participants, allowing for direct comparison of behavioral profiles. To ensure the reliability of the observations, inter-rater reliability was calculated, as described above, for all DOF sessions.

Because the TRF shares many of its items with the DOF, scores on items that overlapped were correlated using Pearson's correlation coefficient. Teacher and observer ratings were considered to be in strong agreement when $r > .50$. On the reactive-proactive aggression questionnaire, the scores obtained for each item were tallied, and the total score gave an indication of whether the participant displayed mainly reactive or mainly proactive aggression. The reactive, proactive, and total aggression scores of each participant were ranked in relation to their classmates, thereby allowing for comparisons of aggression in children with similar sociodemographic backgrounds.

Results and Discussion

Table 14 summarizes the sociodemographic and clinical characteristics of the six participants. Thereafter, the results of the DBD and aggression measures are presented individually for each participant. As mentioned previously, the maternal interviews and DBD were administered as part of Study 1. At that time, the participants ranged in age from 8 to 10 years. The results of the TRF, DOF, and RPQ were collected as part of the current study. At the time of this data collection, the participants ranged in age from 14 to 17 years. For each case, the maternal interview provides context within which to analyze the aggressive and other disruptive behaviors. Because of the longitudinal nature of the results, comments on aggression can be made across a period of time. In addition, the results presented below are from various perspectives (i.e., parent, teacher, observer and self-report), allowing for inspection of aggressive behaviors across social situations. To ensure confidentiality, the participants and their mothers will be identified by the letters A to F, with letters A to C referring to alcohol exposed-participants, and letters D to F referring to controls.

Table 14.

Study 2 Participant Sociodemographic and Clinical Characteristics

Measure	Exposed			Non-Exposed		
	A	B	C	D	E	F
FASD diagnosis ^a	FAS	FAS	ME	Control	Control	Control
Age at observation	17.0	14.5	16.4	16.9	17.3	14.5
School grade ^b	9	Senior	10	9	11	8
WISC IQ score ^c	58.1	51.9	78.2	73.9	88.6	90.4

Note. ^aME refers to moderate exposure to alcohol during pregnancy, ^bChild B attended a special education school which places children into either junior or senior classes according to age, ^cBased on seven WISC-III subtests and Matrix Reasoning from the WISC-IV

Child A

At the time of recruitment into the larger study (i.e., January 2006, approximately 6 years before the data collection specific to the current study), Mother A was interviewed regarding Child A's development, their family and living situation, and her alcohol and drug use history. Mother A separated from Child A's father 5 years prior to the interview, when Child A was 5 years old. His father worked as a taxi driver and had 3 years of education. After separating, Child A's father no longer assumed a parenting role. Mother A was unemployed at the time of the interview, and had not worked in the previous 12 months. As a result, she received a monthly childcare grant for her four children, amounting to R540 per month. Mother A had completed 10 years of formal education.

Regarding Mother A's alcohol history, she reported first drinking at the age of 19. Her last drink was 12 months prior to the interview. She reported abstaining from alcohol and cigarettes since 2004, when she was converted at her local church. Prior to abstaining, Mother A reported drinking frequently on weekends, but never during the week. She reported that over a typical weekend, she shared 18 liters of beer on a Friday evening with three other individuals, followed by 27 liters throughout Saturday, and 9 liters on Sunday. She reported consuming alcohol as described above on a weekly basis. Mother A reported that she had consumed similar amounts of alcohol as described above while she was pregnant with her first child. In addition, she reported that her heaviest drinking period had been when she was 25 years old and pregnant with Child A. When converted into oz of absolute alcohol (AA), Mother A reported consuming 2.17 oz AA on an average day, and 7.16 oz AA on a drinking day throughout the pregnancy. Based on this report, Mother A was classified as drinking

heavily during pregnancy. Following recruitment, Child A was examined by two dysmorphologists, as described in Study 1. They diagnosed Child A with FAS.

When asked about her living situation, Mother A reported that she and her four children lived in a wooden cottage at the back of a relative's property. Their home consisted of three rooms, only one of which was a sleeping area. Their home did not have running water or an inside toilet. Because of her limited monthly income, Mother A reported that she and her children regularly went without meals for entire days. Mother A's socioeconomic status was calculated using the Hollingshead's Scale of Social Class (Hollingshead, 1975). Based on her report, she received a score of 18, which places her in the category of unskilled laborer.

Mother A reported no complications during her pregnancy or during the birth of Child A, and stated that he experienced no delays in reaching developmental milestones. The only medical history of note was a head injury, which took place when Child A was 9 years old. Mother A reported that at the time of the incident, Child A was involved in a fight with another child, who threw a brick at his head. Child A was taken to a local day hospital for examination. A CT brain scan conducted at that hospital was normal. In addition, Mother A reported that Child A did not lose consciousness after being struck by the brick.

At the time of the maternal interview, Child A was in grade 5 at a government-run school. He had not repeated any grades. Mother A reported that Child A was often hyperactive at home. In addition, she reported that his mood often fluctuated and that he became very angry and fought with his siblings regularly. Such behaviors were reiterated in her ratings of the problem behaviors on the DBD. Child A was not on any medication at the time of the maternal interview and at the time the DBD report was completed.

Results from the maternal and teacher DBD rating scales are presented in Table 15. For each listed disorder, the number of reported symptoms was totaled for both the maternal and teacher reports. Together the reports determined whether the participant's behavior met the DSM-III-R criteria for that disorder.

Table 15.

Child A: Disruptive Behavior Disorder Diagnoses

DSM-III-R Disorder	Met Diagnostic Criteria
Inattentive-ADHD	No
Hyperactive-ADHD	Borderline
Combined-ADHD	Borderline
Oppositional Defiant Disorder	Yes
Conduct Disorder	Yes

Note . DSM-III-R = Diagnostic and Statistical Manual of Mental Disorders (APA, 1987)

The maternal and teacher DBD rating scales were administered when Child A was 10 years old (i.e., in 2006, during the same month as the maternal interview). On items assessing inattention, Mother A reported insufficient symptoms to warrant a diagnosis of inattentive-type ADHD. Her report of hyperactivity resulted in a diagnosis of borderline hyperactive-type ADHD, as well as borderline combined-type ADHD. In contrast, scores on items measuring oppositional defiant- and conduct disorder-like behaviors resulted in diagnoses of both ODD and CD. Interestingly, these diagnoses were based on maternal behavior reports only, as Child A's teacher reported no disruptive behaviors at school. Of the reported CD symptoms, most fell within the category of aggression to people and animals. For example, Mother A reported that Child A was very often physically cruel to animals. In addition, she reported that he often initiated fights with people living outside of the household and sometimes bullied, threatened, or intimidated others.

While the maternal interview was being conducted, Child A completed seven WISC-III subtests and the WISC-IV Matrix Reasoning subtest. After applying the summing and norming procedures outlined in Study 1, Child A's Full Scale IQ was estimated to be 58.

As part of the current study, the TRF was administered in order to obtain a more recent teacher report of behavior. At the time of administration of the TRF, Child A had just turned 17 and was in the grade 8 at a local government-run high school. Child A was older than most of his classmates because he had repeated several grades at primary school level. The purpose of the measure was to determine Child A's current level of functioning and problem behaviors at school, and in particular aggressive behaviors. In addition, the measure allowed for comparison with previous behavior reports, thereby enabling the researcher to track the progression of Child A's behavior

Based on his interactions with and knowledge of Child A's abilities, Teacher A reported that Child A's academic performance was within the normal range for boys aged 12 to 18. However, his adaptive functioning (i.e., overall behavior and mood) was very poor compared to his classmates, and fell within the clinical range (a score below the 10th percentile) when compared to the standardized norms for boys his age. In addition, the results of the TRF problem items illustrate the severity of behaviors within specific syndromes. Figure 1 presents the results of the syndrome scales for Child A.

Child A fell within the normal range for boys aged 12-18 on all scales, with the exception of attention problems. Despite most of his scores falling within the normal range, Child A displayed rule-breaking behaviors and aggression more frequently than most boys his age, as reflected by percentile scores of 73 and 81, respectively, on those scales. In terms of aggression, Teacher A reported defiant and disobedient behavior; however, he did not report any physical aggression or bullying and meanness toward others. Overall, Child A's TRF Total Problem score was in the borderline clinical range (89th percentile).

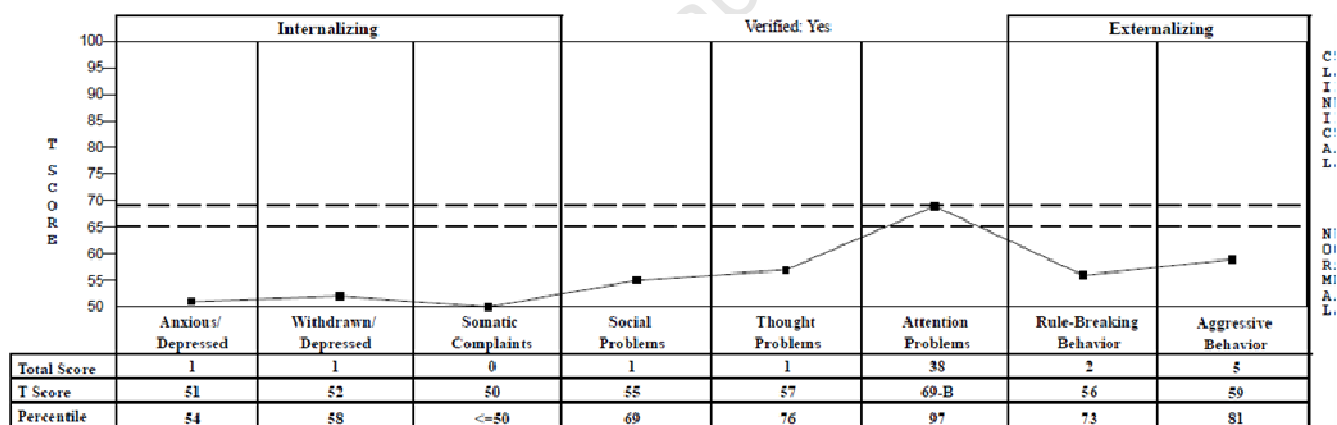


Figure 1. Teacher Report Form syndrome scale scores for Child A (age 17).

When the syndrome scores depicted above were considered in relation to DSM-IV criteria for disruptive behavior disorders, behaviors associated with ODD and CD fell within the normal range, although Child A's scores were higher than most boys his age for both disorders (see Figure 2). In contrast, Child A's score on the ADHD-oriented scale fell within the clinical range (above the 97th percentile). Aggression was not a predominant feature of Child A's behavior at school. These findings contrast with the maternal DBD report made 7 years prior. However, the teacher DBD report yielded no significant findings. It is, therefore, possible that Child A's disruptive and aggressive behaviors were displayed

predominantly in his home environment, while attention problems have become increasingly prevalent at school.

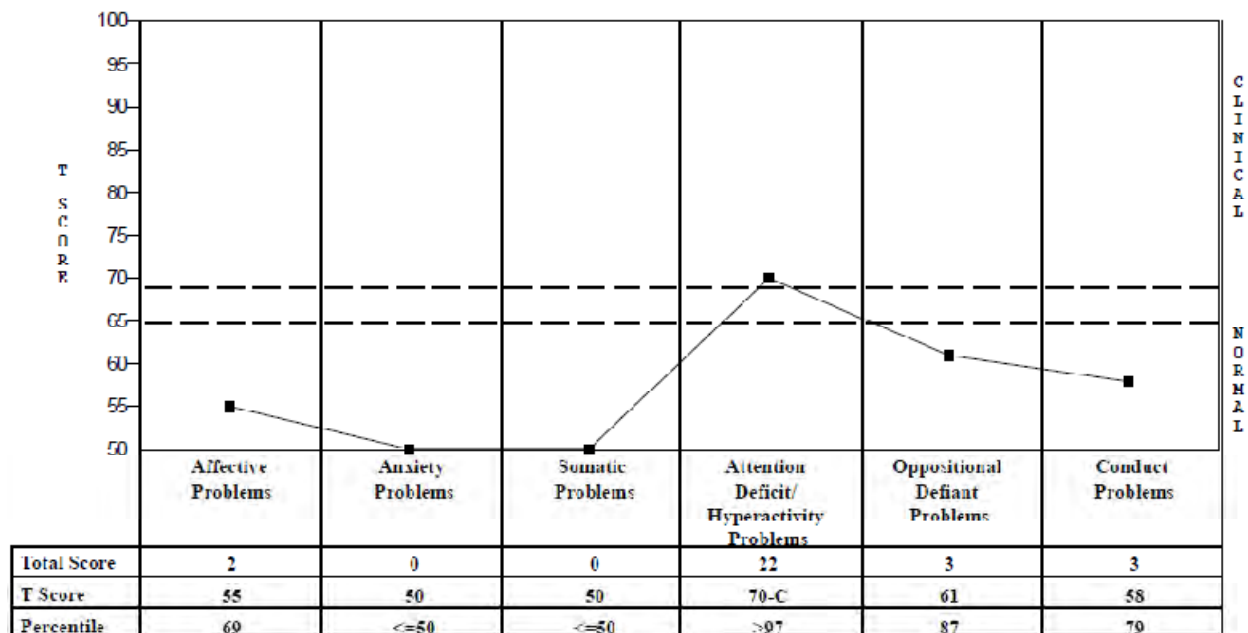


Figure 2. Teacher Report Form DSM-oriented scale scores for Child A (age 17).

In order to further assess Child A's behavior, and in particular his interaction with peers, he was observed over the three 10-minute sessions described above. The results of the two classroom observations yielded no significant findings in any domain. Although falling within the normal range, the problem behaviors most frequently observed were oppositional in nature (76th percentile; see Figure 3). A significant level of agreement ($p < 0.001$) was found between the observers' ratings of classroom behaviors during both classroom observations, with resulting correlation coefficients of $r = .81$ and $r = 1.00$, respectively. In addition to these findings, the recess observation session indicated no problem behaviors in a less structured environment; importantly, no aggressive behaviors were observed. A significant level of agreement ($p < 0.001$) was found between the observers' ratings of recess behaviors, $r = .70$.

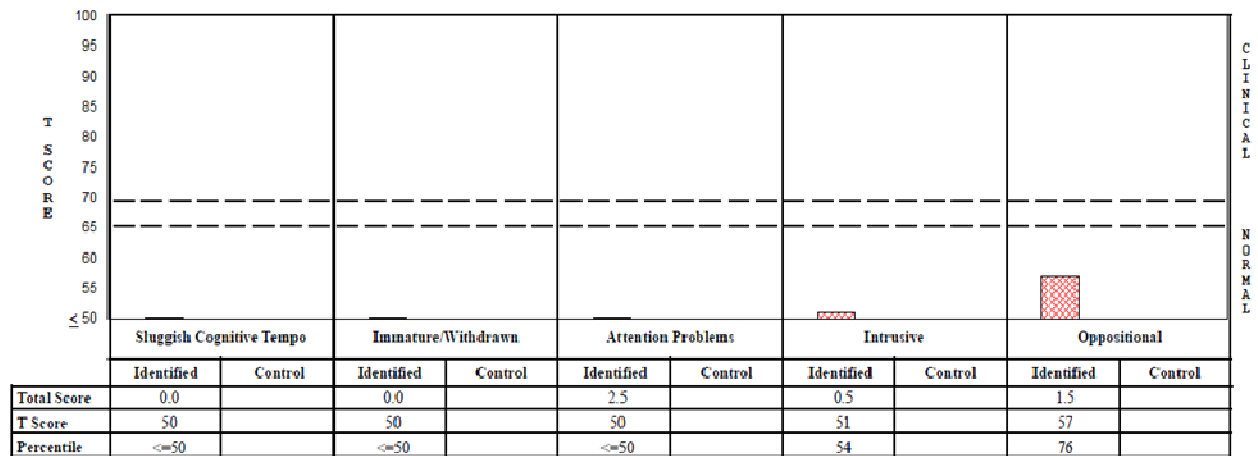


Figure 3. DOF classroom observations of Child A (age 17).

As mentioned previously, the DOF shares 63 items with the TRF, allowing for comparison of the behavior profiles. The ratings of the shared items on the two measures were correlated using Pearson's correlation coefficient. The correlation between the DOF and TRF shared items was highly significant, indicating a high degree of similarity between the behaviors reported by Child A's teacher and those observed by the aggression researchers, $r = .34, p = .01$.

All of the data reported above regarding Child A's aggressive behavior were provided by observers. As part of the current data, Child A completed a self-report measure of aggression. The purpose of this measure was to gain insight into the motivation behind his aggressive behavior, and to compare his self-reported behavior to that reported by others (i.e., his teacher and the aggression researchers). The RPQ was administered to Child A and all of his male classmates ($N = 18$). The 23-item questionnaire yields a total possible score of 22 for reactive items and a total possible score of 24 for proactive items. Child A obtained a score of 11 on items measuring reactive aggression and a score of 12 on items measuring proactive aggression. For most items, Child A indicated performing the respective aggressive act "sometimes." However, the behaviors acknowledged performing "often" were predominantly proactive in nature. For example, he indicated that he often fought with others to show who was on top. Similarly, he often got involved in gang fights in order to appear "cool," and indicated that he frequently shouted at others in order to get his way.

Child A's reactive aggressive score was similar to the mean reactive score of his peers ($M = 10.94, SD = 3.73$). In contrast, his proactive aggression score was higher than the class mean ($M = 8.50, SD = 4.97$). When the reactive and proactive scores of each boy were

ranked, Child A obtained the sixth-highest reactive aggression score and fourth-highest proactive aggression score.

The results of the RPQ suggest that Child A displays both reactive and proactive aggression. His report of more frequent proactive behaviors is in keeping with his comorbid diagnoses of ODD and CD. However, Child A's aggression cannot be described as predominantly proactive, as he scored similarly on items of reactive aggression. This finding suggests that, in addition to the aggression associated with his comorbid diagnoses, other variables (e.g., lowered general intelligence and contextual factors) might be contributing to a defensive and frustration-based form of aggression.

Child B

At the time of the maternal interview (August, 2006), Mother B lived on a farm outside of Cape Town with her three children. She was separated from Child B's father, who continued to live on the farm after their separation. Despite their close contact, he did not support his children financially or continue to assume parenting responsibilities. Mother B was recently unemployed, but had previously worked at a nearby farm stall, where she helped prepare food. Because Mother B received no financial support from her ex-partner, she received a monthly government childcare grant for two of her children, amounting to R380 per month.

Regarding Mother B's alcohol history, she reported first drinking at the age of 19 and consuming alcohol regularly until 7 months prior to the interview. The reason for her abstaining from alcohol was unclear. In the time since Child B's birth (28 September 1997), Mother B drank regularly and heavily on weekends, but abstained during the week. On a typical weekend, she reported consuming beer with one other individual, and reported that she would generally share 6 liters of beer on a Friday evening, 13.5 liters on a Saturday, and 4.5 liters on a Sunday. She confirmed that she drank similarly while she was pregnant with her first two children. Mother B reported that the period during which she drank the heaviest was when she was 23 years old and pregnant with Child B. When converted into oz AA, she reported consuming 2.50 oz AA on an average day and 5.90 oz AA on a drinking day throughout the pregnancy. Based on Mother B's report of maternal drinking in conjunction with examination by two dysmorphologists, Child B was diagnosed with FAS.

In terms of her living situation at the time of the interview, Mother B and her children lived in a farm "shack" that consisted of one room partitioned into a kitchen and sleeping area. Their home did not have electricity, running water, or an inside toilet. Using the

Hollingshead Scale of Social Class, Mother B and her nuclear family had a social class score of 16, placing them in the category of unskilled laborer.

At the time of the maternal interview, Child B was 9 years old. When asked about Child B's developmental history, Mother B reported being physically abused by her partner during pregnancy. At birth, Child B had a low birth weight and jaundice. Mother B worried that the abuse she had suffered during pregnancy had affected her child permanently. At the time of the interview, Child B was in grade 2 at a government-run school. He was, however, repeating the grade, as his teacher felt he was not ready to progress to grade 3. His teacher also reported that Child B was very inattentive and hyperactive in class, and was rude to teachers and peers. The following year, Child B was transferred to a special needs school after he was found to have hearing difficulties. Child B's academic difficulties at a young age can most likely be accounted for by his impaired general intellectual ability, as he obtained a WISC Full Scale IQ score of 52.

Other history of note includes two head injuries: One at the age of 2, and the other at age of 5. The first incident involved a neighbor accidentally hitting Child B on the head with a hammer. Although some details surrounding the incident remain unclear, Child B was taken to a nearby hospital. There, he underwent a CT brain scan, which was unremarkable. The second incident involved Child B being hit by a car while playing in the road. Again, he was taken to hospital but suffered only minor abrasions and no loss of consciousness.

When asked about Child B's mood and personality at home, Mother B described him as a "wild" child whose mood fluctuates constantly. She reported that he got bored and irritable very easily. She also reported that he was frequently physically and verbally bullied by peers at school, and as a result, was tearful at home. In addition, she stated that Child B was often aggressive toward her and toward his siblings.

The maternal reports of Child B's hyperactivity, irritability, and aggressive behavior at home were corroborated by Child B's teacher, via the DBD. Based on both the maternal and teacher DBD results, Child B met the clinical criteria for all five disruptive behavior disorders. In each case, the number of symptoms reported far exceeded the minimum number of symptoms required for that diagnosis.

Table 16.

Child B: Disruptive Behavior Disorder Diagnoses

DSM-III-R Disorder	Met Diagnostic Criteria
Inattentive-ADHD	Yes
Hyperactive-ADHD	Yes
Combined-ADHD	Yes
Oppositional Defiant Disorder	Yes
Conduct Disorder	Yes

Note. DSM-III-R = Diagnostic and Statistical Manual of Mental Disorders (APA, 1987)

Problem behaviors that were reported by both Child B's mother and teacher included engaging in dangerous activities without considering the consequences, initiating fights with people outside of the household, bullying, threatening, or intimidating others, and being physically cruel to animals. Such behaviors were described as occurring frequently. For certain items Mother B provided examples of problem behaviors. For instance, she reported that Child B had once purposefully set his grandmother's bed alight and had, on more than one occasion, deliberately tortured their neighbor's chickens. In addition, in response to the item "is often angry or resentful", she described Child B as having revenge in him.

To obtain a more recent description of Child B's behavior at school, the TRF was administered to Child B's class teacher in March, 2012. At the time, Child B was 14 years old and attending a special needs school. Teacher B explained that Child B's academic capabilities exceeded that of most of his classmates, who were predominantly severely intellectually impaired. However, despite this fact, she indicated that Child B was behaving less appropriately than the other boys in his class. Based on Teacher B's ratings on the TRF problem items, Child B obtained a Total Problem score in the clinical range (a score above the 90th percentile for boys aged 12 to 18 years). When I examined the nature of his problem behaviors, it was evident that the majority of his behaviors were characterized as being externalizing in nature.

Figure 4 presents the results of the various syndrome scores. Child B fell within the normal range for boys aged 12 to 18 years on items measuring mood, somatic complaints, social problems, and thought disorders. In contrast, his score on the attention problem syndrome was in the clinical range (i.e., above the 97th percentile). On items measuring aggressive behavior, Child B obtained a score in the borderline clinical range (93rd to

97th percentile). Aggressive items that Teacher B rated as being very true referred to acts of cruelty, bullying, or meanness to others, as well as teasing behavior. While completing the TRF, Teacher B provided an example of Child B's aggressive behavior. She explained how another student at the school, who is severely physically disabled, had recently received a new walker that enabled him greater mobility. The day after the child received his new walker, Teacher B witnessed Child B intentionally obstructing that child's path so he would trip and fall to the ground. Teacher B described this act as being planned and having malicious intent.

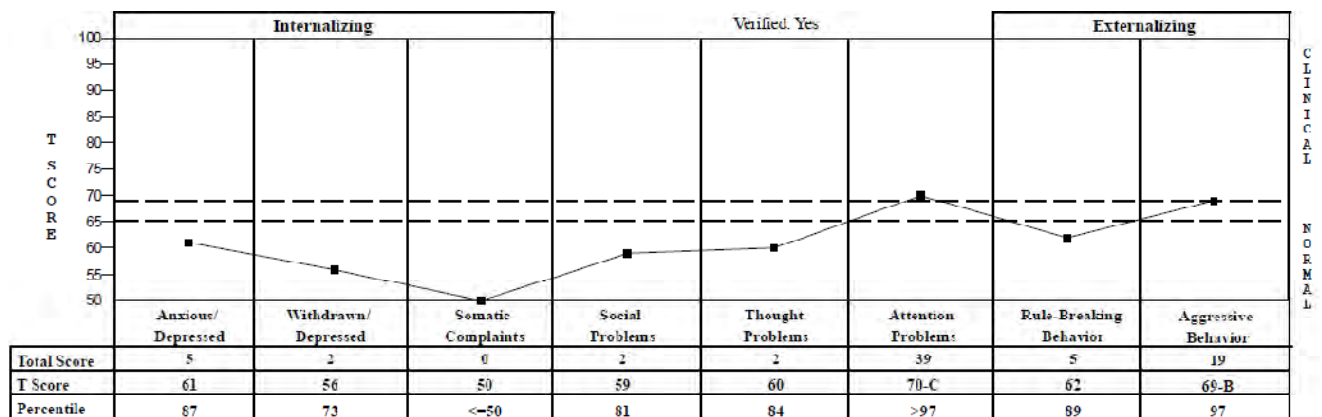


Figure 4. Teacher Report Form syndrome scale scores for Child B (age 14).

In addition to aggressive behavior, Teacher B reported frequent rule-breaking behaviors (e.g., lying, cheating, and swearing). When the aggressive and rule-breaking behaviors were considered in relation to DSM-IV criteria for disruptive behavior disorders, the results indicated that Child B scored in the borderline clinical range on ODD and CD problem scales (see Figure 5). In addition, Child B's score on the ADHD problem scale was in the clinical range. These findings are in keeping with the DBD results collected previously, suggesting that Child B's behavior presentation remained constant over time (from age 9 to 14, with reports collected in 2006 and 2012).

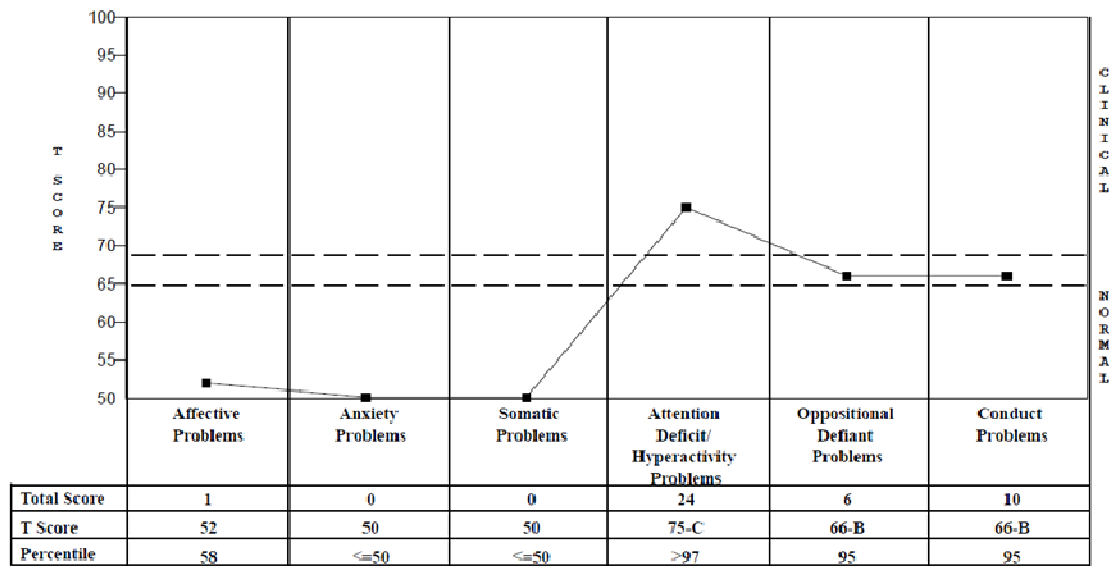


Figure 5. Teacher Report Form DSM-oriented scale scores for Child B (age 14).

In keeping with the teacher report of oppositional behavior, the two aggression researchers observed predominantly immature and oppositional behavior in class. Immaturity / withdrawal was the only observed behavior that warranted clinical concern (borderline), according to the DOF syndrome scale scores. Although falling within the normal range, Child B obtained a percentile score of 84 for observed oppositional behavior, suggesting that defiance is a prominent feature of his behavior. For example, the researchers noted that Child B taunted the boy next to him by pretending to kick him. In contrast to the DBD and TRF results, inattention was not observed frequently during the classroom observation sessions. Figure 6 presents the results of the DOF syndrome scales.

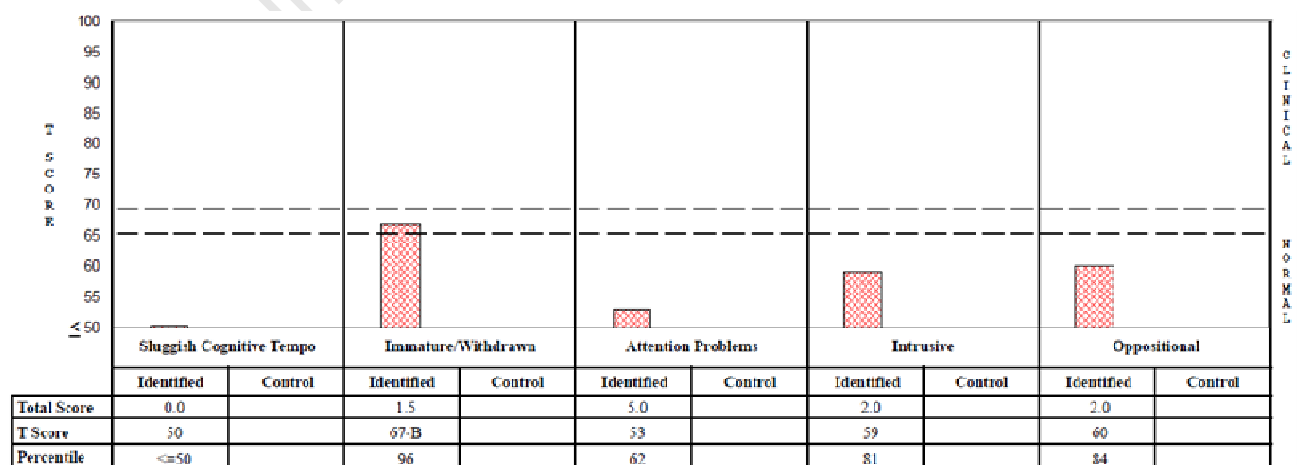


Figure 6. DOF classroom observations of Child B (age 14).

During the recess observation session, Child B displayed no overt acts of aggression toward his peers. As a result, his aggressive behavior score fell within the normal range. His Total Problem score fell within the clinical range, however, based on observations of bragging behaviors, showing off, and distractibility.

For all three observation sessions, the problem item ratings of both observers were in agreement at the level of $p < 0.001$. The inter-rater reliability of the two classroom observations was $r = .76$ and $r = .84$, respectively. Similarly, the inter-rater reliability of the recess observations was $r = .81$. Furthermore, there was a moderate correlation between the teacher and observer reports of Child B's behavior, $r = .54$, $p < 0.001$.

The behavior reports of Child B's mother, teachers, and the aggression researchers indicated that Child B presented with a wide range of disruptive behaviors that are associated with diagnoses of ADHD, ODD and CD. The RPQ was administered to Child B in order to determine the nature of his aggressive behaviors through self-report. As mentioned previously, Child B attended a special needs school. As a result, his class size was very small; therefore, the RPQ was administered to Child B and his three male classmates only. None of the four boys were literate, and therefore the RPQ was administered orally. The participants then indicated their responses to each item orally. Interestingly, the four participants at the special needs school obtained the highest reactive and proactive aggression scores amongst all the participants, across all schools, who completed the questionnaire.

On items measuring reactive aggression, Child B obtained a score of 18 out of a possible 22. Similarly, he scored 19 out of 24 on items measuring proactive aggression. These results suggest a marked prevalence of self-reported aggressive behavior, which is characterized as being both reactive and proactive in nature. When examining the items that he rated as "often", there was no preference for reactive or proactive behaviors. Child B reported very similar patterns of aggression to his male classmates, who obtained a mean reactive score of 17.50 ($SD = 1.29$), and a mean proactive score of 18.00 ($SD = 3.16$). This finding was in contrast to the teacher report, as she described Child B as being more aggressive than his classmates. On both measures, Child B obtained the second-highest scores of the four participants.

The self-reported proactive aggression is in keeping with Child B's comorbid diagnoses of ADHD, ODD, and CD, all of which have been reported to result in intentional and malicious aggression. However, Child B also reported engaging in reactive acts of aggression, suggesting that other variables might be contributing to his aggressive tendencies.

Child C

At the time of the maternal interview (February, 2006), Mother C was 29 years old and had four children, of whom Child C was the second eldest. Mother C reported leaving school in grade 8, and having her first child soon thereafter. She was unmarried at the time of the interview, and had been unemployed for 12 months. She received some financial support from Child C's father, as well as from a government childcare grant.

Mother C reported first drinking at the age of 15. She described drinking regularly on weekends and had last consumed alcohol the day prior to the interview. On a typical weekend, Mother C drank socially with four to five other adults, and would share 18 liters of beer per day. Unlike most mothers in the cohort, who were recruited based on their reports of heavy drinking, Mother C was drinking moderately while pregnant with Child C. On an average day, she consumed 0.18 oz AA; she consumed 1.27 oz AA on a drinking day throughout pregnancy. Following recruitment, Child C was examined by the two dysmorphologists, and was considered to be moderately exposed and non-syndromal.

Of the six mothers in this study, Mother C had the lowest social class rating at the time of recruitment, as evinced by a Hollingshead social class score of 11. At the time of rating, she lived in a four-room council home. Despite having electricity and running water, the home was shared by Mother C, her four children, and their extended family. As a result, up to 30 individuals slept in her home regularly.

At the time of the interview, Child C was in grade 5 at a local primary school. Mother C reported that he was doing well at school, and had not repeated any grades. In addition, she stated that his teachers had not reported any behavioral or learning problems, and they had noted no difficulties socializing with peers. While Mother C provided this information, Child C completed the WISC-III subtests, and obtained a Full Scale IQ score of 78.

In contrast to Mother C's behavior report during the maternal interview, the DBD reports (completed in February 2006) indicated that Child C was presenting with certain problem behaviors that could be characterized by inattention and defiance. Such behaviors presented predominantly in the school environment. Based on the DBD reports, Child C was diagnosed with borderline inattentive-type ADHD, borderline combined-type ADHD, and ODD (see Table 17). Child C's teacher described him as being angry and resentful and reported that he often annoyed his peers deliberately.

Table 17.

Child C: Disruptive Behavior Disorder Diagnoses

DSM-III-R Disorder	Met Diagnostic Criteria
Inattentive-ADHD	Borderline
Hyperactive-ADHD	No
Combined-ADHD	Borderline
Oppositional Defiant Disorder	Yes
Conduct Disorder	No

Note. DSM-III-R = Diagnostic and Statistical Manual of Mental Disorders (APA, 1987)

As part of the current data collection, Child C's class teacher completed the TRF. At the time, Child C was 16 years old. Teacher C reported that Child C's academic performance was poor in comparison to his classmates. As a result, Child C's academic performance score was in the borderline clinical range for boys aged 12 to 18. Teacher C also reported, however, that Child C behaved appropriately at school. On the TRF problem scales, Child C scored in the normal range for boys his age in terms of externalizing and internalizing behaviors. In addition, he scored within the normal range on all syndrome scales (see Figure 7).

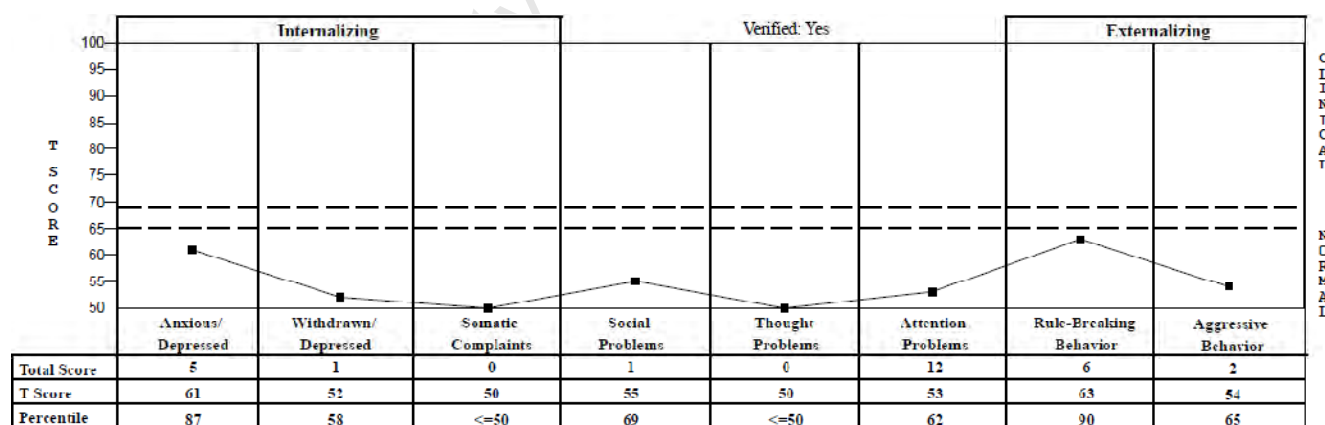


Figure 7. Teacher Report Form syndrome scale scores for Child C (age 16).

The syndromes in which Child C obtained the highest scores were anxiety/ depression and rule-breaking behaviors. In terms of rule breaking, Teacher C reported that Child C frequently attended roll call in the morning and then “jumped the fence” before class began. She stated that he had become involved with a local gang, members of which encouraged him to leave school. She also reported that he believed he had outgrown school. Child C's

aggressive behaviors at school were not frequent enough to warrant clinical concern, however.

When Child C's behavior at school was considered in relation to DSM-IV criteria for disruptive behavior disorders, the results indicated that his behavior was not in keeping with such disorders. His percentile scores for ODD- and CD-type behaviors were higher than most boys his age, however. When analyzed in relation to his DBD diagnoses, it appears that Child C has continued, over the past 6 years, to present with ODD-type behaviors. These are no longer perceived to be of clinical concern, however, and he has developed more CD-type tendencies with age. Despite his CD-type behaviors, aggression is not a predominant feature of his behavior profile at school.

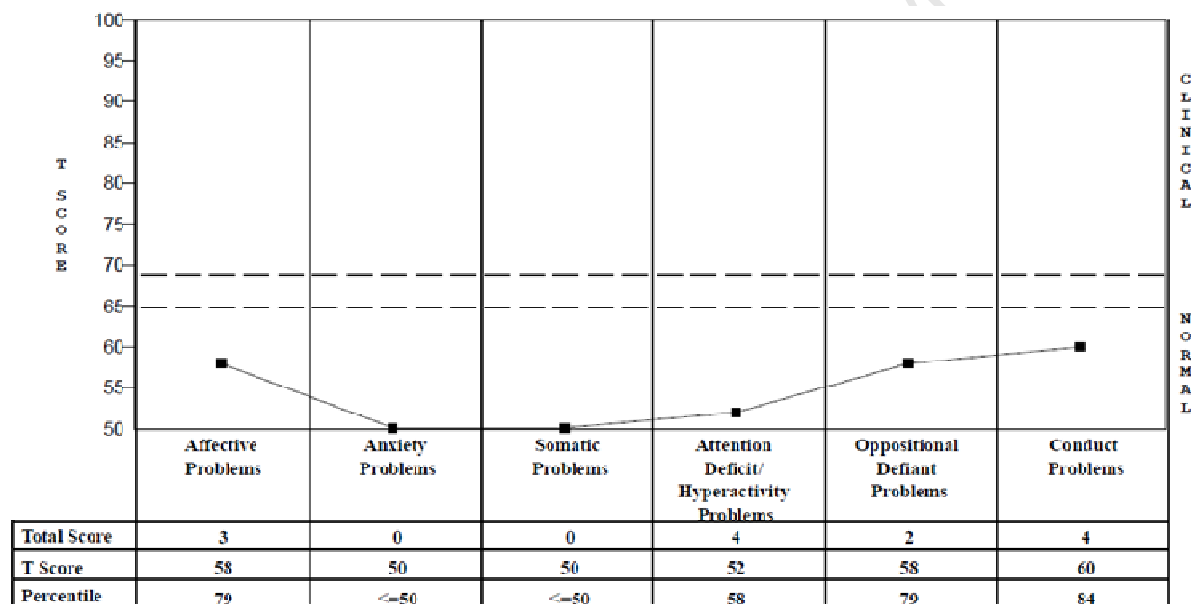


Figure 8. Teacher Report Form DSM-oriented scale scores for Child C (age 16).

The results of the behavior observation of Child C were in keeping with the TRF results. As such, a significant correlation existed between the DOF and TRF shared items, $r = .27, p = .04$. During the two classroom observation sessions, the aggression researchers observed no clinically relevant problem behaviors (see Figure 9). They did report a sluggish cognitive tempo and some oppositional behavior, however. Both findings are in keeping with Teacher C's report of Child C's disinterest in school work and lack of desire to attend to school.

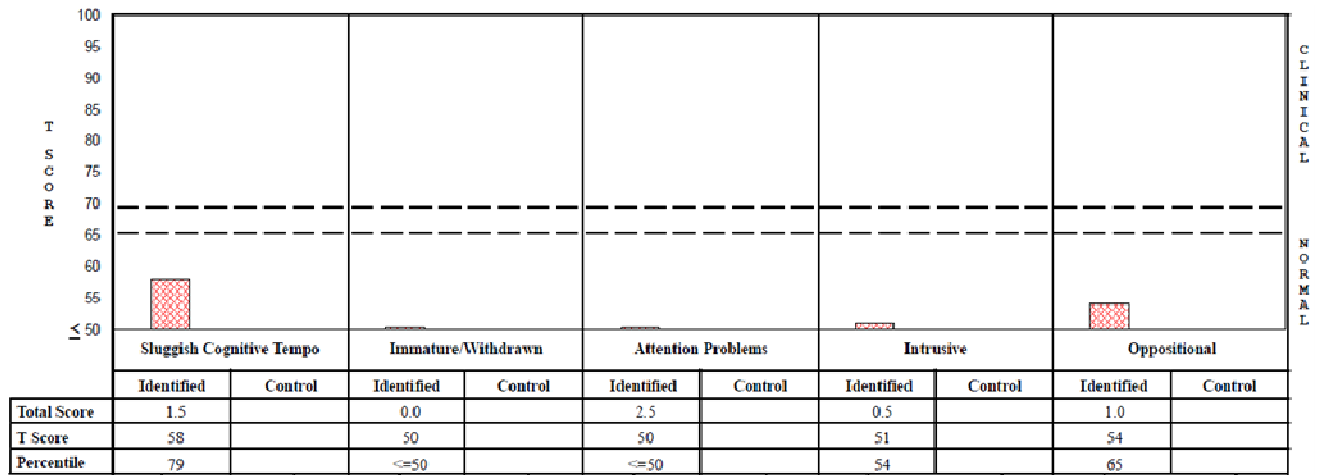


Figure 9. DOF classroom observations of Child C (age 16).

During the recess observation session, the researchers observed no overt acts of aggression. In addition, no significant ODD- or CD-type behaviors were observed, except for smoking, which is against school rules. For all three DOF observation sessions of Child C, the inter-rater reliability of the observations was significant at the level of $p < 0.001$. The Pearson correlation co-efficient for the two classroom observations was $r = .77$ and $r = .70$, respectively, and the correlation between the observers' recess ratings was $r = .62$.

On the proposed day of administration of the RPQ, Child C was absent from school. His class teacher reported that he had once again “jumped the fence.” When Child C and his male classmates ($N = 17$) complete the questionnaire, he provided little self-report of aggression. He obtained a reactive aggression score of 13.0 out of a possible 22, and a proactive aggression score of 9.0 out of 24. These results suggest a slight preference for reactive aggression. Upon inspection of the individual items, all items rated as occurring “often” were reactive in nature. In contrast, all items rated as “never” occurring were proactive in nature. Child C's self-reported aggression was similar to that of his male classmates, who obtained a mean reactive aggression score of 12.06 ($SD = 3.36$) and a mean proactive aggression score of 7.47 ($SD = 4.46$). When his scores were ranked in relation to those of his peers, he was rated as the sixth most aggressive on both measures. Like Child C, all of his male classmates reported a preference for reactive over proactive acts of aggression.

In summary, the results of the RPQ indicate that Child C is not markedly aggressive in comparison to children from similar sociodemographic backgrounds. When Child C does display aggression, it is most often reactive in nature. This finding is in contrast with the expected presentation of comorbid diagnoses of ODD, borderline ADHD, and some CD-type behaviors.

Child D

Mother D had been recruited as a control for the prospective longitudinal study described in Study 1. At the time of recruitment in 2005, she was 30 years old, had given birth to four children, of whom Child D was the eldest. Mother D had no history of alcohol use. Child D was, therefore, recruited into the study as a non-exposed control.

At the time of the maternal interview, Mother D was married and living with her husband and their four children. She was unemployed, but had worked previously as a cleaner at a nearby clothing factory. She began working after she left school at the end of grade 9. Similarly, her husband had completed 9 years of formal education before beginning work as laborer at the Cape Town harbor.

Mother D and her family lived in a government-provided council house. She described their living conditions as confined; the four children shared one small bedroom. Based on her report, Mother D and her family obtained a social class score of 14 on the Hollingshead scale, which placed them in the category of unskilled laborer.

Mother D reported no complications while pregnant with Child D, and no significant medical history for the child. At the time of recruitment, Child D was in grade 4 at a local primary school. Mother D reported that he was struggling at school and had been placed recently in a learning support class for mathematics and literacy. In addition to learning difficulties, Child D's teacher had reported to Mother D that he was very hyperactive in class and that he struggled to remain focused during lessons. Neuropsychological testing, conducted as part of the larger study during May 2005, revealed that Child D had a WISC Full Scale IQ of 74. This result was somewhat unexpected considering his unremarkable medical history and his lack of exposure to any substances prenatally.

The behavior problems described in the maternal interview were reiterated in the teacher and parent DBD reports, which were completed during May 2005. At that time, Child D was 10 years old. Both reports indicated that Child D's problem behaviors were characterized predominantly by inattention and hyperactivity. As a result, he met the clinical criteria for ADHD. Child D's teacher reported several oppositional behaviors, although not sufficient to warrant clinical concern. Similarly, she reported that he sometimes bullied and initiated fights with other children. Mother D reported no such behaviors, however. Hence, Child D's behavior did not meet the criteria for a diagnosis of CD.

Table 18.

Child D: Disruptive Behavior Disorder Diagnoses

DSM-III-R Disorder	Met Diagnostic Criteria
Inattentive-ADHD	Yes
Hyperactive-ADHD	Yes
Combined-ADHD	Yes
Oppositional Defiant Disorder	Borderline
Conduct Disorder	No

Note . DSM-III-R = Diagnostic and Statistical Manual of Mental Disorders (APA, 1987)

Child D's teacher completed the TRF 6 years after initial recruitment, in March 2012, when Child D was almost 17 years old. At the time, he was repeating grade 9. Teacher D described having frequent contact with Child D in his capacity as both a teacher and as a member of the school disciplinary board. Before completing the questionnaire, Teacher D reported that Child D was frequently in trouble at school, particularly for his misbehavior in class and on the sports fields. He described Child D as being explosive, with an uncontrollable temper. In keeping with this informal description, Teacher D noted several areas of problem behaviors on the TRF, almost all of which warranted clinical or borderline clinical concern. Figure 10 illustrates the widespread behavior problems displayed by Child D at school. Overall, his Total Problem score was above the 98th percentile, and indicated an equal and marked prevalence of internalizing and externalizing problems. Importantly, Child D scored within the clinical range for aggressive behavior. In terms of aggression, Teacher D reported explosive behavior, a hot temper, and a tendency to tease and bully others. In addition, he reported that Child D was involved in fights frequently.

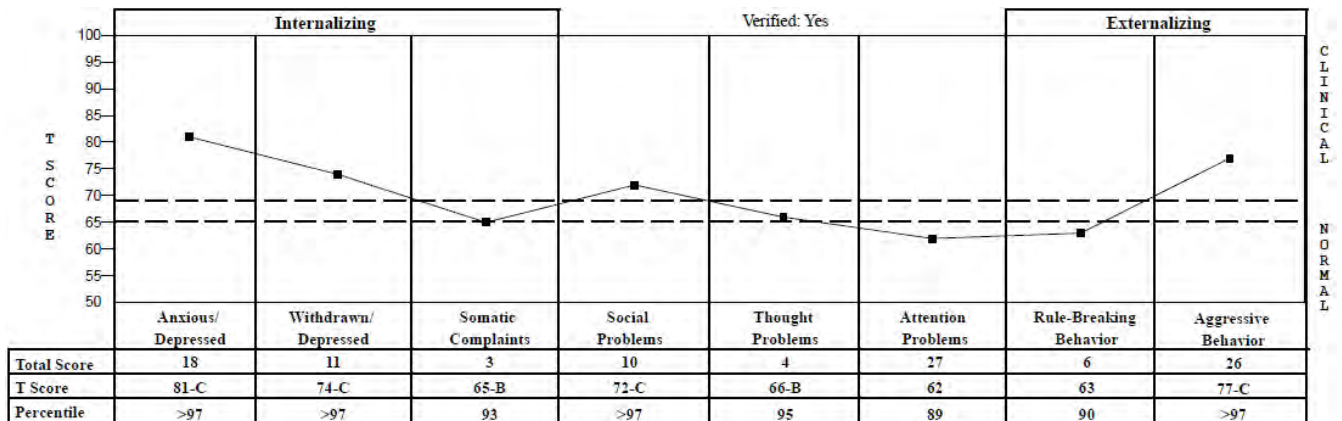


Figure 10. Teacher Report Form syndrome scale scores for Child D (age 16).

When the problem behaviors were considered in relation to DSM-IV criteria for disruptive behavior disorders, Child D's attention and hyperactivity problems fell within the borderline clinical range, suggesting that such behaviors remained a constant feature of his behavioral presentation across the time period when data for him were collected. His oppositional behaviors were in keeping with a clinical diagnosis of ODD, suggesting that such behaviors have too remained a significant feature of his presentation. As with the DBD results, Child D's behavior at the age of 16 was not in keeping with a diagnosis of CD. In addition to the DBD-related diagnoses, Child D presented with clinically significant behaviors in the spheres of affective and anxiety disorders. Figure 11 presents the DSM-oriented profile of Child D.

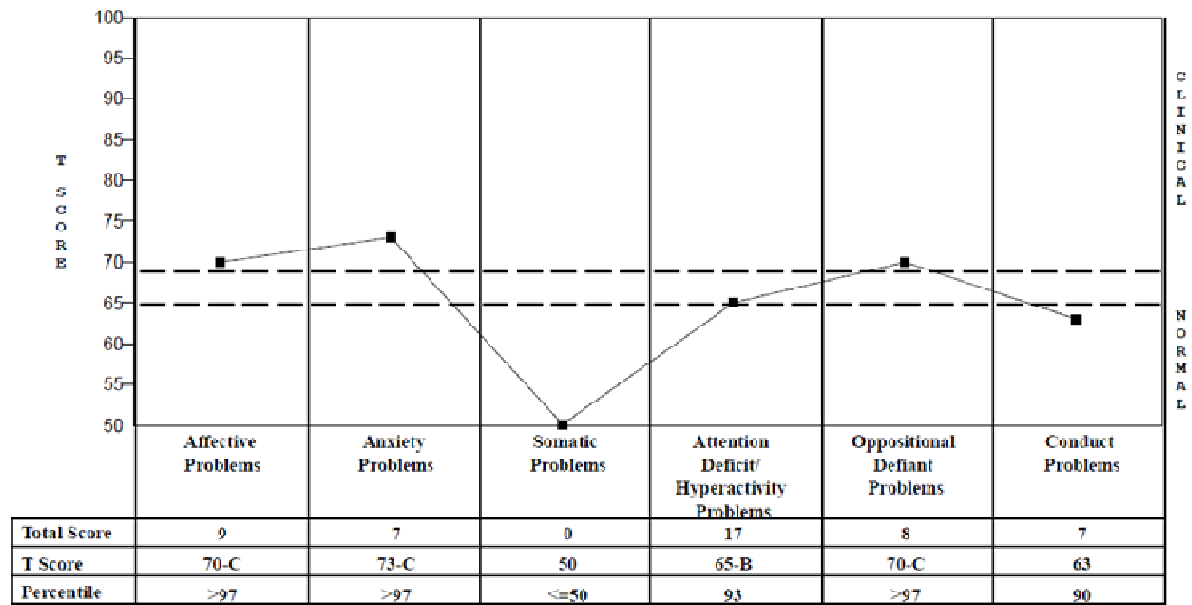


Figure 11. Teacher Report Form DSM-oriented scale scores for Child D (age 16).

In contrast to the DBD and TRF results, the classroom behavior observation sessions yielded no significant findings in any sphere of Child D's behavior. Figure 12 illustrates this fact. As a result, there was no significant correlation between the ratings of the shared items on the DOF and TRF, $r = .21$, $p = .10$. The only syndrome scale on which Child D scored substantially above the 50th percentile was oppositional behavior. Similarly, during the recess observation session, neither research observed any problem behaviors or acts of aggression. In contrast to what was expected based on the DBD and TRF results, Child D was well-behaved during recess; in fact, he appeared to behave more appropriately than his male peers. For all three observation sessions of Child D, the problem item ratings of the observers were in agreement at the level of $p < .001$. The inter-rater reliability of the two classroom observations was $r = .64$ and $r = .70$, respectively. Similarly, the inter-rater reliability of the recess observations was $r = 1.00$.

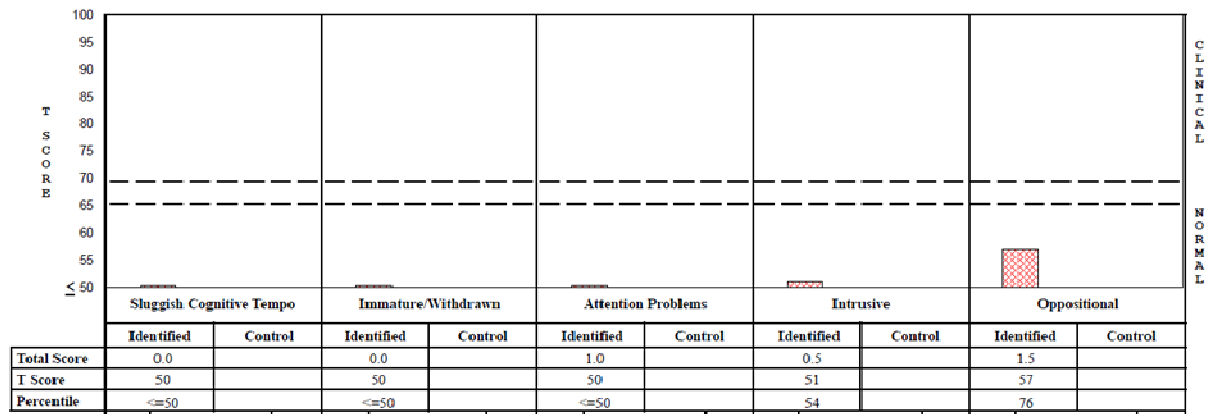


Figure 12. DOF classroom observations of Child D (age 16).

Because of the conflicting reports of aggression from the teacher and observers, the RPQ was administered to assist with obtaining insight into the nature of and motivation underlying Child D's aggression via self-report. Child D completed the RPQ along with all his male classmates ($N = 15$). For both reactive and proactive aggression, Child D obtained a score of 9 (out of 22 and 24, respectively). This self-report of a low level of aggressive behavior is in contrast to the clinically significant aggression reported on the TRF. Upon inspection of the individual items, there was no difference in the reported frequency of reactive and proactive behaviors. Child D's self-reported aggression was similar to that of his male peers, who obtained a mean reactive aggression score of 10.80 ($SD = 3.73$) and mean proactive score of 7.40 ($SD = 4.82$). When the boys' scores were ranked, Child D recorded the seventh-highest reactive score, and the fifth-highest proactive score. In contrast to Child D, all of his classmates reported a preference for reactive aggression. It is interesting to note that Child D as the only participant who reported often carrying a knife to use in a fight; such behavior is considered highly proactive in nature.

In summary, Child D presented, from a young age, with behaviors in keeping with ADHD and ODD. Over time, he developed widespread problem behaviors and was reported to be highly aggressive. In contrast to observer reports, however, Child D provided a low self-report of aggression. Furthermore, he indicated no preference for either reactive or proactive aggression. Although recruited as a control participant, Child D had relatively low general intellectual ability (in fact, his IQ score was lower than exposed Child C). These findings highlight the possible impact of general intellectual functioning on behavior.

Child E

Like Mother D, Mother E was recruited into the prospective longitudinal study described in Study 1 as a control because she had no history of alcohol use. At the time of recruitment (March 2006), Mother E was married and lived with her husband and their two children, of which Child E was the oldest/youngest. Mother E began working after completing her formal education at the age of 18; at the time of recruitment, she was employed as an administrator at a paper-making company.

Mother E and her husband owned their own home, and lived in it with their two children. Mother E did not report any financial problems or difficulty meeting the needs of her family. As such, her Hollingshead social class score of 37.5 was the highest of the 6 mothers, placing her in the category of skilled craftsmen, clerical, or sales worker.

Regarding Child E's medical history, Mother E reported no history of serious illness or injury. She did, however, report that Child E was born with a cleft palate, which was surgically repaired when Child E was an infant. Despite the fact that Child E's lip was repaired at a young age, Mother E reported that he was very aware of his deformity growing up and that other children frequently mocked him. He became increasingly sensitive and would often become very upset at home. Mother E reported that when Child E was tearful or depressed, it was most often related to his poor self-image. Despite having some difficulty with school peers, Mother E reported that Child E was doing well academically, and his teachers reported no problems with learning or behavior. Neuropsychological testing following recruitment into the study (during March 2006, when he was 11 years old) indicated that Child E had a WISC Full Scale IQ of 89.

Consistent with the above, Mother E reported no significant behavior problems on the DBD when she filled out the form in March 2006. She reported only one symptom related to ODD (viz., Child E's tendency to be easily annoyed by others). Similarly, on her DBD report, completed during the same month, Child E's teacher did not report any behavioral problems at school. As a result, Child E did not meet the diagnostic criteria for any DSM-III disruptive behavior disorder (see Table 19).

Table 19.

Child E: Disruptive Behavior Disorder Diagnoses

DSM-III-R Disorder	Met Diagnostic Criteria
Inattentive-ADHD	No
Hyperactive-ADHD	No
Combined-ADHD	No
Oppositional Defiant Disorder	No
Conduct Disorder	No

Note. DSM-III-R = Diagnostic and Statistical Manual of Mental Disorders (APA, 1987)

Six years later, when Child E was 17 years old, his teacher completed the TRF in order to provide an updated account of his behavior at school. Teacher E reported that Child E had a good academic record and interacted well with his peers. On the TRF individual problem scales, Child E displayed no problem behaviors on any scale and, as a result, fell within the normal range for boys aged 12 to 18. Of the 113 items on the TRF, Child E scored only one point, which related to shy and timid behavior. Consequently, his total problem, externalizing, and internalizing behavior scores fell below the 50th percentile. Importantly, Teacher E reported no acts of aggression at school. Figure 13 presents Child E's TRF behavioral profile.

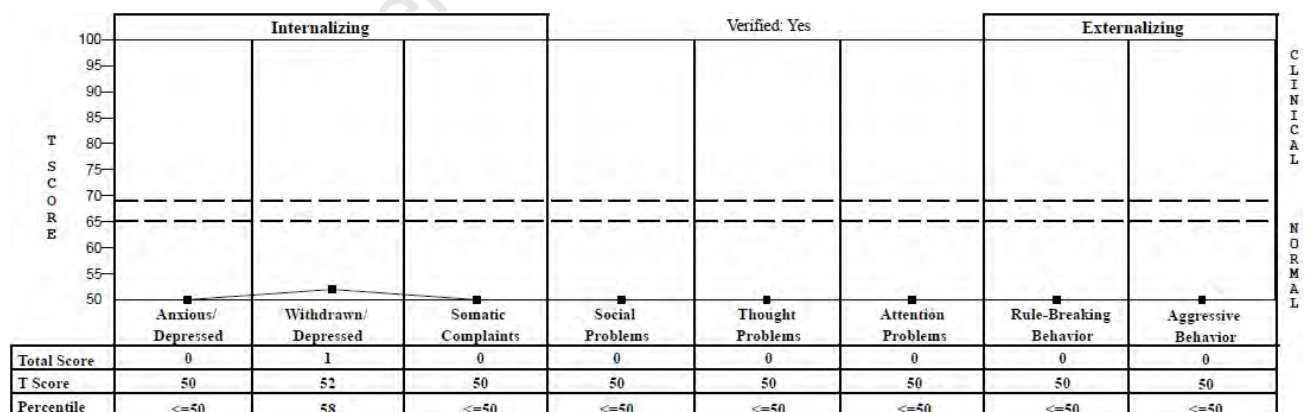


Figure 13. Teacher Report Form syndrome scale scores for Child E (age 17).

Consistent with the data reported above, the DSM-oriented scales indicated no behaviors that were suggestive of ADHD, ODD, or CD. This finding in accordance with the

maternal and teacher DBD ratings collected previously, which suggested that Child E did not display any behaviors typically associated with disruptive behavior disorders.

The results of the classroom and recess observation sessions were consistent with the maternal and teacher reports of behavior. That is to say, the researchers observed no problem behaviors during class and no aggression during recess. It was, however, noted that Child E spent most of the recess observation session alone, and appeared to be unsociable. The inter-rater reliability for all three observations was strong (classroom behaviors $r = .89$ and $r = .66$, respectively, and $r = 1.00$ for the recess observations, all $ps < .001$). Furthermore, the correlation between the shared DOF and TRF item ratings was highly significant, $r = .72$, $p < .001$. Together, the DOF and TRF findings suggest that Child E's behavioral profile has remained stable over time and is considered to be appropriate across social situations and when perceived by different observers.

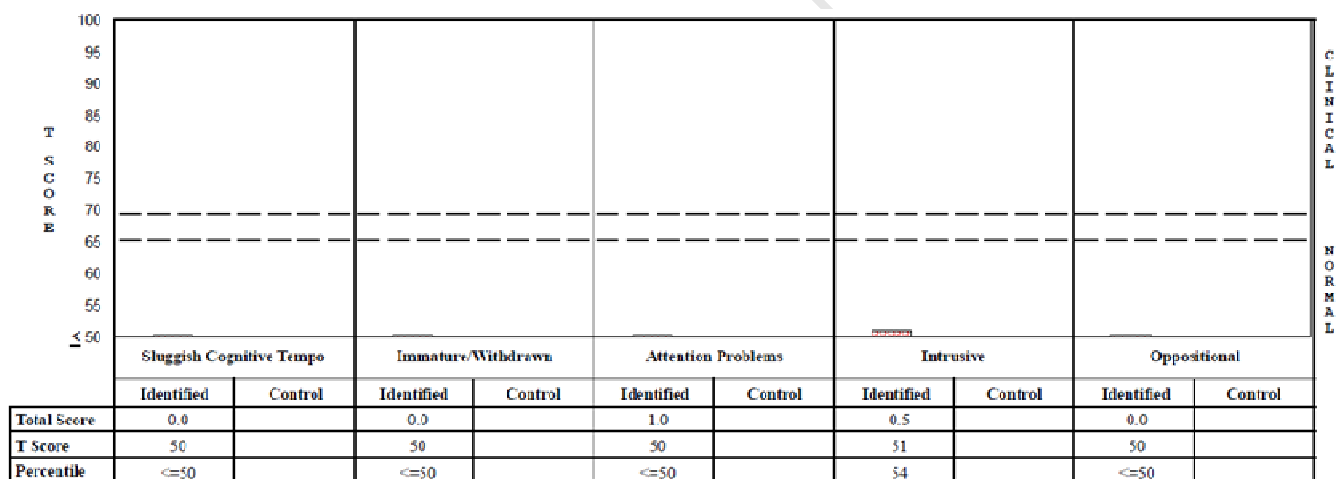


Figure 14. DOF classroom observations of Child E (age 17).

Based on mother and teacher reports of no problem behaviors at home or at school, and because no displays of aggression were observed by the researchers, it was expected that Child E would obtain a low score on the RPQ. However, Child E obtained a reactive aggression score of 11 and proactive aggression score of 1. His self-reported proactive aggression took the form of occasionally yelling at others in order to get his way. Child E's self-reported reactive aggression was similar to the mean score his classmates ($M = 9.18$, $SD = 4.21$) as was his proactive aggression ($M = 2.18$, $SD = 1.47$). In addition, Child E's reactive aggression score was not markedly lower than that of the other five boys in the study. However, what differentiated Child E from was the marked difference in his self-report of

reactive versus proactive aggression. That is to say, he was the only participant who displayed one form of aggression almost exclusively.

The RPQ results of Child E and his classmates highlight two important considerations. The first of these is the context within which aggressive behavior occurs. Of all six classes across the four schools, the participants in Child E's class obtained the lowest average aggression scores. In addition, Child E's school was situated in the suburban area with the highest standard of living according to a survey of SES in Cape Town suburbs (Romanovsky&Gie, 2006). This finding suggests that the sociodemographic context within which the school exists impacts on the behavior of its students. In contexts where aggression and violence is less common, it is also less socially acceptable.

The second consideration is the impact of bullying behavior on aggressive tendencies. Child E was the only participant to report a significant preference for reactive aggression. In addition, he was the only participant whose mother reported a history of difficulty socializing and being the victim of school bullying. Being the victim of bullying has been shown to result in frustration-based reactive aggression (Salmivalli&Nieminen, 2002); hence, being bullied may account for Child E's predominantly reactive presentation.

Child F

At the time of the maternal interview (November 2005), Mother F was 32 years old and lived with her four children and her second husband, whom she had recently married. Her first husband had died 5 years prior while trying to break up a fight between two work colleagues. Since his death, Mother F had received a child care grant and had remained unemployed. Her highest level of formal education was grade 9. Mother D's second husband works in construction and helps to support Mother F. At the time of recruitment, Mother F and her husband were expecting their second child (Child F).

Mother F and her family lived in a wooden cottage on their landlord's property. The cottage had one sleeping area that was shared by all six occupants. Based on their living conditions, the parents' level of education and monthly income, the family had a social class score of 21 on the Hollingshead scale, placing them in the category of machine operator or semi-skilled worker.

Mother F was recruited into the prospective longitudinal study described in Study 1 as a control participant because she had abstained from alcohol while pregnant with Child F. Regarding previous alcohol use, Mother F drank socially from the age of 18 years. She reported that, from that age, she would share 2.3 liters of beer on a Friday and Saturday

evening with four people. She reported that this was her heaviest drinking period. Other than that period, she reported typically having one drink at social occasions only.

Mother F experienced no complications while pregnant with Child F, and reported that he had experienced no significant medical problems since his birth. When asked about Child F's mood and behavior at home, Mother F reported that Child F had been angry and aggressive since his father's death. That event had happened suddenly, and Child F struggled to cope with the loss. Since the father's death, Mother F reported that Child F got upset easily and cried often at home, and had become increasingly withdrawn. She also reported that, since the death, Child F had taken it upon himself to be a father figure to his younger siblings, despite Mother F remarrying. As a result, Child F often argued and became physically aggressive with his siblings.

At the time of the maternal interview, Child F was 8 years old and in grade 2 at a government-run primary school. Mother F reported that he was doing well at school; she stated, however, that his grade 1 teacher had reported that Child F had some difficulty paying attention during class. Despite this report, Child F progressed to grade 2 and was coping well. Neuropsychological assessment of Child F following recruitment (i.e., in November 2005) indicated that his WISC full scale IQ score was 90 (the highest score of the six participants reported upon here).

In keeping with the information gleaned from the maternal interview, Child F's mother and teacher DBD reports (completed during November 2005) both mentioned inattentive and hyperactive behaviors. The severity of such behaviors did not warrant a diagnosis of either form of ADHD, however. Neither mother nor teacher DBD report suggested any significant CD type behaviors, although Child F's teacher noted that he occasionally initiated fights with girls at school. In terms of oppositional behavior, both Child F's mother and teacher described him as being angry and resentful, and reported that he frequently blamed others for his mistakes. As a result, Child F was diagnosed with borderline ODD (see Table 20). Mother F reported that such behaviors occurred most often when Child F was having a "bad day" in terms of coping with the loss of his father.

Table 20.

Child F: Disruptive Behavior Disorder Diagnoses

DSM-III-R Disorder	Met Diagnostic Criteria
Inattentive-ADHD	No
Hyperactive-ADHD	No
Combined-ADHD	No
Oppositional Defiant Disorder	Borderline
Conduct Disorder	No

Note. DSM-III-R = Diagnostic and Statistical Manual of Mental Disorders (APA, 1987)

At the time of the TRF administration (March 2012), Child F was 14 years old and in grade 8 at a government-run high school. Teacher F reported that Child F was performing well academically, and noted that his behavior was more mature than that of his peers. Consistent with this informal report, Teacher F reported no problem behaviors on any of the 113 TRF problem items. As a result, Child F fell below the 50th percentile on all problem scales, including aggressive behavior and rule-breaking. Consequently, his behavior was not suggestive of any DSM-oriented disorders. Overall, Child F's total problem score was the lowest of all six participants (at the 5th percentile). The results of the TRF are consistent with the DBD ratings. In contrast to the teacher DBD report at age 8, however, Teacher F did not report any oppositional behaviors at school at age 14.

Behavioral observation of Child F was challenging. Both classroom observation sessions took place amidst chaos, as the class teacher was unable to enforce order on an extremely unruly class. Despite the surrounding chaos, Child F sat quietly and kept to himself. Both observers noted that he appeared apathetic and disinterested. He avoided eye contact with others and did not consistently respond when spoken to. As a result, Child F obtained high, but within normal range, scores for sluggish cognitive tempo (87th percentile), and immaturity/withdrawal (90th percentile); see Figure 15. Consistent with the TRF, no inattentive behaviors were observed during class. Similarly, oppositional behavior was not observed frequently, and the behaviors that were considered to be oppositional in nature (difficulty following directions, and not listening) might be viewed as an expression of his apathetic and disinterested presentation. There was a strong positive correlation between ratings on the shared DOF and TRF items, $r = .70, p < 0.001$.

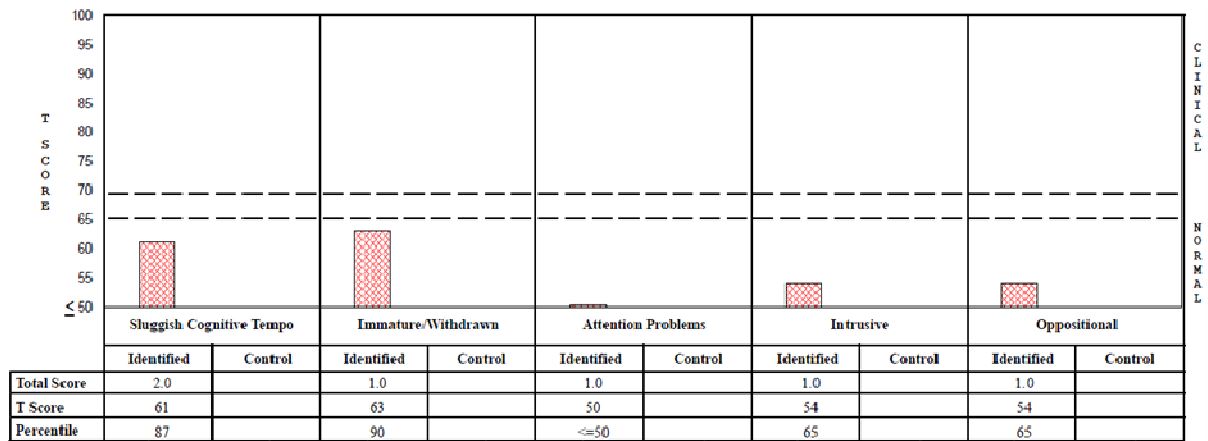


Figure 15. DOF classroom observations of Child F (age 14).

Based on Child F's observed quiet and apathetic behavior, and on the TRF and DOF scores, it was expected that he would provide little self-report of aggressive behavior. Because of the diagnosis of borderline ODD, some minor degree of proactive aggression was expected. In contrast to these expectations, however, Child F obtained the second-highest reactive and proactive aggression scores of the six participants.

Child F obtained a score of 15 out of a total possible 22 for reactive aggression and a score of 14 out of 24 for proactive aggression. The results, therefore, indicated a similar and considerable level of both forms of aggression. Although his self-report of reactive aggression was similar to that of his male classmates ($M = 11.69$, $SD = 3.35$), his proactive aggression score far exceeded theirs ($M = 5.01$, $SD = 4.67$). Based on these results, Child F was ranked the second most proactively aggressive boy in his class ($N = 29$) and fourth most reactively aggressive. These results are in contrast to both the teacher and observer reports of behavior. Upon inspection of the individual items, Child F was one of only three boys in his class who reported using physical force to get his own way. In addition, he was the only boy in his class who reported often getting others to gang up on another child. These results are in direct contrast to his teacher's reports and to what was found through observation of his behavior. Such behaviors are in keeping with a diagnosis of CD, symptoms of which have not been reported previously by Child F's mother or teachers.

Comparative Analyses of Aggression

The individual case studies illustrated the aggressive behaviors of the six participants within each of their sociodemographic contexts. This section summarizes the similarities and

differences in the behavioral profiles of the alcohol-exposed and non-exposed participants. A summary of the participants' comorbid diagnoses is presented in Table 21.

One of the most striking differences pertained to the presence of comorbid diagnoses at a young age amongst the alcohol-exposed boys. In the current study, all three alcohol-exposed boys met the criteria for a borderline or clinical diagnosis of one or more subtype of ADHD. In contrast, only one control child was diagnosed with ADHD. Similarly, two exposed boys met the clinical criteria for a diagnosis of CD, while none of the controls presented with CD-type behaviors. In terms of ODD type behavior, there was a less clear divide between the groups. Although all three alcohol-exposed boys presented with oppositional behavior in keeping with a diagnosis of ODD, two control boys met the criteria for a borderline ODD diagnosis. Together, these results are consistent with the findings of Study 1, which indicated a significant correlation between diagnoses of ADHD and CD and prenatal alcohol exposure in Sample B, but no significant correlation between diagnoses of ODD and prenatal alcohol exposure. The fact that all three alcohol-exposed participants met the clinical criteria for disruptive behavior disorders is significant because such disorders are typically associated with aggression.

Table 21.

Summary of Disruptive Behavior Disorder Diagnoses

Measure	Exposed			Non-Exposed		
	A ^a	B ^a	C ^b	D	E	F
ADHD-Inattention	No	Yes	Borderline	Yes	No	No
ADHD-Hyperactivity	Borderline	Yes	No	Yes	No	No
ADHD-Combined	Borderline	Yes	Borderline	Yes	No	No
Oppositional Defiant Disorder	Yes	Yes	Yes	Borderline	No	Borderline
Conduct Disorder	Yes	Yes	No	No	No	No

Note. ^aDiagnosed with FAS, ^bModerately exposed and non-syndromal

Another point of interest in the current sample is the relation between aggression and general intelligence, an association that has attracted some debate in the literature (see, e.g., Huesmann, Eron, & Yarmel, 1987; Seguin et al., 1999). The non-exposed Child D presented with several disruptive behaviors and clinical levels of aggression on the TRF. His Full Scale IQ score was 74, which was lower than that of the exposed Child C. Furthermore, Child B had the lowest IQ of the six participants and presented with the most disruptive behavior disorders as well as significant levels of aggression on the TRF. These findings highlight the

fact that, in addition to prenatal alcohol exposure, other variables, such as general intellectual functioning, may contribute to the presentation of disruptive behaviors and aggression.

The DBD and IQ results described above were collected at a young age. By administering the TRF 6 years later, the researchers were able to track the development of behavior in the six participants. In terms of disruptive behaviors, the TRF results generally indicated stability over time: All of the participants, with the exception of Child F, continued to display similar patterns of disruptive behaviors. In the case of Child D, the severity of the disruptive behaviors increased with age. Because of the well-recognized relation between disruptive behavior disorders and aggression, it was expected that the teachers would report significant levels of aggression in the participants who displayed ADHD-, ODD-, and CD-type behaviors. As such, more reports of aggression were expected in the alcohol-exposed participants than non-exposed participants, with the exception of Child D.

Table 22 presents a summary of the TRF aggression results. As expected, all three alcohol-exposed boys obtained aggression scores that were higher than many boys their age (above the 65th percentile). In contrast, control participants E and F scored below the 50th percentile. Amongst the alcohol-exposed boys, the two who were diagnosed with FAS scored above the 80th percentile. However, non-exposed Child D was the only participant whose aggression warranted clinical concern. This finding once again highlights the impact that other variables (e.g., general intelligence and contextual factors) might have on the presentation of aggression.

Table 22.

Summary of TRF Aggression Results

Measure	Exposed			Non-Exposed		
	A	B	C	D	E	F
TRF Percentile Score ^a	81	97	65	>97	<50	<50
TRF Level of Functioning ^a	Normal	Borderline	Normal	Clinical	Normal	Normal

Note. ^aCompared to standardized norms for boys aged 12 to 18

The results of the DOF observation sessions did not yield any significant findings with regard to disruptive classroom behaviors or aggression. That is not to say that behavior observation is not a useful tool, however, as there was a significant correlation between the TRF and DOF reports in all six cases. The limitations of the current observation technique and suggestions for future research are presented in the General Discussion.

Reactive and Proactive Aggression

The reports of aggression summarized thus far were obtained from the participants' mothers and teachers and via direct observation. However, as mentioned in the General Introduction's literature review, observers merely witness behaviors but are precluded from understanding the motivations underlying them. That is to say, observers may report aggressive behaviors based on the participants' involvements in hostile interactions. The nature of and motivation underlying their involvement is unknown to the observer. The RPQ self-report data were collected in order to address this problem.

Table 23 presents a summary of the RPQ results. Because previous research (e.g., O'Connor et al., 2008) has indicated a tendency amongst alcohol-exposed youth to make hostile attribution biases, it was hypothesized that the three alcohol-exposed participants would display predominantly reactive aggression. Some proactive aggression was expected based on their comorbid diagnoses. When examining the nature of the participants' aggression, the alcohol-exposed participants reported a relatively equal prevalence of reactive ($M = 14.00$, $SD = 5.13$) and proactive behaviors ($M = 13.33$, $SD = 5.13$). In contrast, the non-exposed participants showed a preference for reactive aggression, with a mean reactive aggression score of 11.6 ($SD = 3.05$) and mean proactive score of 8.00 ($SD = 6.56$). When comparing the group means, the greatest difference in reported aggression pertained to proactive behaviors. The results, therefore, suggest that (a) as expected, the alcohol-exposed participants reported, on average, higher levels of aggression than the non-exposed participants, and (b) that the group difference in reported behavior related to a higher self-report of proactive aggression amongst the alcohol-exposed participants. This finding does not provide support for the hypothesis that the alcohol-exposed participants would report predominantly reactive aggression. It is interesting to note that self-reported reactive aggression was similar between the groups. Possible explanations for this pattern of data are presented in the General Discussion.

Table 23.

Summary of RPQ Results

RPQ Scores	Exposed			Non-Exposed		
	A	B	C	D	E	F
Reactive Aggression ^a	11	18	13	9	11	15
Proactive Aggression ^b	12	19	9	9	1	14

Note . ^aMaximum score of 22. ^bMaximum score of 24.

Bullying Behavior

As mentioned above, proactive aggression is what distinguished the alcohol-exposed participants from the non-exposed participants. Because bullying is widely accepted as a proactive behavior that has the intention of harm, the bullying behaviors of the six participants were examined. The researcher proposed that by examining bullying behavior specifically, the motivation underlying proactive aggression in the alcohol-exposed participants could be better understood. All items that measured bullying behavior on the DBD, TRF, DOF, and RPQ were examined. Table 24 presents the results of the analyses. On each measure, the scores for items measuring bullying behavior were totaled to produce a bullying score. As such, the maximum obtainable score differed on each measure.

On the DBD items measuring bullying behaviors at age 8-10 year, no clear pattern of differences between the alcohol-exposed and non-exposed participants emerged. Interestingly, participants A and B had similar levels of prenatal alcohol exposure, similar levels of intelligence, and presented with similar comorbid diagnoses, but Child B displayed more than twice the number of bullying behaviors. Six years later, the TRF report indicated that Child A was displaying no bullying at school. In contrast, Child B continued to be viewed as a bully. At neither point in time did moderately-exposed Child C display bullying behavior.

Amongst the non-exposed participants, Child D engaged in few bullying behaviors, in keeping with his DSM-III-R diagnoses. Similarly, Child F's teacher reported bullying behavior at a young age; however, no bullying behaviors were evident 6 years later.

In keeping with the general lack of significant findings on the DOF, the aggression researchers observed few acts of bullying during the observation sessions. Child B was the only participant who engaged in more than one proactive bullying-type behavior across the three observation sessions.

Table 24.

Bullying Behavior across the Measures

Measure	Exposed			Non-Exposed		
	A	B	C	D	E	F
DBD ^a	4	10	0	5	0	8
TRF ^b	0	6	0	4	0	0
DOF ^c	0	3	0	0	0	1
RPQ ^d	9	16	7	5	1	9

Note. ^aScore out of 12 for proactive bullying behaviors, ^bScore out of 8 for proactive bullying behaviors, ^cNumber of observed bullying behaviors across the 3 observation sessions, ^dScore out of a possible 16 for self-reported proactive bullying behavior

In contrast to the observer reports, the self-report data indicated a marked difference in bullying between the groups, with the alcohol-exposed children providing a higher self-report of bullying behavior ($M = 10.67$, $SD = 4.73$) than the non-exposed participants ($M = 5.00$, $SD = 4.00$). The mean score of the alcohol-exposed participants was, however, affected by Child B's remarkable report of bullying behavior (he obtained the maximum possible score). His bullying behaviors included often taking things from other students, using physical force to get his way, and threatening others.

In summary, the results of the RPQ indicated that what differentiated the alcohol-exposed participants from the non-exposed participants was a greater engagement in proactive acts of aggression amongst the children with FASD. Consequently, bullying behavior was examined in order to determine whether the proactive behaviors were motivated by an intention to harm. The results of this examination indicated a higher self-report of bullying behavior amongst the alcohol-exposed participants. This finding is in contrast to the hypothesis that children with FASD act aggressively in reaction to real or perceived threats, and suggests a more malicious intent.

GENERAL DISCUSSION

The current research aimed to add to the FASD literature by addressing gaps in knowledge regarding the relationship between prenatal alcohol exposure and aggression. The research comprised two separate studies. Study 1 aimed to examine the prevalence of developmental disorders that are commonly comorbid with FASD and typically associated with aggressive behavior. Study 2 aimed to describe, in rich qualitative detail, the presentation and motivation underlying aggression in a small sample of alcohol-exposed adolescent boys. The results of both studies highlighted the prevalence of aggressive behavior following prenatal alcohol exposure and the need for further investigation of such behaviors.

Prenatal Alcohol Exposure and Comorbid Developmental Disorders in FASD

The results of Study 1 suggested that alcohol-exposed youth presented frequently with comorbid diagnoses of ADHD and CD, and tended to present with more ODD-type behaviors. These findings are consistent with previous FASD research (e.g., Bhatara et al., 2006; Nash et al., 2006; O'Malley and Nanson, 2002). The most striking Study 1 finding, however, was the significant between-group differences in the presence of CD diagnoses amongst the boys in both Sample A and Sample B.

In both samples, there were significant correlations between the presence of CD diagnoses and the continuous measures of alcohol exposure. These findings suggest a direct impact of prenatal alcohol exposure on the likelihood of CD-type behavior during childhood and adolescence. The association between prenatal alcohol exposure and CD was further emphasized by the fact that CD diagnoses occurred across the FASD continuum in the boys who had been exposed to substantially more alcohol (i.e., Sample B), but did not do so in the boys exposed to lower levels of exposure: In Sample A, only syndromal boys presented with CD. This finding is partially consistent with previous research reporting similar levels of social functioning and behavior deficits across the FASD continuum (Mattson & Riley, 2000; Sood et al., 2001). However, the results suggest that disruptive behaviors present at high levels of exposure (but in both syndromal and non-syndromal children) only. The extent to which CD and other disruptive behavior disorders are present at lower levels of exposure remains unclear.

Aggression and Comorbid Developmental Disorders in FASD

The extent to which increased alcohol exposure impacts on the presentation of disruptive behaviors amongst alcohol-exposed children is particularly important when considering the nature and severity of aggressive behavior in such children. This is because diagnoses of CD, ADHD, and ODD are often associated with aggressive behavior. The significant correlations observed here between the presence of such diagnoses and continuous measures of alcohol exposure suggest that alcohol-exposed children are more likely to present with aggressive behaviors than non-exposed children. This finding was confirmed further by the significant positive correlation between prenatal alcohol exposure and the occurrence of the aggressive subtype of CD. The fact that 15% of the variance in aggressive CD behaviors amongst alcohol-exposed boys was explained by the average amount of alcohol consumed by their mothers per day is an important finding and lends itself to further questions regarding the prevalence and quality of aggression in alcohol-exposed children.

Another important finding pertains to the stability of such disruptive behaviors, and aggression in particular, over time. This stability of behavior was illustrated by the continuity of behavior reports in Study 2. Amongst the alcohol-exposed children, CD-type behaviors and aggression tended to persist: They were reported at 8-10 years and again at 14-17 years. This set of reports suggests that disruptive behaviors are present relatively early in life, that they persist at least through adolescence, and that, consequently, they may have long-term effects on adaptive functioning.

Aggression as a Behavioral Outcome in FASD

Building on the findings of Study 1, Study 2 aimed to address knowledge gaps regarding the nature of aggression in FASD by conducting an in-depth examination of the aggressive behaviors of six adolescent boys. The study aimed to provide a comprehensive description of aggression by gathering self-report, other report, and direct observation accounts.

When the six participants in Study 2 (three alcohol-exposed, three non-exposed) were first recruited between the ages of 8 and 10 years, all three drinking mothers reported that their sons displayed aggressive behavior at home, most often in the form of initiating fights with family members. In addition, the two most heavily exposed participants initiated fights with people outside of their home environments, bullied and intimidated others, and engaged in acts of cruelty towards animals. Teachers provided reports of similar behavior at school. Such disruptive behaviors are characteristic of the aggressive subtype of CD. In contrast, the

moderately exposed child did not display such behaviors frequently at first assessment (10 years old).

When a teacher's assessment of aggressive behavior was obtained 6 years later, the three alcohol-exposed participants displayed comparable levels of CD-type behaviors at school. The behaviors of the two most heavily exposed participants were no longer predominantly aggressive in nature but rather conformed to the traditional conception of CD, characterized by rule breaking and anti-social behavior. The similar prevalence of CD behaviors amongst the alcohol-exposed participants is in keeping with the argument that behavioral impairments may be equally profound across the FASD continuum (Astley et al., 2009; Jacobson & Jacobson, 1999; Streissguth et al., 2004). Because the diagnoses were based on rule violations and antisocial behavior, comments cannot be made on the severity of aggressive CD at lower levels of exposure.

When aggression was examined exclusively on the TRF, no clear pattern emerged. The aggression scores of two of the exposed participants fell within the normal range for boys their age. Only the most heavily exposed participant displayed aggression that warranted borderline clinical concern. However, the low-IQ control participant obtained an aggression score in the clinical range.

Interestingly, the results of the DOF observation sessions yielded no significant findings with regards to group differences in aggressive behavior. When analyzing these findings, it is important to consider the limitations of teacher and observer reports of aggression. First, the aggression scales on the TRF and DOF do not measure aggression exclusively but also include items referring to disruptive and inattentive behavior and changes in mood. Furthermore, the items that do measure aggression are limited to overt acts. Henry et al. (2000) argue that the supervised nature of the school environment and disciplinary action associated with misbehavior does not lend itself to overt acts of aggression. They argue, therefore, that aggression is more likely to be displayed at home and in the community than at school. Furthermore, Pepler, Craig, and Roberts (1998) argue that observers, and in this case teachers and researchers, require substantial training to accurately distinguish intentional or malicious aggression from playful behavior.

With these limitations in mind, Henry (2006) argued that self-report measures of aggression may be more accurate, as they are sensitive to aggression that occurs both within and outside of the school environment. In addition, they are protected from observer bias. In the current study, the self-report measure yielded a substantially higher report of aggression amongst the alcohol-exposed participants than controls. The statistical significance of the

group difference cannot be confirmed, however, because of the small sample size. However, inspection of the individual items indicated that the alcohol-exposed participants not only acknowledged engagement in a greater range of aggressive behaviors, but also stated that they engaged in those behaviors more frequently than the control participants. To my knowledge, this is the first study that has administered the RPQ to alcohol-exposed participants. In addition, this is the first time a self-report measure has been used to examine aggression exclusively in a FASD sample.

The Nature of Aggression in FASD

As mentioned, previous FASD research has quantified aggression as a behavioral outcome following prenatal alcohol exposure. The qualitative features of such aggression have not been explored, however. The current study utilized the distinction between reactive and proactive aggression as a framework for examining aggression in FASD. The notion of reactive and proactive aggression has gained much support since it was first proposed by Hartup (1974), and numerous studies have provided evidence for distinct social cognitive processes related to each form of aggression (Dodge & Coie, 1987). How the two forms of aggression relate to cognitive deficits following prenatal alcohol exposure has not been examined, however.

The limited research on social information processing deficits in FASD suggests that alcohol-exposed children tend to make more hostile attribution biases than non-exposed children (O'Connor et al., 2008), and have great difficulty perceiving and responding to social cues (Green, 2007; McGee et al., 2009; Streissguth et al., 1991). As such, it was hypothesized that the alcohol-exposed participants in Study 2 would report predominantly reactive aggression on the RPQ. This hypothesis was not supported by the data: Both participants with FAS showed a similar preference for reactive and proactive aggression, while the moderately exposed participant engaged in more reactive behaviors. When comparing the mean scores of the exposed and non-exposed participants, the group difference was accounted for predominantly by the greater report of proactive aggression amongst the alcohol-exposed participants.

One explanation for this unexpected result is that the presentation of aggression is not dependent solely on social-cognitive processes, but is also affected by different familial and contextual precursors, relates to different social experiences, and is associated with different behavioral outcomes (Hubbard, McAuliffe, Morrow, & Romano, 2010). For example, Dodge (1991) suggested that reactive aggression is associated with a harsh, threatening, or

unpredictable environment. Similarly, a history of physical abuse and lack of maternal care giving or maternal attachment has been associated with reactive aggression (Brendgen, Vitaro, Boivin, Dionne, & Pérusse, 2006). In contrast, proactive aggression is associated with a lenient social environment where parental monitoring is poor (Dodge, 1991), as well as with parental substance abuse (Brendgen et al., 2006).

With the Hubbard et al. (2010) framework in mind, it was hypothesized that all six participants would display aggressive behavior to some degree. That is to say, aggression would not be exclusive to the alcohol-exposed participants but would also present in non-exposed children, albeit to a lesser extent. Amongst the alcohol-exposed children, it was hypothesized that aggression would be the result of both prenatal alcohol exposure and environmental risk factors, a phenomenon that Carmichael Olson et al. (2009) termed 'double jeopardy.' Alcohol-exposed children have been shown to be disproportionately exposed to the contextual risk factors of both reactive and proactive aggression, for example unpredictable home environments (Coggins et al., 2007), parental substance abuse (Jacobson et al., 2008), and neglectful parenting (Carmichael Olson et al., 2009; Fast & Conry, 2004; Rogers-Adkinson & Stuart, 2007).

Although Study 2 did aim to ground reports of aggression within contexts, the specific contextual influences mentioned above were not investigated thoroughly. Furthermore, a multiple case-study approach does not allow for associations to be determined statistically, but rather fosters qualitative observations that might lay the groundwork for later multivariate investigations in larger samples. Hence, conclusions cannot be drawn from the current study as to the impact of contextual factors on the nature of aggressive behavior displayed by the six participants. A wealth of evidence does, however, exist illustrating the unique contexts and social experiences of alcohol-exposed youth (e.g., McGee et al., 2009; Smith-Thiel et al., 2011; Streissguth et al., 2004, Thomas et al., 1998) and future studies examining the nature of aggression in FASD should take such factors into account in addition to the teratogenic effects of alcohol on behavior.

Bullying Behavior in FASD

If the qualitative feature of aggression in FASD is its proactive nature, then examining bullying behavior may provide insight into the motivation underlying such proactive aggression. In the current study, no direct measure of bullying was administered to the participants or their classmates, although several of the measures used included items that referred to acts of bullying. Little is known about bullying behaviors in children and

adolescents with FASD. As is the case in the current study, previous FASD research used measures that incorporated bullying-related questions, but which did not investigate bullying exclusively. In the current research, the mother of the most heavily exposed participant reported that he bullied other children frequently. No clear group differences in bullying behavior were evident on the maternal, teacher, or observer reports, however. It is important to acknowledge the limitation of such reports, as the key distinction between proactive and reactive behaviors is the motivation underlying them. Because bullying is a proactive behavior with an intention of harm, bullying researchers emphasize the importance of one's self-perception as either bully or victim, a concept that is obscure to observers.

When examining the self-reported bullying behaviors, a noteworthy difference in bullying emerged between the groups, with the alcohol-exposed participants engaging in such behaviors more frequently. Bullying research has indicated that bullies score consistently highly on measures of proactive, but not reactive, aggression, and that, conversely, victims of bullying score high on measures of reactive, but not proactive, aggression (Camodeca, Goossens, Terwogt, & Scheungel, 2002). However, the children who are most aggressive are those who fall into the category of bully-victim: children who are not only the targets of bullying, but are also bullies themselves (Salmivalli & Nieminen, 2002). Such children display high levels of both reactive and proactive aggression.

In the current study, the alcohol-exposed participants provided a considerable self-report of proactive bullying behavior. This pattern of data is consistent with previous literature that has reported bullying behavior in FASD samples (Streissguth et al., 1989; Streissguth et al., 1991). However, the current study did not examine whether the participants were victims of bullying. Several FASD studies have indicated that school-age children with FASD are at increased risk of victimization (Page, 2001; Smith Thiel et al., 2011). It is, therefore, possible that the alcohol-exposed participants fall into the category of bully-victim, based on their high prevalence of both reactive and proactive forms of aggression. An important implication for FASD research is that bully-victims are at risk of remaining involved in bullying over a long period of time (Kumpulainen, Räsänen, & Henttonen, 1999). It is important, therefore, that future studies investigate the nature of bullying in FASD because of its long-term trajectory and possible consequences for adaptive functioning.

Intellectual Functioning and Aggression

The relation between aggression and intellectual ability has been highlighted by the fact that the low-IQ control participant was rated as being the most aggressive participant on

the TRF and was the only participant whose aggression score fell within the clinical range when judged against standardization data for boys aged 12 to 18. Research on typically developing children and adolescents has identified low intellectual functioning as a significant predictor of aggression and delinquency, even when controlling for SES (Huesmann, Eron, & Yarmel, 1987). This negative correlation applies predominantly to boys; aggression and conduct problems are positively associated with intelligence amongst girls (Loeber & Hay, 1997).

Several FASD studies have attempted to address the extent to which intellectual functioning can account for patterns of social behavior in alcohol-exposed participants. The results generally indicate that deficits in social behavior and adaptive functioning extend beyond what can be explained by impaired general intellectual functioning alone (Carr, Agnihotri, & Keightley, 2010; Thomas et al., 1998; Whaley et al., 2001). That is not to say, however, that intelligence has no bearing on the presentation of behavioral problems such as aggression. Because of the descriptive nature of Study 2, the extent to which lowered IQ contributed to the behavioral outcomes of the participants could not be determined. The results do, however, suggest that lowered general intelligence plays a role in the presentation of aggression. Future studies investigating the relation between prenatal alcohol exposure and aggression with a larger sample should, therefore, examine the effects of IQ on aggressive behavior.

Aggression in the South African Context

The ways in which biological impairments resulting from prenatal alcohol exposure interact with environmental factors to produce aggression have already been acknowledged. However, it is important to consider the characteristics of the South African context and how these might influence the presentation of aggression, not only amongst the alcohol-exposed participants, but also amongst the controls. Two facts may yield insight into the presentation of aggression in the current study: first, the Western Cape has one of the highest FASD prevalence rates in the world (May et al., 2007), and, second, this province has one of the highest rates of violent crime in the country (Prinsloo et al., 2003). The implications of these facts are that the participants in the current study have grown up in environments where drinking during pregnancy is common and culturally acceptable in certain social circles, and where they are exposed to intense levels of violence.

Regarding the particularly high incidence of FASD in the Western Cape, heavy drinking has been normalized for many citizens of the Western Cape, and particularly those

living in farming communities, due to the lasting effects of the “dop” system, a term that refers to a system of payment whereby farm workers were paid with alcohol as a supplement to, and in some cases instead of, money (May et al., 2005). Although the system has been formally outlawed, drinking heavily on weekends has remained a social custom. The social custom of heavy drinking was voiced by many of the drinking mothers interviewed in Study 1. Acknowledging the cultural influence on drinking patterns is important when considering the fact that heavy alcohol exposure was associated with a greater proportion of CD diagnoses and aggressive CD behaviors than lower levels of exposure were.

The second contextual factor, the high rate of violent crime in the Western Cape, is relevant to the current study because previous literature suggests that the extent to which children are exposed to violence affects their own aggressive tendencies (Barbarin et al., 2001; Loeber & Hay, 1997). In particular, Baldry (2003) argued that exposure to community violence increases the risk of proactive bullying behavior amongst children and adolescents. Although the extent to which the participants were exposed to violence was not examined specifically in the current research, the results of the RPO, in conjunction with comments made by the teachers, indicated that the six participants in Study 2 and their classmates were exposed to gangs frequently, and associated gang violence with “being cool”. With this teacher report of exposure to violence, future FASD studies aiming to obtain a comprehensive understanding of the nature of aggression (i.e., proactive and reactive) and associated behaviors, such as bullying, in alcohol-exposed children should incorporate a measure of exposure to violence.

Limitations and Directions for Future Research

The current research aimed to add to an understanding of aggression as a behavioral outcome in FASD by addressing some of the methodological shortfalls of previous studies. For example, it addressed the need for observational data and self-report data. Although the current study has provided useful insights into the presentation of aggression in individuals with FASD, there are several limitations that need to be acknowledged.

The first, and perhaps most significant limitation is the small sample sizes. Study 1 used two samples in an attempt to show that the results were replicable. However, once the samples were split by gender and by diagnostic group, the number of participants in each cell was small. In saying so, it must be noted that the choice of diagnostic system may have affected the results. As mentioned previously, the FASD diagnoses were based on the Institute

of Medicine diagnostic criteria (Stratton et al., 1996). However, had another diagnostic system been used, it is possible that the cell sizes may have differed. In Study 2, the sample size was limited by the number of boys who remained in school and the willingness of school principals to participate in the research. Hence, the final sample size allowed an exploratory multiple case-study, rather than a full-blown multi-factorial quasi-experimental design. So, because of Study 2's small sample size, correlations and possible causal relations between prenatal alcohol exposure, sociodemographic variables, and aggression could not be determined. As such, group differences in aggression and other behavioral outcomes could not be confirmed with certainty, and observations could not be generalized beyond the current sample. The fact that only four schools were willing to participate in the research highlights the potential impact that selection factors may have on the results. Although it is possible that future studies will be faced with the same challenges, particularly due to the fact that adolescents with FASD have a well-documented risk of disrupted school experiences (Streissguth et al., 2004), such studies should aim to recruit larger samples of alcohol-exposed and non-exposed participants. By doing so, group differences in the presentation of comorbid diagnoses and aggression can be examined statistically. In addition, the effects of other confounding variables such as IQ can be controlled for statistically.

Additionally with regard to Study 1, the longitudinal nature of the data collection means that a degree of caution is warranted when interpreting the results. In particular, some Sample A data were collected years earlier than others. There is, therefore, the possibility that, in some cases, sociodemographic data, and perhaps mothers' lifetime diagnosis of alcohol abuse or dependence, may have been outdated. A similar cautionary note is in order with regard to Study 2; the sociodemographic and clinical diagnostic data for the six participants taken from Sample B were collected 6 years prior to the school testing and observation session.

A second major limitation of the current research was the choice of observation technique in Study 2. Although FASD researchers have consistently cited a need for observational data (e.g., Carmichael Olson et al., 2009; Jacobson & Jacobson, 2003; Kully-Martens, Denys, Treit, Tamana, & Rasmussen, 2012; Olswang, Svensson, & Astley, 2010), the behavioral observation measure in the current study did not yield any significant findings. However, that is not to say that behavior observation is not a useful and potentially insightful methodology; rather, it might mean that the current method was flawed and could be improved on in future endeavors. In the current study, the DOF was chosen based on the fact that the classroom and recess observation sessions produced profiles of oppositional, conduct

disordered, and aggressive behaviors. In addition, the DOF shares many of its items with the TRF, allowing for comparisons between the measures. However, unlike the TRF, which is normed for boys aged 12 to 18, the DOF is normed for boys aged 6 to 11. The relevance of the participants' percentile scores is, therefore, questionable. In addition, although the measure was ideal in theory, the practicalities of conducting direct observations limited the ability to produce significant findings. The first constraint was the timeframe. Each participant was observed three times over a period of 1 day in order to minimize the impact of the researchers' presence on the day-to-day running of the schools involved. Ideally, each participant would be observed over a longer period of time, such that a more representative sample of behavior could be obtained. Future studies should, therefore, aim to address this limitation by extending their observation periods. The second, equally important, constraint was the inability of the researchers to remain unnoticed by the students. Both observers felt that their presence attracted much attention amongst the students and made it extremely difficult to remain focused on the target participant. This was particularly true for recess observations, where the examiners were required to track the participants across the school grounds. Both examiners felt that their behavior was unnatural while tracking the participants. It is, therefore, possible that the observed behaviors are not a true reflection of the participants' natural behavior. The possibility that the behaviors were unnatural has important implications, particularly for the recess observation sessions that yielded the aggression scores.

A third limitation of the current research relates to the fact that the behavior reports and direct observation of behavior in Study 2 were restricted to the school environment. As previously mentioned, aggression is more likely to occur in the community and at home than at school (Henry et al., 2000). Although the self-report measure extended beyond the school environment, many of the conclusions made in the current study were based on aggressive behavior at school only, and therefore, may not be a comprehensive reflection of the participants' aggressive tendencies. As a result, it may be beneficial to obtain parent behavior reports of aggression in order to compare aggressive behavior at home and at school. In addition to broad behavior measures, such as the CBCL, future studies should incorporate a parent report of reactive versus proactive aggression, thereby allowing for comparisons with self-report measures of aggression. For example, Kempes et al. (2006) developed the Parent-rating scale for Reactive and Proactive Aggression (PRPA), which consists of 22 Likert-type items, 11 of which load on reactive aggression and 11 on proactive aggression. Like the Raine et al. (2006) RPQ, respondents are required to rate whether a specific behavior is

engaged in never, sometimes, or often. By incorporating such a measure, future studies may enhance their ability to accurately distinguish the nature of aggression in individuals with FASD.

In Study 2, it was suggested that in addition to a substantial report of reactive aggression, the prevalence of proactive aggression is what separated the participants with FASD from the controls. As a result, it was argued that examining bullying behavior might be useful as a means of exploring the motivation underlying aggression. In the current study, no direct measure of bullying was administered. Future studies examining aggression in FASD may benefit by incorporating a measure of bullying and victimization, particularly to determine whether children and adolescents with FASD are predominantly bullies or bully-victims; as discussed previously, these individuals present with different profiles of aggression. In addition to a self-report of bullying and victimization, peer reports should be obtained, as it has been suggested that they provide access to the unique relationships and perspectives of those who both observe and participate in bullying interactions (Salmivalli & Nieminen, 2002).

Study 2 limited its investigations of aggression to boys, due to the fact that (a) a positive correlation was observed between prenatal alcohol exposure and aggressive CD in boys only, (b) the RPQ was developed and normed using boys only, and (c) the researchers were more likely to observe overt acts of aggression than relational aggression. However, it would be beneficial for the purposes of a comprehensive behavior profile of FASD to determine whether the well-researched gender differences in aggression among typically developing children remain true for girls with FASD. Furthermore, future studies should investigate whether girls with FASD display predominantly reactive or proactive aggression, as research with typically developing adolescents has identified gender-specific behavior and life-experience correlates of reactive versus proactive aggression (Connor et al., 2003).

Finally, it was hypothesized that the alcohol-exposed participants would display predominantly reactive aggression, based on the theory that prenatal alcohol exposure results in impairments in social information processing. In particular, it has been argued that children with FASD make significantly more hostile attribution biases than typically developing children. Although the relation between social information processing deficits and reactive and proactive aggression has been well researched with children who have been subjected to negative life experiences (e.g., Dodge & Petit, 2003; Kempes et al., 2005), to date only two studies have examined such deficits in individuals with FASD (McGee et al., 2009; O'Connor et al., 2008). No measure of social information processing was administered in the

current study. Furthermore, because of the small sample size, no firm conclusions would have been possible had the researchers included such a measure. Because there is a wealth of evidence linking social information processing deficits to aggression, but little knowledge regarding such deficits in FASD, future studies should address this knowledge gap by incorporating a measure of social information processing. By doing so, the findings can be used to determine the extent to which social information processing deficits exist at varying levels of alcohol exposure, and how such deficits relate to objective and subjective measures of aggression in FASD.

Summary and Conclusions

FASD research has identified aggression as one of the externalizing behaviors that occur frequently in children and adolescents who have been exposed to alcohol prenatally. Unfortunately, little is known about the unique features of FASD aggression, including under which circumstances it arises and the qualitative characteristics of such aggressive acts. Study 1 of this thesis aimed to address this knowledge gap by examining disruptive behavior disorders that commonly present with aggression in two samples of alcohol-exposed and non-exposed children. The results indicated a high prevalence of ADHD and CD diagnoses, both of which are known to feature aggressive behavior. Study 2 was an in-depth exploratory examination of aggression in a small sample of adolescent boys with and without prenatal alcohol exposure. By using a multiple case-study approach, the researcher was able to obtain a rich description of the adolescents' lives and a greater understanding of how their biological impairment, in conjunction with individual sociodemographic characteristics and associated life experiences, shaped their affinity for aggression. By incorporating behavior reports of aggression with naturalistic observation and self-report data, the current study was able to provide a multi-dimensional account of aggressive behavior.

Study 1's results were, largely, consistent with the original hypotheses. That is to say, the alcohol-exposed participants presented with significantly more disruptive behavior disorder diagnoses than the non-exposed participants. In addition, the number of diagnoses increased as levels of prenatal alcohol exposure increased. Furthermore, aggressive-subtype CD behaviors were correlated significantly with prenatal alcohol-exposure amongst alcohol-exposed boys. Together, these findings illustrate the presence of aggression as a significant behavioral outcome in FASD.

Study 2's results were not, however, consistent with the original hypotheses. Neither the teacher nor observer reports of aggression indicated a substantial difference in the

presence and frequency of aggressive behavior between exposed and non-exposed boys. The teacher reports did, however, illustrate the stability of disruptive behaviors over time, and also provided evidence for the presence of such behaviors across the FASD continuum. Furthermore, the nature of the aggressive behavior amongst the alcohol-exposed participants stood in contrast to the original hypothesis, as the most noteworthy difference in reported aggression between exposed and non-exposed boys pertained to proactive behaviors. The results of Study 2, therefore, indicate that in addition to reactive aggression, which was reported by both the exposed and non-exposed participants, the adolescents with FASD reported a high prevalence of proactive aggression.

Together, these two studies add to our current understanding of aggression following prenatal alcohol exposure, particularly with regard to the nature of aggression in adolescent boys with FASD. These studies aimed to overcome some of the methodological shortfalls of previous research, and although they did not succeed in doing so entirely, their results have identified avenues for future research, which may continue to contribute significant findings to the ever-growing behavioral profile of FASD. Understanding the presentation of and mechanisms underlying aggression is crucial to a comprehensive behavioral profile of FASD because of its implications for later life experiences and secondary disabilities.

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Appendix A

Consent Documents

Maternal Consent Form for Study 1 (Afrikaans Version)

Toestemming deur Ouers/Ingeligte Instemming tot Navorsing

Neurobeelding Studie van die Brein in FAS Kinders in Suid-Afrika

U en u kind _____ word genooi om deel te neem aan 'n navorsingstudie waarin ons kinders se ontwikkelingsalondersoek. Lees asseblief hierdie vorm deeglik deur en vra asseblief enige vrae wat u mag hê voordat u instem om aan die studie deel te neem. Die studie word onderneem deur Erneste Meintjes, Ph.D., Colin Andrew, Ph.D., en Christopher Molteno, M.D., aan die Universiteit van Kaapstad, in samewerking met Sandra W. Jacobson, Ph.D., en Joseph L. Jacobson, Ph.D., van Wayne Staats-Universiteit in Amerika. Wayne Staats-Universiteit en die Nasionale Navorsingsraad van Suid Afrika finansier die navorsing.

Doel van die studie: Die doel van die studie is om 'n nuwe metode te gebruik waarmee die brein bestudeer kan word, naamlik EEG opnames van die brein, om beter te probeer verstaan hoe rook en die drink van alcohol tydens swangerskap kinders se ontwikkeling kan beïnvloed. Vir die EEG opnames, sit die kind op 'n stoel met 'n kappie op sy/haar kop wat gekoppel is aan 'n EEG masjien wat die elektriese seine van die brein opneem om prentjies te maak. Aangesien u kind reeds 'n sessie in die skandeurder by Groote Schuur hospitaalsuksesvol voltooi het, word hy/sy nou genooi om deel te neem aan nog 'n fase van die studie. In hierdie fase van die studie sal ons opnames doen met die EEG masjien by ons laboratorium aan die Universiteit van Kaapstad terwyl u kind eenvoudige take doen.

Metodes: Indien u instem om u kind te laat deelneem aan die studie sal ons u en u kind na ons laboratorium bring aan die Universiteit van Kaapstad (UK) vir omtrent 4 ure. Tydens u besoek aan UK sal u kind eenvoudige take doen waarin hy/sy sy/haar vingers moet beweeg met die kappie wat aan die EEG masjien gekoppel is op sy/haar kop. U kind sal gevra word om so stil as moontlik te sit en om sy/haar oë so min as moontlik te knip terwyl die seine opgeneem word.

Voordele: In hierdie studie sal die EEG opnames slegs vir die navorsingsdoeleinde gebruik word. Indien enige abnormaleiteit of probleem waargeneem word sal ons vir u daarvan sê en u

verwysna 'n dokter en/of vir herstellende/remediërendehulp. Geen inligting aangaande u kind saluitgegee word vir mediese of opvoedkundigedoeleindesnietensy u ditskriftelikversoek.

Risikos: Die EEG opnamesmaak glad nie seer nie en is heeltemalskadeloos. Die enigsteongerief wat u kind dalk mag ervaar is dat sy/hy hare natgemaaksal word met 'n skadelosevloestof wat na die tydweeroitgewassal word. Die EEG masjien wat gebruik word is 'n gesertifiseerde mediese toestel wat aan strengvereistesmoesvoldoen om terallete die veiligheid van die persoon wie se brein seine opgeneem word te verseker.

NavorsingsVerwanteBeserings: As u of u kind seer krytydenshierdie studies sal u behandelingontvang. Eerstehulp, noodbehandeling, en opvolgsorgsal beskikbaar wees, soosbenodig. Geenterugbetaling, vergoeding, of gratis mediesesorg word deur Wayne Staats-Universiteit of die Universiteit van Kaapstadaangebiednie. Indien u dink dat u kind seergekry het as gevolg van sy/haardeelname aan die studiemoet u die navorserdaadelik in kennisstel.

Koste: U en u kind hoefniks te betaal om deel te neem aan hierdiestudie.

Vergoeding: Vir u deelneeming aan hierdienavorsingsstudiesal ons u R100 (\$20) betaal vir u besoek en ons sal vir u kind 'n kleingeskenkie gee.

Vertroulikheid: Ons salalle inligting wat ons oor u en u se kind varsamel het tydenshierdiestudiegeheim hou, tot die mate wat die wet dittoelaat. U en u kind sal in die navorsingsrekordsdeur 'n kodenommergeïdentifiseer word. Ons salgeen inligting wat u of u kind by name bekend maakuitgeenietensy u vir ons skrifteliketoestemming gee. U rekors mag egterhersien word deur die borge van die studie, die MenslikeNavorsingskomitee by Wayne Staats-Universiteit, of ander regeringsliggame.

VrywilligeDeelname/Onttrekking: U deelname aan hierdiestudie is vrywillig. U kan kies om u kind te laatdeelneem aan die studie en later van besluitverander en ophou. U en u kind het ook die reg om 'n vraagnie te antwoordnie of om enigetaak of onderhoud te stop voordatdit klaar is. Die navorser, of die borg, mag u kind se deelname aan die studie stop selfs al stem u niedaartoe in nie.

Vrae: indien u nou op 'n latere stadium enigevrae het kan u dokters Ernesta Meintjes of Christopher Molteno skakel by 021-406-6212 of dokter Sandra Jacobson by 091-313-993-

5454. Indien u enigevrae het of bekommerd is orr u of u kind se regte as 'n deelnemer aan die studie, kan u die voorsitters van die MenslikeNavorsingskomitee by die Universiteit Kaapstad (021-406-6338) of Wayne-Staats Universiteit (091-313-577-1628) skakel.

Toestemming om aan die navorsingsstudiedeel te neem: Om vrywilliglik in te stem om u kind aan hierdiestudie te laatdeelneem, moet u hieronder teken. Indien u kies om u kind te laatdeelneem, mag u of u kind openige stadium u deelname stop. Nie u of u kind gee enige van julleregte op deurhierdievorm te tekennie. U handtekeningwysdat u vormheeltemaldeurgelees het, of datdit aan u voorgelees is, insluitende die del wat die risikos en voordeleverduidelik, en dat ons al u vraebeantwoord het. Ons sal vir u 'n afskrif van hierdietoestemmingsvorm gee om huis toe te vat.

Handtekening van ouer/voog

Datum

Naam van ouer/ voog in drukskrif

Tyd

Mondelikseinstemming (kinders 7-12 yaars)

Datum

*Handtekening van getuie (wanneer van toepassing)

Datum

*Naam van getuie in drukskrif

Tyd

Handtekening van person wat toestemmingontvang

Datum

Naam van person wat toestemmingontvang

Tyd

*Gebruikwanneer die toestemmingsvorm aan die ouer/voogvoorgelees is (m.a.w. in gevalle van ongeletterheid, blindheid, vertaling in 'n ander taal)

UNIVERSITY OF CAPE TOWN



Child Development Research Laboratory

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Dear _____

Your student _____ is participating in a research study on child growth and development at the University of Cape Town. Most of the assessments are conducted in our laboratory at the university. We would be very grateful if we could obtain information from you about how s/he is doing in school.

We have discussed this aspect of the study with his or her parent(s) and obtained their consent, as indicated below. I am writing to ask you to fill out the attached questionnaire and return it to me at the University of Cape Town in the enclosed stamped envelope. Thank you for your assistance.

Sincerely
Professor Christopher D. Molteno M.D.

PARENTAL RELEASE

To: _____

I hereby give permission for you to provide the information about my child _____ which has been requested by Prof. Molteno in this letter.

Thank you.

 (date)

 (parent's signature)



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CONSENT TO PARTICIPATE IN A RESEARCH PROJECT

Aggressive Behaviors in Adolescents with Fetal Alcohol Spectrum Disorders (FASD)

Dear Parent

A Masters student at the University of Cape Town is busy conducting a research project under the supervision of Dr Kevin Thomas. The goal of the project is to understand behavioral changes that occur in school age children as a result of exposure to alcohol before birth. Her particular interest is aggression, which appears to be common after alcohol exposure.

This research will be conducted at several schools in and around Cape Town. The aim of the study is to determine whether children who were exposed to alcohol before birth act more aggressively in the classroom and on the playground than their non-exposed peers. The majority of the children involved in this research will not have been exposed to alcohol during pregnancy.

PROCEDURE

If you decide to participate in this study and give consent for your child to participate, the following shall happen:

During school hours, at a time designated by the teachers, your child and the rest of his/her class will be given a questionnaire to fill out. The questionnaire consists of 23 questions that concern how your child deals with feelings of anger. The questionnaire only takes 10 minutes to complete, thereby only taking minimal time away from teaching.

The student conducting this research, along with a fellow student, will be present at your child's school for a few days and will be observing the children's behavior and interactions in the classroom and during playtime. The children won't be approached during this time, but merely observed.

This research will take place during the first school term of 2012.

CONFIDENTIALITY

All of the students will be required to put their names on the questionnaire which they fill out. Each child's name will be given a code number that will not be known to anyone but the student conducting the research. The names will be used for administrative purposes only. Your child's name will not be used in publications about this study.

RISKS AND BENEFITS

There are no physical or psychological risks associated with this research. While your child will not benefit from the research directly, we hope that what we learn from this study will increase academic and public awareness of the negative effects of drinking during pregnancy.

PARTICIPATION

Your participation in this study is completely voluntary. You have the right to not take part in this study or change your mind about your child's participation at any point in time.

QUESTIONS

If you have any questions in connection with this research, you can contact the researchers responsible for conducting this study:

Kevin Thomas (student supervisor) 021 650 4608

Chris Molteno (student supervisor) 021 406 6291

Keelie Smith (student researcher) 084 799 7902

If you have any ethical questions in connection with this research, you can contact the University of Cape Town Faculty of Health Sciences Research Ethics Committee:

Mrs Lamees Emjedi 021 406 6338

CONSENT

Your child must also give his/her assent to participate in this study

Child's name (print)

Child's signature

Date

You, as parent, give permission for your child to participate in this research. Your signature shows that you have read the above information and agree to it.

I have read the above information. I have had the opportunity to ask questions and all of my questions have been answered to my satisfaction. By signing this consent form, I give consent for my child's participation in this study.

Child's name

Parent/ guardian's name

Parent/ guardian's signature

Date

Telephone number



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ASSENT TO PARTICIPATE IN A RESEARCH PROJECT

Aggressive Behaviors in Adolescents with Fetal Alcohol Spectrum Disorders (FASD)

Dear student

My name is Keelie Smith. I am a student at the University of Cape Town and am trying to learn more about how young people deal with feelings of anger. Research has shown us that when mothers drink when they are pregnant, their children sometimes have difficulty controlling their feelings, especially feelings of anger, because of the alcohol they were exposed to in their mothers' wombs. With your help, I would like to find out whether this is true amongst South African children attending various schools in Cape Town. Most of the children who will take part in this study were not exposed to alcohol when their mothers were pregnant.

What will happen to me during this study?

I, and another student from the University of Cape Town, will be visiting your school. During our visit, the following will happen.

During one of your classes, I will give you a questionnaire to fill out. The questionnaire is made up of 23 questions, which address how you deal with feelings of anger. You will be asked to answer out all of the questions as honestly as possible. This will only takes 10 minutes away from your class.

You will also notice that we will be sitting in on some of your classes and will be outside during break time. During our time at your school, we will be watching how everyone gets along at school. At no time will we approach you or ask you any questions.

Will this study help me or harm me in any way?

If you agree to be part of this study, you will not be harmed in any way or be put at risk. We will only be asking you to fill out a questionnaire. You are not expected to perform any other tasks. While this study will not benefit you directly, what we learn from this study will be very helpful. If we feel that you are struggling to control your anger, we will suggest that you speak to your school guidance counsellor.

Will anyone know I am in the study?

When you fill out the questionnaire, you will be asked to write your name on it. I will then give your name a code number. When I tell people about my study, I will only use your code number, and never your name. Your name will not be used when I write up what I have found.

Can I choose if I want to be part of the study?

Your parent or guardian has to say its fine for you to be in the study. After they decide, you get to choose if you want to do it too. If you don't want to be in the study, no one will be cross and you will not get into any trouble. If you want to be in the study now and change your mind later, that's fine. You can stop at any time.

Who can I talk to if I have questions about the study?

If you have any questions that you would like to ask me about this study, you can phone me on 021 762 5950. You can also phone Professor Christopher Molteno, who is in charge of this study, on 021 406 6291. We are happy to answer any questions you might have.

Do you understand what you will be asked to do if you agree to be part of this study?

 YES

 NO

Do you agree to be part of this study?

 YES

 NO

 Signature of student

Teacher Consent Form for Study 2

 Date

Department of Psychology
 University of Cape Town
 Rondebosch, 7701
 Tel: +27 21 650 4608
 Email: Kevin.Thomas@uct.ac.za



CONSENT TO PARTICIPATE IN A RESEARCH PROJECT

Aggressive Behaviors in Adolescents with Fetal Alcohol Spectrum Disorders (FASD)

Dear _____

Your student _____ is participating in a research study on aggression in adolescent boys with Fetal Alcohol Spectrum Disorders (FASD). Some of the students involved in the study have been exposed to alcohol during pregnancy, while others have not. We would like to obtain a teacher's perspective of how the above-named student has behaved at school over the last two months. We would be very grateful if you would agree to fill out a questionnaire regarding the child's behavior. We have discussed this aspect of the research with his parent/caregiver and have obtained their consent.

If you have any questions regarding the research, please feel free to contact the researchers involved:

Doctor Kevin Thomas: 021 650 4608

Professor Chris Molteno: 021 406 6291

Keelie Smith (student researcher): 084 799 7902

I _____ have read the above information. I have had the opportunity to ask questions and all of my questions have been answered to my satisfaction. By signing this consent form, I agree to fill out a questionnaire regarding the abovementioned child's behavior at school. I also agree to keep this information confidential.

 Teacher's signature

 Date

Appendix B
Ethical Approval

Study 1: Ethical Approval from Wayne State University IRB Committee (Sample A)



IRB Administration Office
 87 East Canfield, Second Floor
 Detroit, Michigan 48201
 Phone: (313) 577-1628
 FAX: (313) 991-7122
<http://irb.wayne.edu>

NOTICE OF FULL BOARD CONTINUATION APPROVAL

To: Sandra Jacobson
 Psychiatry
 University Square Office Plaza

From: Dr. Scott Mills or designee
 Chairperson, Behavioral Institutional Review Board (B3)

Date: March 15, 2012

RE: IRB #: 02670683F
Protocol Title: Neural Bases of Eyeblink Conditioning in FASD
Sponsor: = NATIONAL INSTITUTE ON ALCOHOL ABUSE AND ALCOHOLISM
 = NATIONAL INSTITUTES OF HEALTH
Protocol #: 0802005726

Expiration Date: March 14, 2013

Risk Level / Category: 45 CFR 46.404 - Research not involving greater than minimal risk

Continuation for the above-referenced protocol and items listed below (if applicable) were APPROVED following Full Board review by the Wayne State University Institutional Review Board (B3) for the period of 03/15/2012 through 03/14/2013. This approval does not replace any departmental or other approvals that may be required.

- Actively accounting participants
- Research Informed Consent: Detroit Adult Study (Pilot version #1r, dated 07/07/2011)
- Parental Permission/Research Informed Consent: Detroit Child Pilot (Protocol version #2, dated 08/04/2010)
- Parental Permission/Research Informed Consent - English and Afrikaans Versions (Protocol version #2r, dated 11/30/2009)
- Parental Permission/Research Informed Consent - English and Afrikaans Versions (Protocol version #2rr Alternate, dated 07/27/2010)
- Parental Permission/Research Informed Consent: Blood Draw and Diagnostic Clinic Consent - English and Afrikaans Versions (Protocol version #3r, dated 08/27/2009)
- Research Informed Prescreening Consent: Infant Pilot Study - English and Afrikaans Versions (Protocol version #4r, dated 08/03/2010)
- Parental Permission/Research Informed Consent: Cape Town Infant Study - English and Afrikaans Versions (Protocol version #4.1r, dated 01/04/2012)
- Parental Permission/Research Informed Consent: Cape Town Infant MRI Study - English and Afrikaans Versions (Protocol version #4.2, dated 01/06/2012)
- Parental Permission/Research Informed Consent: ERP Infant Study - English and Afrikaans Versions (Protocol version #4.3r, dated 05/18/2011)
- Adult Permission/Research Informed Consent: Adult Comparison Group - English and Afrikaans Versions (Protocol version #5, dated 11/30/2009)

Study 1: Ethical Approval from UCT Faculty of Health Sciences Research Ethics Committee (Sample A)

 UNIVERSITY OF CAPE TOWN <small>UNIVERSITEIT VAN KAPSTAD</small>	HUMAN RESEARCH ETHICS COMMITTEE	05 OCT 2012	FACULTY OF HEALTH SCIENCES <small>Human Research Ethics Committee</small>
	FHS016: Annual Progress Report / Renewal		

HREC office use only (FWA00001637; IRB00001938)			
This serves as notification of annual approval, including any documentation described below.			
<input checked="" type="checkbox"/> Approved	Annual progress report	Approved until/next renewal date	20/5/2018
<input type="checkbox"/> Not approved	See attached comments		
Signature Chairperson of the HREC	Signed by candidate		Date Signed 9/10/12

Principal Investigator to complete the following:

1. Protocol information

Date form submitted	October 3, 2012		
HREC REF Number	187/2008	Current Ethics Approval was granted until	30/05/2012
Protocol title	Neural Bases of Eyeblink Conditioning in FASD		
Protocol number (if applicable)			
Principal investigator	A/Prof EM Meintjes		
Department / Office Internal Mail Address	Department of Human Biology, Room 5.14 Anatomy Building, Faculty of Health Sciences, Anzio Road, Observatory		
1.1 Does this protocol receive US Federal funding?	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	
1.2 Has sponsorship of this study changed? If yes, please attach a revised summary of the budget.	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	

2. List of documentation

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Study 1: Ethical Approval from Wayne State University IRB Committee (Sample B)

NOTICE OF EXPEDITED CONTINUATION APPROVAL

To: Sandra Jacobson
 Psychiatry
 University Square Office Plaza

From: Ellen Barton, Ph.D. _____
 Chairperson, Behavioral Institutional Review Board (B3)

Date: October 13, 2009

RE: HIC #: 099504B3F
 Protocol Title: Neuroimaging Studies of FAS Children in South Africa
 Sponsor: ° NATIONAL INSTITUTES OF HEALTH
 Protocol #: 0504001735

Expiration Date: October 12, 2010

Risk Level / Category: 45 CFR 46.404 - Research not involving greater than minimal risk

Continuation for the above-referenced protocol and items listed below (if applicable) were APPROVED following Expedited Review by the Chairperson/designee of the Wayne State University Institutional Review Board (B3) for the period of **10/13/2009 through 10/12/2010**. This approval does not replace any departmental or other approvals that may be required.

- Closed to accrual (date of closure 7/30/09)

- ° Federal regulations require that all research be reviewed at least annually. You *may* receive a "Continuation Renewal Reminder" approximately two months prior to the expiration date; however, it is the Principal Investigator's responsibility to obtain review and continued approval **before** the expiration date. Data collected during a period of lapsed approval is unapproved research and can **never** be reported or published as research data.

- ° All changes or amendments to the above-referenced protocol require review and approval by the HIC **BEFORE** implementation.

- ° Adverse Reactions/Unexpected Events (AR/UE) must be submitted on the appropriate form within the timeframe specified in the HIC Policy (<http://www.hic.wayne.edu/hicpol.html>).

NOTE:

1. Upon notification of an impending regulatory site visit, hold notification, and/or external audit the HIC office must be contacted immediately.
2. Forms should be downloaded from the HIC website at *each* use.

Study 1: Ethical Approval from UCT Faculty of Health Sciences Research Ethics Committee (Sample B)

UNIVERSITY OF CAPE TOWN



Health Sciences Faculty
 Research Ethics Committee
 Room E52-24 Groote Schuur Hospital Old Main Building
 Observatory 7925
 Telephone [021] 406 6338 • Facsimile [021] 406 6411
 e-mail: lamees.emjedi@uct.ac.za

06 June 2008

REC REF: 196/2008

A/Prof EM Mcintjes
 Human Biology
 Anatomy Building

Dear A/Prof Mcintjes

PROJECT TITLE: NEUROIMAGING TECHNOLOGY FOR PAEDIATRIC DEVELOPMENT DISORDERS IN SOUTH AFRICA

Thank you for submitting your study to the Research Ethics Committee for review.

It is a pleasure to inform you that the Ethics Committee has **formally approved** the above-mentioned study.

Approval is granted for one year till the 30th May 2009.

The researchers rated this study as "no greater than minimal risk (46.404) and adequate provision is made to obtain assent from individual child participants and written parental consent.

Please submit an annual progress report if the research continues beyond the expiry date. Please submit a brief summary of findings if you complete the study within the approval period so that we can close our file.

Please note that the ongoing ethical conduct of the study remains the responsibility of the principal investigator.

Please quote the REC. REF in all your correspondence.



UNIVERSITY OF CAPE TOWN

Health Sciences Faculty
 Faculty of Health Sciences Research Ethics Committee
 Room E52-24 Groote Schuur Hospital Old Main Building
 Observatory 7925
 Telephone [021] 406 6338 • Facsimile [021] 406 6411
 e-mail: sumayah.eric@uct.ac.za

04 August 2011

HREC REF: 250/2011

Prof C Molteno
 Psychiatry & Mental Health

Dear Prof Molteno

PROJECT TITLE: AGGRESSIVE BEHAVIOUR IN ADOLESCENTS WITH FETAL ALCOHOL SPECTRUM DISORDERS

Thank you for addressing the issues raised by the committee.

It is a pleasure to inform you that the Ethics Committee has **formally approved** the above-mentioned study.

Approval is granted for one year till the 15 August 2012.

Please submit a progress form, using the standardised Annual Report Form (FHS016), if the study continues beyond the approval period. Please submit a Standard Closure form (FHS010) if the study is completed within the approval period.

Please note that the ongoing ethical conduct of the study remains the responsibility of the principal investigator.

Please quote the REC. REF in all your correspondence.

Yours sincerely

Signed by candidate

PROFESSOR M BLOCKMAN
CHAIRPERSON, HSF HUMAN ETHICS

Federal Wide Assurance Number: FWAG0001637.
 Institutional Review Board (IRB) number: IR800001938

This serves to confirm that the University of Cape Town Research Ethics Committee complies to the Ethics Standards for Clinical Research with a new drug in patients, based on the Medical Research Council (MRC-SA),



WESTERN CAPE Education Department

Provincial Government of the Western Cape

awyngaard@pgwc.gov.za

tel: +27 021 476 9272

Fax: 0865902282

Private Bag x9114, Cape Town, 8000

wced.wcape.gov.za

REFERENCE: 20110708-0021

ENQUIRIES: Dr A T Wyngaard

Miss Keelie Smith
UCT Medical Campus
Observatory
7925

Dear Miss Keelie Smith

RESEARCH PROPOSAL: AGGRESSIVE BEHAVIOR IN ADOLESCENTS WITH FETAL ALCOHOL SPECTRUM DISORDERS

Your application to conduct the above-mentioned research in schools in the Western Cape has been approved subject to the following conditions:

1. Principals, educators and learners are under no obligation to assist you in your investigation.
2. Principals, educators, learners and schools should not be identifiable in any way from the results of the investigation.
3. You make all the arrangements concerning your investigation.
4. Educators' programmes are not to be interrupted.
5. The Study is to be conducted from **18 July 2011 till 30 September 2011**
6. No research can be conducted during the fourth term as schools are preparing and finalizing syllabi for examinations (October to December).
7. Should you wish to extend the period of your survey, please contact Dr A.T Wyngaard at the contact numbers above quoting the reference number.
8. A photocopy of this letter is submitted to the principal where the intended research is to be conducted.
9. Your research will be limited to the list of schools as forwarded to the Western Cape Education Department.
10. A brief summary of the content, findings and recommendations is provided to the Director: Research Services.
11. The Department receives a copy of the completed report/dissertation/thesis addressed to:

**The Director: Research Services
Western Cape Education Department
Private Bag X9114
CAPE TOWN
8000**

We wish you success in your research.

Kind regards.

Signed: Audrey T Wyngaard

for: **HEAD: EDUCATION**

DATE: 08 July 2011

Appendix C

Study 1: Additional ADHD Analyses for Sample A

Measure	Syndromal	Non-syndromal	Non-exposed	χ^2	<i>p</i>	ESE
Total sample (<i>n</i> = 91)	(<i>n</i> = 30)	(<i>n</i> = 33)	(<i>n</i> = 28)			
Any ADHD Diagnosis	20.0	24.2	17.9	0.40	.82	0.07
Inattentive and Combined ADHD	16.7	6.1	14.3	1.85	.40	0.14
Hyperactive and Combined ADHD	16.7	6.1	14.3	1.85	.40	0.14
Girls (<i>n</i> = 41)	(<i>n</i> = 14)	(<i>n</i> = 13)	(<i>n</i> = 14)			
Any ADHD Diagnosis	31.2	35.0	28.6	0.16	.92	0.06
Inattentive and Combined ADHD	31.2	10.0	21.4	2.53	.28	0.23
Hyperactive and Combined ADHD	31.2	10.0	21.4	2.53	.28	0.23
Boys (<i>n</i> = 50)	(<i>n</i> = 16)	(<i>n</i> = 20)	(<i>n</i> = 14)			
Any ADHD Diagnosis	7.1	7.7	7.1	0.004	.99	0.01
Inattentive and Combined ADHD	0.0	0.0	7.1	1.98	.37	0.22
Hyperactive and Combined ADHD	0.0	0.0	7.1	1.98	.37	0.22

Note . ESE = effect size estimate, calculated using Phi

Appendix D

Study 2: Reactive-Proactive Aggression Questionnaire

Instructions: There are times when most of us feel angry or have done things we should not have done. Rate each of the items below by putting a circle around 0 (never), 1 (sometimes), or 2 (often). Do not spend a lot of time thinking about the items, just give your first response. Make sure you answer all the items.

Reactive-Proactive Questionnaire Items

How often have you...	Never	Sometimes	Often
Yelled at others when they have annoyed you	0	1	2
Had fights with others to show who was on top	0	1	2
Reacted angrily when provoked by others	0	1	2
Taken things from other students	0	1	2
Gotten angry when frustrated	0	1	2
Vandalized something for fun	0	1	2
Had temper tantrums	0	1	2
Damaged things because you felt mad	0	1	2
Had a gang fight to be cool	0	1	2
Hurt others to win a game	0	1	2
Become angry or mad when you don't get your way	0	1	2
Used physical force to get others to do what you want	0	1	2
Gotten angry or mad when you lost a game	0	1	2
Gotten angry when others threatened you	0	1	2
Used force to obtain money or things from others	0	1	2
Felt better after hitting or yelling at someone	0	1	2
Threatened and bullied someone	0	1	2
Made obscene phone calls for fun	0	1	2
Hit others to defend yourself	0	1	2
Gotten others to gang up on someone else	0	1	2
Carried a weapon to use in a fight	0	1	2
Gotten angry or mad or hit others when teased	0	1	2
Yelled at others so they would do things for you	0	1	2

Appendix E

Study 2: Letter of Information for the Schools



Department of Psychology
University of Cape Town
Rondebosch, 7701
Tel: +27 21 650 4608

Email: Kevin.Thomas@uct.ac.za

AGGRESSION IN FETAL ALCOHOL SPECTRUM DISORDERS STUDY

Dear teachers of _____

A Masters student at the University of Cape Town is currently conducting a research project on the ways in which alcohol exposure during pregnancy affects child development. She is particularly interested in aggressive behaviors, as aggression has been shown to be a common behavioral outcome in children exposed to alcohol during pregnancy.

The student has obtained ethical approval from the Western Cape Education Department as well as permission from the school principal to conduct her research at your school. Two female students will be on the school property and in one of the classrooms over a period of a few days. They will be watching how the children interact with one another in class and on the playground. At a point in time that is considered convenient, they will give the children a questionnaire to complete. This will take roughly ten minutes of class time. We would greatly appreciate your co-operation in allowing the students to sit in on your classes and to administer the questionnaire at a time you feel is convenient.

If you have any questions or concerns regarding the research, please feel free to contact one of the following persons:

Kevin Thomas (research supervisor): 021 650 4608

Chris Molteno (research supervisor): 021 406 6291

Keelie Smith (student researcher): 084 799 7902