

**CHILDHOOD AGGRESSION AND EXECUTIVE FUNCTIONING:
VARIATIONS ACROSS BOYS AND GIRLS**

by

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Abstract

Childhood aggression has long been a significant concern for researchers, practitioners and policy makers alike, due to its ominous connection to psychological maladjustment in both its perpetrators and victims. As modern theories of the origins of aggression shift to incorporate the role of neuropsychological risk factors, increasing empirical attention has been paid to executive functioning and its link to childhood aggression. Recent developmental research has documented links between executive functioning deficits and *physical* aggression, but the role of executive functioning in physical aggression's more cognitively complex counterpart, *relational* aggression, is less established and may differ across boys and girls. The current study attempted to replicate and extend recent findings regarding sex differences in the associations between executive functioning and physical versus relational aggression in preschool-aged children, as well as examine differences in parent and teacher ratings of executive functioning and aggression. The results of a standard multiple regression indicated several key and significant findings. Replicating previous findings, boys were found to be more physically aggressive than girls, but there were no sex differences in levels of relational aggression. Also consistent with previous research, children who were high in physically aggressive behaviors were found to display elevated deficits in executive functioning according to both teachers and parents, especially "hot" EFs - inhibition, shifting and emotional control. In terms of relational aggression, parent ratings of poor emotional control predicted relational aggression in both boys and girls. Teacher ratings indicated marginal sex differences. Specifically, for girls, deficits in inhibition and shifting and working memory were associated with higher ratings of relational aggression, but for boys, poor inhibition predicted higher relational aggression. The results of the current study lend some support for a sex-specific model of EF and aggression.

Preface

This thesis is an original intellectual product of the author, J.Moore. The original data was collected by Dr. Tracy Vaillancourt of McMaster University and her team in 2004/2005. The secondary analysis of this collected data by the author was covered by UBC Ethics Certificate number H15-01165.

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Chapter 1: Introduction

Overview

Childhood aggression has received extensive theoretical and empirical attention, owing in large part to evidence that aggressive behavior is typically associated with maladjustment. In fact, aggression is a major risk factor for psychopathology, as well as a symptom of several psychological disorders among children (American Psychiatric Association, 2013; Dodge, Coie & Lynam, 2006). The list of potential consequences for those directly involved is long, including peer rejection, school adjustment problems, substance use, and social anxiety (e.g., see Crick, Nelson, Morales, Cullerton-Sen, Casas, & Hickman, 2001). There are a plethora of studies within the developmental literature that chronicle the consequences of the widespread problem of aggression. Card, Stucky, Sawalani and Little (2008), for example, showed that childhood aggressors demonstrated higher rates of externalizing problems, poor peer relations, and reduced pro-social skills. It is important to note that these are often life-long consequences for individuals that in turn, have an impact on communities and the greater society (Dodge, 2008; Tremblay et al., 2004). Identifying cognitive impairments that distinguish aggressive and non-aggressive children could help facilitate early detection and consequent intervention and prevention efforts.

Aggression is comprised of acts with the intention or consequence of inflicting harm, hurt or injury to others (Berkowitz, 1981). Factor-analytic studies indicate two distinct forms of aggressive behaviors (Crick & Grotpeter, 1995; Vaillancourt, Brendgen, Boivin, & Tremblay, 2003). One form includes physicality (such as hitting and pushing), as well as overt verbal attacks such as name calling, teasing and threatening. A second form includes hurtful manipulation of relationships and attempts to damage social position, often through indirect or

covert means (Dodge et al., 2007; Little, Henrich, Jones, & Hawley, 2003). In this paper, these two broad forms of aggression are referred to as physical and relational aggression, respectively.

It is important to understand the social, emotional, and cognitive factors associated with the onset and developmental course of these different types of aggression in order to develop truly effective prevention and intervention programs to address these behaviours (Leff, Power, Manz, Costigan, & Nabors, 2001). Moreover, research regarding developmental processes associated with childhood aggression may inform efforts to target at-risk children and thus prevent maladaptive developmental trajectories (Sroufe, 1997).

Society's attempts to understand the development of aggression have typically examined psychosocial factors such as inappropriate social learning (e.g., Bandura, 1969, 1973, 1986) and increased exposure to violence through media (e.g., Ostrov, Gentile, & Mullins, 2013). However, recently, the notion that "within-child" characteristics, such as temperament and neuro-cognitive deficits, may have implications for the development of aggression and other anti-social behaviors has been explored further. In fact, results of a meta-analysis by Morgan and Lilifield (2000) has documented a significant relationship between antisocial behaviours and weaknesses in neuro-cognitive abilities, such as executive functioning. Several other studies, to be reviewed in more detail below, have more firmly established the relationship between executive functioning weaknesses and physical aggression (e.g., Séguin, Boulderice, Harden, Tremblay, & Pihl, 1999; Seguin et al., 2004).

While the link between physical aggression and executive dysfunction has been rather firmly established, there is limited research regarding the relationship between relational aggression, which is arguably a more cognitively complex behaviour (Andreaou, 2006), and executive functioning. Moreover, results of a recent study by Kozey (2014, described in detail

below) suggests that gender may moderate the relationship between aggression and executive functioning.

Problem Statement

The goal of the present study was to further explore the links between subtypes of aggression and executive functioning in preschool children. Specifically, the present study is designed as a replication and extension of recent findings (Kozey, 2014) regarding executive functioning and physical versus relational forms of aggression, using a new sample of younger, preschool-aged children and different measures of both executive functioning and aggression. Additionally, both parent and teacher ratings of children's aggression and executive functioning were used. Of interest is whether these links differed across types of aggression (relational versus physical) and across boys and girls.

Chapter 2: Literature Review

The literature review below is divided into several parts. The first section provides a brief synopsis of our current knowledge of physical and relational aggression, followed by a review of gender differences in aggression. The next section briefly summarizes our knowledge of executive functioning and its established relationship to physical aggression and, to a lesser degree, relational aggression. Finally, unidentified issues are presented, as well as the rationale, purpose and significance of the present study.

Introduction

Parke and Slaby (1983) defined aggression as “behavior that is aimed at harming or injuring another person or persons” (p. 50). Aggressive behavior is associated with maladjustment for aggressors (e.g., Coie & Dodge, 1998) as well as their victims (e.g., Card, 2003; Card, Issacs & Hodges, 2007). Research suggests that aggressive children commonly experience a range of concurrent and future problems, including peer rejection (Vaillancourt & Hymel, 2006), anxious and depressive symptoms (e.g., Marsee, Weems, & Taylor, 2008; Zimmer-Gembeck, Hunter, & Pronk, 2007), externalizing behaviours within the classroom (e.g., Zalecki & Hinshaw, 2005) and poor scholastic performance (e.g., van Lier & Crijnen, 2005). Childhood aggression is associated with the larger social problems of bullying, childhood psychopathology, delinquency and violence (Tremblay, 2000), and as such, it is of great importance for researchers to continue to seek clarity, as well as a greater understanding of, the mechanisms that underlie aggressive behavior, particularly within young children.

While physical manifestations of aggression are more thoroughly researched, it is important to note that one-dimensional approaches to aggression are likely to provide an incomplete picture (Little et al., 2003). Aggression forms are often overlooked, despite

theoretical and empirical work suggesting that predictors and consequences of aggression may vary depending on the form it takes (e.g., physical or relational) (e.g., Bushman & Anderson, 2001; Little et al. 2003). Little and colleagues (Little et al., 2003; 2010) subtype childhood aggression into overt and relational aggression (see also, Crick & Grotpeter, 1995; Vaillancourt et al., 2003). The division of the overarching concept of aggression into two forms has been supported empirically (see Card et al., 2008 for a review).

Physical versus Relational Aggression

The bulk of aggression research has addressed physical forms of aggression, defined as the intent to hurt or harm another using physical force (Tremblay & Nagin, 2005). Socially, physically aggressive children demonstrate reduced pro-social skills and poor peer relations (e.g., Card et al., 2008). Additionally, childhood aggressors are also at a higher risk for later alcohol and drug abuse, accidents, violent crimes, depression, suicide attempts, spouse abuse and neglectful/abusive parenting (Farrington, 1994; Ferguson & Harwood, 1998; Kokko & Pulkkinen, 2000; Nagin & Tremblay, 1999; Serbin et al., 1998; Stattin & Magnusson, 1989). Given the negative outcomes associated with aggression, it is of utmost importance to continue to understand and identify physical aggression in young children, especially early childhood risk factors evident prior to formal school entry. Early intervention at the preschool level is assumed by researchers to offer the most hope for prevention and intervention efforts (Tremblay et al., 2004).

Developmentally, children tend to become less physically aggressive with age. Studies of physical aggression during infancy indicate that, by 17 months of age, the vast majority of children are physically aggressive toward siblings, peers, and adults. However, most children learn alternative behaviours prior to preschool entry (Tremblay et al., 2004). Around this same

age, sex differences being to emerge for physical aggression, with boys being more physically aggressive than girls (Loeber & Hay, 1997). Tremblay and colleagues (2004) theorize that children learn to regulate the use of physical aggression during the preschool years, which makes these early childhood years of particular interest to researchers, as this period of life is likely to be appropriate for preventative interventions. Those children who do not learn to regulate their physically aggressive behaviours are at the highest risk of more serious violence during adolescence and adulthood. In an extensive longitudinal study of the development of aggression from 17 months of age into adulthood, Tremblay et al. identified three distinct trajectories. One trajectory included those children who displayed little or no physical aggression (28% of the sample); a second included those who displayed a rising trajectory of modest aggression (58% of the sample). Finally, a third group of children followed a rising trajectory of high physical aggression (14% of the sample), which were considered at the highest risk for later maladjustment. Importantly, high levels of physical aggression at 17 to 42 months of age was found to be predictive of antisocial behaviours in adolescence and adulthood, further stressing the need for early identification and preventative efforts.

Over the past two decades, aggression research has widened to include behaviours that are more non-confrontational and socially based, such as rumor spreading and ostracism (Putallaz et al., 2007). Three terms have been used to describe the overlapping, but distinguishable, aggressive behaviours that involve social manipulation: relational aggression, social aggression and indirect aggression (e.g., Cairns et al., 1989; Feshbach, 1969; Galen & Underwood, 1997; Lagerspetz et al., 1988). These terms all have subtle differences, but all of them include the basic premise that the aim of the behavior is to harm the reputation and/or social relations of another (Bjorkvist, Lagerspetz, & Kakiainen, 1992; Crick & Grotpeter, 1995;

Galen & Underwood, 1997). Indirect aggression is often more covert in nature, whereas relational aggression can be covert/indirect (e.g., spreading a rumor) or overt/direct (e.g., not inviting a peer to a birthday party if they don't comply with a request.) Social aggression also encompasses both indirect and direct behaviours, and includes non-verbal aggressive behaviours (e.g., making mean faces). Although these terms have undeniable, albeit subtle, distinctions amongst themselves, that have been explored within the research literature (see Underwood, 2003 for a review), the term "relational aggression" (Crick, 1995) is used in this paper, as this construct was assessed in the current study. Relational aggression is defined as the intent to harm another through the manipulation, threat or damage to close relationships (Crick & Grotpeter, 1995).

Developmentally, studies have shown that preschool children as young as age 3 engage in relational aggression (Crick, Casas, & Mosher, 1997; McNeilly-Choque, Hart, Robinson, Nelson, & Olsen, 1996). In terms of the trajectory of relational aggression, less is known. Direct, relationally aggressive acts (e.g., withdrawing an invitation) are more common during early childhood, whereas both direct and indirect relationally aggressive acts (e.g., giving the "silent treatment") are common during middle childhood and adolescence (Crick et al., 1999).

Relational aggression differs from its physical counterpart in our knowledge of its long-term consequences for both perpetrators and victims, as well as the greater society. A number of past studies have demonstrated that relationally aggressive children experience high levels of maladaptive outcomes, including poor social status, peer rejection and both internalizing and externalizing disorders (Crick et al., 1997; Crick, Ostrov, Burr, Cullerton-Sen, Jansen-Yeh, & Ralson, 2006; Ostrov & Crick, 2007; Ostrov & Godleski, 2007). However, there has also been evidence to the contrary. Underwood (2003) suggests that relational aggression is more

widespread, normative and adaptive than its physical counterpart. Some scholars purport that relational aggression may be more tolerated by peers than physical aggression, and that relationally aggressive children may avoid some of the negative social consequences typically linked with physically aggressive behaviours (Calvete & Orue, 2011). Card et al. (2008) found that some relationally aggressive children also demonstrate high levels of pro-social behavior. Other studies have demonstrated that some relationally aggressive children enjoy increased social status, especially if they also possess characteristics deemed desirable by peers (Vaillancourt & Hymel, 2006; Vaillancourt, McDougall & Hymel, 2003). In terms of younger children, Gower et al. (2014) found that high levels of relational aggression were associated with more positive transitions to kindergarten. Overall, findings are mixed, and the pathways between relational aggression and children's adjustment are complex in nature. What is true for some perpetrators (e.g., peer rejection) may not be true for others (Garandeau & Cillessen, 2006).

Aggression and Sex

There has been long standing interest in sex differences in aggression, as well as how the mechanisms and processes of aggression differ in boys and girls. Sex differences in physical aggression are well established, with boys engaging in more physical aggression than girls (e.g., Crick et al., 1997). These sex differences begin to emerge as early as 3 years of age (e.g., Crick et al., 1997) and remain stable throughout adolescence and into adulthood (e.g., Broidy et al., 2003; Stranger, Achenbach, & Verhulst, 1997). It is important to note the distinction between the words, sex (which refers to biological sex), and gender (which refers to the socially constructed roles and characteristics that are attributed to men and women). The term sex is used in this paper in order to reference biological sex, as opposed to gender.

One of the challenges within the aggression literature is that research has focused more on male-dominated physical aggression, and often studies focus only on male children, excluding female participants. In the past two decades, research on aggression has expanded to include relational aggression. This, in turn, has allowed researchers to broaden their work to include female participants, and study sex differences in different subtypes of aggression across the lifespan. The popular belief that boys are more aggressive than girls seems to apply primarily to physical forms of aggression, when relational forms of aggression are also considered, girls and boys are fairly equal in their use of aggression (e.g., Crick & Grotpeter, 1995; Rys & Bear, 1997).

Although there is a commonly held notion that relational aggression is a “female form” of aggression, whereas physical aggression is the “male form” of aggression, empirical support for this has been inconsistent. While some research has documented sex differences in relational aggression across the lifespan, in favor of girls, there is significant variation in the effect size associated with this difference (Archer & Coyne, 2005). A meta-analysis of peer nomination studies (which is the most common method for examining relational aggression) showed an overall effect size near to zero, which suggests no overall sex differences (Archer, 2004). Alternatively, observational studies produce a large effect size in the female direction (Archer, 2004).

Overall, research suggests that sex differences in relational aggression tend to be smaller in younger years, become larger from ages 8 to 11, and reach a peak in adolescence (Archer & Coyne, 2005). Studies of adult sex differences in relational aggression using self-report measures tend to show no reliable differences between men and women (Archer & Coyne, 2005; Bjorkvist et al., 1994; Campbell et al., 1997). In contrast, in middle childhood, Lagerspetz et al.

(1988) found that 11-year-old girls exhibited significantly more relational aggression than 11-year-old boys. This finding has been replicated consistently with this age group, with large effect sizes (e.g., Bjorkqvist et al., 1992; Owens, 1996; Salmivalli, Kaukianen & Lagerspetz, 2000).

There have been relatively few studies that have examined sex differences in relational aggression in preschool-aged children. Crick et al. (1997) found no sex differences in relational aggression when using peer nomination methods, but found a large difference favoring female children when using teacher reports (an effect size of $-.74$), suggesting that the method used to identify sex differences can be instrumental in discovering differentiated aggressive behaviours in boys and girls. This finding has not been consistently replicated (e.g., McEvoy, Estrem, Rodriguez & Olson, 2003). Vaillancourt et al. (2005) studied the development of relational aggression in children aged 4 to 11 using mothers' reports. Results indicated that sex differences were very small at younger ages, and were more established from ages 9 to 11, with girls showing more relational aggression than boys. The lack of sex differences in studies of younger children may reflect the limitations of the peer nomination method in this age group. Overall, there is a need for clarification in sex differences in relational aggression in preschool-aged children and younger. In terms of proportional use of the subtypes of aggression, research has been more consistent. Girls are more likely to use relational aggression, as opposed to physical aggression, whereas boys tend to use both forms of aggression fairly equally (e.g., Cillessen & Mayeux, 2004; Loukas, Paulos & Robinson, 2005).

Gender Linked Model of Aggression

One suggested model of sex differences in aggression is Ostrov and Godleski's (2010) Gender Linked Model of Aggression, which posits that gender may predict the developmental pattern of aggression, as well as the outcomes associated with aggression. The term gender is

used here, as the authors of the model are referencing the societal construct of gender, as opposed to biological sex. The model was designed to provide a parsimonious explanation for the development of sex-based aggressive behavior and help explain the “black box” of the processing of social information. The model is based on the social information processing model (Crick & Dodge, 1994), which suggests that children are active agents in their own contexts, and emphasizes real time processing of cues and decision-making when faced with different situations. The theory suggests that children enter situations with a “database of prior experiences and social schemas” (Crick & Dodge, 1994, p. 76) that guide them towards their responses in different situations. Ostrov and Godleski’s Gender Linked Model of Aggression uses the same premise as social information processing, but focuses specifically on the role of gender identity in aggressive behavior response selection, explaining how the child’s gender identity helps guide the selection of physically/relationally aggressive behaviours.

The model focuses on children in early and middle childhood (approximately 3 to 12 years of age). This phase of the development process is very gender segregated in terms of the social world of peer interactions, which allows for greater sex-specific socialization influences, as well as frequent access to gender stereotypes (see Rose & Rudolph, 2006). Ostrov and Godleski (2010) argue that gender roles influence all steps of a child’s processing of social cues, and, in turn, one’s choice of responses in different social interactions, including aggressive responses. The authors assert that past gender-relevant peer experiences are stored as memories, which are readily accessible in ambiguous social situations as “gender schemas.” Schemas describe an organized pattern of thought or a mental structure of preconceived ideas. A gender schema is a framework of different things that societal agents (i.e., our family, parents, school, peers) tell us are a part of being “male” or “female.” The Gender Linked Model of Aggression

suggests that these gender schemas are very much a part of how a child interprets and responds to different stimuli within the environment, including potentially aggressive responses. These schemas affect the episodic information that is encoded and interpreted and also influences the interpretation of social cues in the future. Ostrov and Godleski further assert that information consistent with prior experiences and gender/self schemas is likely to be interpreted in an antagonistic manner, as opposed to gender irrelevant information. That is, girls will likely interpret relationally aggressive acts as hostile, especially when the provocation is ambiguous, whereas boys will likely interpret physically aggressive acts as hostile. Response options considered are also processed with a gender-specific schema.

Ostrov and Godleski (2010) offer several predictions about an individual child's behavior during early childhood based on this theory. First, the theory predicts that children will have more knowledge about their gender-typical forms of aggression, which no known studies have tested empirically. Second, they predict that children should *associate* female gender identity with relational aggression and male gender identity with physical aggression. This prediction has received some empirical support in children in both early and middle childhood (e.g., Crick, Bigbee & Howes, 1996; French, Jansen & Picada, 2002; Giles & Heyman, 2005). Third, the theory suggests that children should recall more information about hypothetical scenarios, actual events and specific behavioral descriptions for their gender-typical subtype of aggression. Giles and Heyman (2005) demonstrated that children distort their memories of aggressive events to be more consistent with their gender schemas, which supports this predication. Fourth, the theory suggests that children should prefer to use gender-consistent aggressive behaviours and avoid gender inconsistent behaviours. This assertion has been demonstrated in middle childhood, but not early childhood (Putallaz et al., 2007). Finally, the theory predicts that children should find

gender-consistent forms of aggression to be more harmful or morally wrong than gender inconsistent subtypes. In early childhood, Goldstein, Tisak and Boxer (2002) found that female preschool children evaluated relationally aggressive responses to be more wrong than did male children, whereas male children rated physically aggressive responses as more wrong than their female peers (Goldstein & Tisak, 2004; Goldstein, Tisak, & Boxer, 2002).

The Ostrov and Godleski (2010) Gender Linked Model of Aggression also makes four group level predictions. First, young girls should display and receive more relationally aggressive acts than boys, whereas young boys should display and receive more physical aggression. While it is clear that boys display and receive more physical aggression, there are mixed findings observed regarding sex differences in relational aggression (as demonstrated in the preceding review). It has not been consistently established that girls engage in more relational aggression than boys, though it has been demonstrated that girls engage in more relational aggression than they do physical aggression (e.g., Cillessen & Mayeux, 2004; Loukas et al., 2005). Second, the Ostrov and Godleski model suggests that aggression should be targeted towards same-sex peers rather than opposite-sex peers (i.e., girls are aggressive to girls and boys are aggressive to boys) as this is more consistent with a child's gender schema. There has been some evidence to support this claim. Specifically, girls have been found to direct more relational aggression to female peers in three observational studies of early childhood (Crick et al., 2006; Ostrov & Keating, 2004). Third, the model predicts that girls should display more relational aggression than physical aggression and boys should display more physical aggression than relational aggression, consistent with their gender schema. While this has been demonstrated in middle childhood (e.g., Putallaz, 2007), it has not yet been demonstrated in early childhood. Finally, the model predicts that gender serves as an important moderator of associations between

aggression and predictors of aggressive behaviours. As well, for girls, relational aggression should be predictive of future maladjustment, whereas for boys, physical aggression should be predictive of future maladjustment, as this would be more developmentally salient and thus more likely to be associated with maladjustment. Evidence of this is seen in early childhood, where relational aggression was found to be associated with future peer rejection, but only for girls (Crick et al., 2006; Ostrov, 2008). For boys, only physical aggression has been found to be associated with future peer rejection during early childhood (Crick et al., 2006). This model suggests that sex is of utmost importance when examining aggression from a theoretical and empirical perspective. If this model is an accurate perception of a child's mental processes, it suggests that potential predictors of aggression may look different for boys and girls, and underscores the importance of examining sex differences when investigating aggression.

Of note, while this model follows from the initial information processing model (Crick & Dodge, 1994) and describes in detail the steps children go through when interpreting information and subsequently providing responses, it lacks a description of any inward mechanisms used to complete the steps of the model. The purpose of the present study was to further investigate how boys and girls differ in terms of neurocognition (i.e., executive functioning) and how this relates to sex differences in relational and physical aggression.

Determinants of Individual Differences in Aggression

Theories of the potential causes of individual differences in aggression range from biology to socialization. Most current aggression models unite these factors through interactions, transactions, mediation and moderation. Studies have explored the role of genetics (e.g., Moffitt, 2005; Rhee & Waldman, 2002), temperament and personality (e.g., Giovanelli, & Walsh, 1998; Keenan, Shaw, Delliquadri, Miller & Lynam, 2001), as well as biological factors such as resting

heart rate (Raine, 2002) in aggressive behavior. Ecological contexts, including culture, community and family, are also assumed to play a role in the development of childhood aggression (Dodge, Coie, & Lynam, 2007). For example, Bandura (1973) theorized that aggressive behavior develops through social learning processes, which includes imitation of aggressive models and reinforcement of aggressive acts (both directly and through observational learning). Consistent with Bandura's arguments, for example, viewing violence on television has been shown to account for 10% of the variance in child aggression (Wood, Wong, & Chachere, 1991). A full review on the research regarding the varying determinants of individual differences in aggression can be found in Dodge, Coie and Lynam's (2007) chapter on aggression and antisocial behavior in youth.

One growing area of aggression research is the influence of neuropsychological factors, such as verbal ability, spatial deficits, and executive functioning on aggressive behavior and development. Although the role of neuropsychological factors in aggression has been explored in for centuries (e.g., Rush, 1812), recent advances in our understanding of the human brain has lead to a number of studies exploring its links to our behaviours, including aggression. As described below, there is compelling evidence that some physically aggressive children show impairment in areas of executive functioning (Lynam & Henry, 2001).

Executive Functioning

Executive functioning (EF) describes a set of cognitive abilities that control and regulate other abilities and behaviour (Gioia, Isquith, Kenworthy, & Barton, 2002). It is a widely recognized as an "umbrella term" that refers to a collection of different capacities that are necessary for goal-directed behavior (Welsh, 2002). The term encompasses such necessary skills as the ability to start and stop actions, to organize and to plan future behavior when faced with

new tasks and situations (Gioia et al., 2002; Isquith, Crawford, Epstey, & Gioia, 2005; Mahone et al., 2002). An individual's EF skills allow for the anticipation of potential outcomes, as well as adaptation to changing situations as dictated by the environment. Responsible for most multifaceted behaviours, EFs are intrinsic to the ability to respond in an adaptive manner to novel or unexpected situations. They are also the basis of many cognitive, emotional and social skills (Lezak, Howieson, & Loring 2004).

Though research on EF is relatively new, studies to date underscore the importance of EFs in successful academic, social and behavioral functioning (Anderson, 1998; Diamond, 2006; Lezak et al., 2004; Miller & Cohen, 2001; Stuss & Alexander, 2000; Welsh, 2002). While cognitive abilities such as fluid reasoning (which is one's capacity to think logically and solve problems in novel situations, independent of acquired knowledge) and crystallized knowledge (which is one's general knowledge and skills that are accumulated over a lifetime) determine the content-related knowledge required for goal attainment (Cattell, 1987), EFs determine the strategies an individual uses to ensure a goal is met (Lezak et al., 2004). Conversely, difficulty determining appropriate goal-related strategies can result in a host of developmental challenges, including social difficulties (Carlson, 2005; Riggs et al., 2007), challenging behavior (Barker et al., 2007; Riggs, Blair, & Greenberg, 2001), and mental health problems (Pennington & Ozonoff, 1996; Powell & Voeller, 2004; Zelazo & Mueller, 2002).

Effective EF has been implicated in nearly all aspects of childhood success, and has substantial predictive power for childhood outcomes related to academics (e.g. Blair & Razza, 2007; Bull, Espy, & Wiebe, 2008; Martel, Nigg, Wong, Fitzgerald, Jester et al., 2007), social-emotional functioning (Carlson, 2005; Riggs, Jahromi, Razza, Dillworth-Bart, & Mueller, 2007), behavior (Barker, Seguin, White, & Bates, 2007), and mental health outcomes (Baron, 2004;

Pennington & Ozonoff, 1996; Powell & Voeller, 2004). The absence of well-developed EF skills is implicated in numerous childhood mental disorders such as Attention-Deficit Hyperactivity Disorder, Autism Spectrum Disorder, Specific Learning Disabilities and Conduct Disorder, in both clinical and community based samples (e.g., Castellanos, Sonuga-Barke, Milham, & Tannock, 2006; Giancola, Mezzich, & Tarter, 1998; Lueger & Gill, 1990; Moffitt, 1993; Willcutt, Doyle, Nigg, Faraone, & Pennington, 2005). Poor EF skills have also been linked to poor social competence in school-aged children (Nigg, Quamma, Greenber, & Kusche, 1999; Clark, Prior, & Kinsella, 2002). Even when other cognitive functions are intact and functioning within the normal range, poor EF has significant implications for a child's success (Damasio, 1994).

There is some debate within the research literature as to whether EF is a unitary construct or a multidimensional construct with interrelated, yet distinct, processes (Juarado & Rosselli, 2007; Senn, Espy, & Kaufmann, 2004). Miyake et al. (2000) argue that EF has both an overarching unitary source, under which there are three components: Shifting (the ability to switch between different tasks), Updating (continuous monitoring and quick addition or deletion of contexts within working memory) and Inhibition (the ability to override initial responses within a situation). The general consensus within the literature is that EFs are multidimensional (Morgan & Lilienfeld, 2000). A recent validation of the commonly used EF rating scale, the BRIEF supported the notion of EF as a multidimensional construct (Duku & Vaillancourt, 2014). The number of specific EFs, however, tends to be age-dependent, since EFs grow and develop as an individual ages (Shing, Lindenberger, Diamond, Li, & Davidson, 2010).

Zalazo and colleagues have further argued that EFs can be divided into two main categories, "hot EFs;" which include emotional regulation and inhibition, and "cool EFs" which

are more cognitive in nature, and include working memory, attention and flexibility (Happaney, Zelazo, & Stuss, 2004; Zelazo et al., 2004; Zelazo & Mueller, 2002). “Cool EFs” are thought to be related to cognition, and are less activated by contextual forces, whereas “hot EFs” are associated with emotions, and uncertain “real-life” situations that are ambiguous in nature. Seguin (2004; Seguin & Zelazo, 2005) proposes that “hot EFs” are related to physical aggression in children (Seguin, 2004; Seguin & Zelazo, 2005). It is important to note that whether an EF is considered “hot” or “cold” depends on the context of the situation. For example, inhibition can be “cold,” as in the context of a Stroop Test, as well as “hot,” as in the context of trying to withhold aggression when a peer has insulted you. Given the marked sex differences that have been documented in criminal acts, as well as externalizing pathologies that are disinhibitory in nature, one might expect sex differences in the EFs underlying aggression (Paschall & Fishbein, 2002). However, overall sex differences appear to be absent, weak or inconsistent on EF tasks. (Dianmantopoulou, Rydell, Thorell & Bohlin, 2007; Dodge et al. 2007). In the next section, research exploring the links between aggression and EF is reviewed.

Physical Aggression and Executive Functioning

Poor EF skills have been consistently linked to physically aggressive behaviours throughout childhood (Seguin et al., 1999). Seguin (2008) suggests that EF deficits put individuals at risk for engaging in aggression because they decrease one’s ability to generate socially appropriate behavior when placed in taxing circumstances. In support of this theory is the well-documented decline in aggression that occurs from early to middle childhood, which coincides with increasing EF skills (Seguin & Zelazo, 2005; Diamond, 2002). There have been several studies that have identified links between poor executive functioning and physically

aggressive behaviours in children ranging from preschool age through to adolescence (e.g., Ciairano et al., 2007; Lewis et al., 2007; Seguin et al., 1995,1999; White et al., 2013)

EF impairments are thought to facilitate physical aggression through the lack of inhibitory control, as well as a lack of flexibility in responding, and difficulty in planning and self-monitoring (Hawkins & Trobst, 2000). Longitudinal studies have shown that EF deficits are associated with the stability and continuity of conduct problems (Seguin et al., 1995). Specifically, Seguin et al. (1995, 1999) found that stably aggressive boys, aged 13-15 years, performed more poorly on working memory related tasks, compared to other boys. A meta-analysis by Morgan and Lilienfeld (2000) found a robust relation between antisocial behavior and EF deficits. Additionally, studies have linked poor inhibition with higher levels of physical aggression in middle childhood (Atkins & Stoff, 1993; Jones, 2007). Poor executive attention and self-regulation have also been linked to higher levels of physical aggression in clinical populations of all ages, specifically, children diagnosed with Attention-Deficit Disorder (Barkley, 1997).

These results have also been shown true of younger children. Hughes, White, Sharpen, and Dunn (2000) found that angry and antisocial behaviours in preschool children were related to poor performance on particular EF tasks, most notably inhibitory control and planning. Recently, Kozey (2014) also found that proactive physical aggression in kindergarten students, both boys and girls, was significantly associated with weaknesses in both “cold” and “hot” EFs, specifically, visual spatial working memory, attentional inhibition, flexibility and shifting. Taken together, these findings suggest that neuropsychological dysfunction in EF is linked to early onset and persistent physically aggressive behaviours. One goal of the present study was to replicate and extend the research on sex differences in the links between EF and physical

aggression by considering a younger age group, in order to determine if there is developmental continuity of the relationship between EF deficits and physical aggression. Additionally, the present study considers informant ratings of EF, as opposed to more in-depth and time-consuming direct assessments of EF, as used by Kozey (2014), are reliably linked to physical aggression.

Relational Aggression and Executive Functioning

Although links between physical aggression and EF deficits have been firmly demonstrated, the links between relational aggression and EF deficits has not been extensively explored. The relationship between EF and relational aggression may be more complex, and different from the relationship between EF and physical aggression. Conceptually, relational aggression is considered to be a cognitively complex behavior (Andreou, 2006), particularly when compared to physical aggression, which is often reactive in nature, and tied to poor inhibitory control (Atkins & Stoff, 1993; Hughes et al., 2000; Jones, 2007). Scholars have argued that relational aggression often requires more skilled social manipulation on the part of the aggressor, making strong EF skills beneficial in a relationally aggressive child (Heilbron & Prinstein, 2008; Pellegrini & Roseth, 2006; Vaughn, Vollenweider, Bost, & Snyder, 2003). Relational forms of aggression such as social exclusion often require a manipulation of the mental states and beliefs of others in the form of gossip, rumors and lies, which is arguably complex in nature. Sutton, Smith, and Swettenham (1999) argue that many children who use relational aggression in bullying can accurately process social information and use this skill to their advantage. In fact, relational aggression has been found to be positively correlated with peer-rated social intelligence in groups of 8-, 12- and 14-year-olds, whereas physical and verbal aggression were not (Kaukiainen et al., 1999). Overall, conceptually, it would be expected that

strong EF skills, particularly good planning and inhibitory control, might be a necessary element of successful relational aggression.

There has been only one study, a recent, unpublished dissertation by Kozey (2014), which has empirically examined the relationship between EF and relational aggression. In a sample of kindergarten children, using direct assessments of a broad range of different EF skills and teacher assessments of relational aggression, Kozey found the relationship between proactive relational aggression, as rated by teachers, and direct assessments of EFs to be sex-specific. Girls high in proactive relational aggression demonstrated strengths in verbal working memory and planning, compared to girls or boys with low levels of proactive relational aggression. For boys, no substantial pattern of linkages was observed between increased proactive relational aggression and EFs. These results suggest that sex may differently impact the role of EF in the development of aggression and EF may underlie some of these sex differences.

Research Questions and Hypotheses

Results of the Kozey (2014) study indicate that the relationship between EF and subtypes of aggression is different for boys and girls, and requires replication. It is important to understand whether EF may be differentially important in the emergence of aggressive behavior for girls and boys. The present study extends Ostrov and Golemski's (2010) model by proposing potential mechanisms through which sex differences in aggression may occur, extends Kozey's (2014) findings to a younger age range, and evaluates the utility of using different informant ratings to assess EF, which is more efficient and practical, and purportedly taps similar processes as those assessed using more direct performance measures of EF. Specifically, whereas Kozey assessed EF in terms of direct measures, completed by the children themselves with a trained professional over several hours, the present study used parent and teacher evaluations of

children's EF, which are commonly used in clinical settings. Furthermore, a relatively quick parent/teacher evaluation such as the BRIEF, which takes approximately 20 minutes to complete, is preferable to direct child measures, which can take hours, in terms of ease of completion. If a parent/teacher evaluation can serve as an accurate proxy for the more involved but direct measures, this could make for more efficient screening of children to allow for early identification of risk and intervention. Finally, the younger age range of the subjects included in the present study also allows for an exploration of whether these sex differences are identifiable in preschool-aged children, which has not been studied before. Preschool evaluations could make for more effective screening prior to official school entry.

A secondary focus of this study was to further examine some of the measurement issues related to capturing EF skills and aggression. Specifically, the present study allows for a comparison of parent versus teacher ratings of EF in terms of descriptive utility, which is of interest due to the relatively low inter-rater reliability documented in previous studies of the psychometric properties of the BRIEF-P (Gioia, Espy, & Isquith, 2003), the measure used in the current study (see Methods section below)

The present study attempts to answer the following research questions, in order to contribute to gaps in the literature:

Research Question # 1: Do male and female children differ in terms of their physical and relational aggression levels?

Replicating previous research (Broidy et al., 2003; Crick et al., 1997; Stranger et al., 1997), male children were expected to be more physically aggressive than female children, according to both parent and teacher reports. It is likely that these differences will not have a large effect size, due to the young age of the subjects, as girls have been found to be more physically aggressive in

younger years (Dodge, Coie, & Lynam, 2007). The Gender Linked Model of Aggression would predict that male children would be more physically aggressive, and female children would be more relationally aggressive (Ostrov & Godleski, 2010). Thus, it is also expected that girls will be more relationally aggressive than boys. Although sex differences in relational aggression have not been consistently observed in the literature (e.g., Campbell et al., 1997; Bjorkqvist et al., 1994; Crick et al., 1997; McEvoy et al., 2003), there have been several studies that have found that girls are more relationally aggressive than boys (e.g., Bjorkqvist et al., 1992; Owens, 1996; Salmiavalli, Kaukianen & Lagerspetz, 2000, Crick et al., 1997; Vaillancourt et al. 2005).

Research Question #2: Do parents and teachers differ in their ratings of children's executive functioning? Which group of raters is more predictive of physical and relational aggression?

Given the low inter-rater reliability reported in studies of the BRIEF-P (Gioia Espy & Isquith, 2003) (discussed in more detail in the methods section), it was expected that parents and teachers would differ in their ratings of children's EF. Specifically, there may be more EF demands in the classroom context, and more opportunities for EF difficulties to be observed by teachers.

Additionally, the interactions between the children in the classroom setting could provide unique opportunities to observe difficulties with inhibition and emotional control. Teachers are also exposed to many different children of varying EF capabilities, thus may be more discriminating in their assessment of EF. As such, it was hypothesized that teachers' ratings of EF would be more informative regarding the relational and physical aggression of the child participants than parent ratings. Past studies have shown that teachers tend to be as accurate, if not more accurate than parents in rating children's behaviours (e.g., Wochos, Semerjian, & Walsh, 2014; Verulst, Koot, & Van der Ende, 1994). Convergent validity of the BRIEF-P parent and teacher ratings

and Child Behaviour Checklist scales (Achenbach & Rescorla, 2000) examined by Duku and Vaillancourt (2014) has indicated that *both* parent and teacher BRIEF-P ratings showed good convergent validity with related constructs such as attention problems (with working memory), aggression (with inhibition) and emotional reactivity (with emotional control).

Research Question # 3: Do male and female children who are high in physical aggression differ in terms of executive functioning abilities?

Based on previous research (e.g., Hawkins & Troubst, 2000; Hughes et al., 2000; Kozey, 2014; Morgan & Lilienfeld, 2000; Seguin et al., 1999;), it was expected that physically aggressive children would be rated as demonstrating lower EF, particularly with regard to the “hot EF’s” (i.e., inhibition, shifting and emotional control), but also in terms of “cool EF’s” (i.e., working memory and planning/organization). Following Kozey (2014), it was expected that this pattern of relationships would be similar for boys and girls. Of additional interest was whether such differences were evident when behaviour and EF were evaluated by parents versus teachers, who observe children’s behavior and functioning in distinct contexts.

Research Question # 4: Do male and female children who are high in relational aggression differ in terms of executive functioning abilities?

There is less research in this area upon which to base predictions. Kozey (2014) found sex differences in the relationship between relational aggression and EF. Girls (but not boys) high in relational aggression demonstrated strengths in “cool EFs” compared to girls and boys with low levels of relational aggression. If Kozey’s results are replicated, no links between relational aggression and executive functioning are expected for boys, but girls who are high in relational aggression were expected to have relatively stronger “cool EFs” (i.e., working memory and planning/organization). It is important to note that the BRIEF-P measure is designed to detect

weakness, and thus a higher score on the BRIEF-P simply points to the absence of a weakness, and not a “strength.”

Chapter 3: Methodology

The present study examined the relationship between EF and both physical aggression and relational aggression in young children, with particular interest in whether these relationships are moderated by sex. Data for the study was collected as a part of a research project conducted by Dr. Tracey Vaillancourt in 2004-2005 at McMaster University. Forty preschools in the Hamilton, Ontario area took part in the study. Parents and teachers of students in these preschools were recruited, and teachers were compensated 5 dollars per completed questionnaire. Recruitment documents are included in Appendix A. Ethics approval was received at McMaster University and the data (anonymized) were used secondarily for the purposes of the present study. Ethics approval for secondary use of these data was obtained from the University of British Columbia behavioural research ethics committee.

Participants

Participants included 433 preschool children (230 male, 203 female), aged 25 to 74 months, with a mean age of 41 months ($SD = 8.1$ months). English was the primary language reported for 75.9% of the participants, and 85% were born in Canada. The socioeconomic status of the sample was estimated using parent self-reports of family yearly income, as well as highest level of education obtained. Socio-economic status in the proposed study was considered to be slightly higher than the Canadian population (Human Resources and Skills Development Canada, 2012).

Table 3.1
Demographic Characteristics of Participants

Characteristic	N	Percentage ¹
Age (in months)		
25-30	29	6.7
31-36	115	26.6
37-42	102	23.6
43-48	117	27
49-54	46	10.6
55-60	12	2.8
61-66	8	1.8
66-71	4	0.9
72-74	1	0.2
Highest Education Level		
Some High School	23	5.3
High School Diploma/Equivalent	35	8.0
Some trade/technical/vocational or business college	14	3.2
Some community college, CEGEP, or nursing school	20	4.6
Some university	12	2.8
Diploma	93	21.3
Trade certificate	23	5.3
Bachelor or undergraduate degree	89	20.4
Masters degree	19	4.4
Degree in medicine, dentistry, law, optometry or veterinary	8	1.8
Doctorate degree	5	1.1
Household Income		
Less than 10,000	21	4.8
Between 11,000 and 30,000	55	12.6
Between 31,000 and 50,000	40	9.2
Between 51,000 and 70,000	57	13.0
More than 71,000	157	36.0

¹ Percentages were rounded and thus do not always add to 100

Procedure

As part of a larger study, parents and teachers completed an extensive set of questionnaires regarding their child/students. For the present study, data on demographic information, as well as the child's mental health, physical and relational aggression levels, and executive functioning were considered, as described below. The specific questionnaires used in the study were not reproduced in this paper due to copyright law. Parents and teachers of the child participants completed the questionnaires.

Measures

Demographic information. Parents completed a demographics questionnaire that included questions regarding their level of education, current employment, household income, primary language, ethnic/cultural heritage, age and marital status (see Appendix B for a copy of the questionnaire). These data were used for descriptive purposes.

Behaviour Rating Inventory of Executive Function- Preschool. The Preschool version of the Behaviour Rating Inventory of Executive Function (BRIEF-P; Gioia Espy & Isquith, 2003) was used to assess children's EF skills, as observed by parents and teachers. The BRIEF-P is a rating scale that is designed to measure EF in children aged two years to five years and eleven months. The BRIEF-P is completed by parents, teachers and/or caregivers in the context in which the child's behaviour occurs (e.g., at home, at daycare). All items are scored on a scale of 1 (never), 2 (sometimes), and 3 (always). The instrument was developed conceptually so that the items in each subscale reflect the intended domain of EF, with higher scores indicating a greater degree of maladjustment (e.g., a higher score on the "inhibition" subscales indicates poor inhibition, a higher score on the "shifting" subscale indicates the subject has difficulty with shifting appropriately). The domains of EF were defined on the basis of theory, clinical practice

and research (Gioia et al., 2003). The BRIEF-P is used extensively, particularly within clinical settings, as an indirect measure of children's EF capabilities.

The BRIEF-P includes 63 items that yield five clinical EF subscales: Inhibition (16 Item), Shifting (10 items), Emotional Control (10 items), Working Memory (17 items), and Planning/Organization (10 items). The Inhibition scale measures the child's ability to resist impulses, and to stop his/her behaviour when inappropriate. The Shifting scale measures the child's ability to adjust quickly to changing circumstances (e.g., demands of a problem, activity etc.). The Emotional Control scale measures the child's ability to appropriately adjust or manage emotional responses. The Working Memory scale measures the child's capacity to hold information in their mind, as well as manipulate the information in some manner (e.g., one's ability to remember complex directions). The Planning/Organization scale measures the child's ability to manage task demands (both current demands, as well as anticipated future demands), such as anticipating future steps, implementing instructions, as well as organizing materials appropriately.

The developers of the tool report good internal consistency (0.80 to 0.97) and test retest reliability (0.65 to 0.94) for the five subscales. Inter-rater reliability across parent and teacher raters was reported to be low, ranging from 0.06 for the Planning/Organization scale to 0.28 for the Shift scale (Gioia et al., 2003). Thus, parents and teachers do not necessarily agree regarding EF ratings, which could reflect differences in observers, or different contexts in which the children are being observed. This speaks to the need to consider and compare parent and teacher evaluations of EF. In terms of validity, as mentioned above, convergent validity of the BRIEF-P parent and teacher ratings and CBCL scales examined by Duku and Vaillancourt (2014), suggested that *both* parent and teacher BRIEF-P ratings showed good convergent validity with

related constructs such as attention problems (with working memory), aggression (with inhibition) and emotional reactivity (with emotional control).

BRIEF-P Multidimensional Factor Structure (Duku & Vaillancourt, 2014). The BRIEF-P has received some criticism in the field, as it has been shown to have limited construct validity (e.g., Anderson, Anderson, Northam, Jacobs, & Mikiewicz, 2002). Recently, Duku and Vaillancourt (2014) examined the psychometric properties and measurement structure of the BRIEF-P using parent and teacher reports of a sample of toddlers. Results of their analyses indicated that the BRIEF-P had good internal consistency and convergent validity, but the measurement models examined exhibited poor fit statistics and showed that the EF construct was not unidimensional but multidimensional with inter-related sub-constructs. Further analysis demonstrated that three scales, Emotional Control, Planning/Organization and Working Memory, were unidimensional and invariant across informant (i.e., parent/teacher). The two other scales, Inhibition and Shifting, were multidimensional and differed across informants. Specifically, the Inhibition scale could be split into two sub-scales (Inhibition 1 and Inhibition 2), and the Shifting scale could be split up into three sub-scales (Shifting 1, Shifting 2 and Shifting 3). A comparison of the original BRIEF-P structure and the revised structure is presented below in Table 3.5. Duku and Vaillancourt's analyses were performed at the item level, which is superior to using item parcels, and likely represents a more accurate factor structure of the rating scale components. In the present study, parent and teacher ratings of EF were assessed using both the original and the revised set of subscales (see Table 3.5) in order to determine which scales/subscales best predict preschool children's aggressive behavior. The factor structure of the BRIEF-P was examined in the present sample, in order to verify which factor structure (original BRIEF-P or the revised structure proposed by Duku and Vaillancourt) best fit the data obtained for the present study.

Differences between parent and teacher ratings were a secondary research focus.

Table 3.2

Comparison of BRIEF-P Structure and Revised BRIEF-P Structure (Duku & Vaillancourt, 2014)

BRIEF-P Scale	Description	Example Item	Revised BRIEF –P Structure (Duku & Vaillancourt 2014)	Description	Example Item
<i>Inhibition (16 Items)</i>	The ability to resist impulses and stop one’s behavior at an appropriate time	“Gets out of control more than playmates.”	<i>Inhibition 1 (4 Items)</i>	Inhibition related to the reactions of others	“Unaware of how behavior affects others”
			<i>Inhibition 2 (11 Items)</i>	Behaviour related inhibition	“Is impulsive”; “becomes too silly”
<i>Shifting (10 Items)</i>	Ability to make transitions, and tolerate changes in schedule, plans or people. Additionally, the ability to switch attention/focus from one topic to another easily.	“Is upset by a change in plans or routine.”	<i>Shifting 1 (5 Items)</i>	Routine related shifting	“Is upset by a change in plans or routine”
			<i>Shifting 2 (4 Items)</i>	People-related shifting	“Has trouble adjusting to new people”
			<i>Shifting 3 (5 Items)</i>	Environment related shifting	“Acts overwhelmed or over stimulated in busy situations.”
<i>Emotional Control (10 items)</i>	Regulation of one’s emotions	“Overreacts to small problems.”	<i>Emotional Control (10 Items)</i>	Same as BRIEF –P	
<i>Working Memory (17 Items)</i>	The capacity to hold information in mind to complete a task, encode information or generate goals.	“Given two things to do, only remembers the first or the last.”	<i>Working Memory (17 Items)</i>	Same as BRIEF –P	
<i>Planning/Organization (10 Items)</i>	Setting goals and reaching them, through a series of steps, as well as bringing order to activities, information, materials or the environment.	“When cleaning up, puts things away in a disorganized way.”	<i>Planning/Organization (10 Items)</i>	Same as BRIEF –P	

Social Behaviour and Experience Questionnaire (Crick and Grotpeter, 1995). This questionnaire, adapted from Crick and Grotpeter (1995), was used to assess children’s physical and relational aggression. This measure is a well-recognized measure that has been used extensively in previous aggression research. Physical aggression was measured with three items (*gets into many fights, physically attacks people, and kicks and bites other children*) and relational aggression was measured with five items (*when mad at someone: tries to get others to*

dislike that person, becomes friends with another as a form of revenge, says bad things behind the other's back, says lets not be friends with him/her, and tells the other one's secrets to another person). Parents and teachers were asked to rate behavior on a three-point, Likert Scale (0 = never, 1 = sometimes, 2 = often). The scores on relevant items were then totaled, with higher scores indicating higher levels of physical and relational aggression.

Chapter 4: Results

Overview of Analyses

The archival data was analyzed using SPSS 210.0 (IBM Corporation, 2012). The psychometric quality of the measures was examined, followed by correlational analyses to evaluate the relationships among variables. Standard multiple regression analyses were conducted to assess whether various EF skills (as assessed by the standard BRIEF-P, or, the revised BRIEF-P factor structure by Duku and Vaillancourt, 2014), as rated by parents and teachers, predicted a child's level of physical and/or relational aggression.

Initial analyses examined the psychometric quality of the measures used in this study, including the internal consistency of the scales/subscales derived from the original BRIEF-P factor structure (Inhibition, Shifting, Emotional Control, Working Memory and Planning/Organization), and the eight subscales derived from the factor structure presented by Duku and Vaillancourt (2014) (Inhibition I, Inhibition II, Shifting I, Shifting II, Shifting III, Emotional Control, Working Memory and Planning/Organization). The internal consistency of the composites for relational aggression and physical aggression were also examined. For both EF and aggression measures, Cronbach's alpha (Cronbach, 1951) was used to assess the internal consistency of each scale/subscale.

Next, correlational analyses (Pearson Product Moment correlations) were conducted to evaluate the relationships among the variables of interest. Of particular interest were correlations between parent and teacher ratings of aggression, correlations among the original and revised BRIEF-P subscales, and correlations between ratings of physical and relational aggression.

Next, a series of t-tests were conducted to explore sex differences in all variables of interest. In addition, in order to compare parent and teacher ratings of each participant, a series of

repeated measures ANOVAs were performed on all of the variables (All BRIEF-P scales, Physical Aggression, and Relational Aggression). Descriptive analysis included inspection of variable means, variability and inter-correlations between cognitive and executive function variables.

The primary research questions were investigated using standard multiple regression analyses to assess whether various executive functioning skills (EF skills as assessed by the standard BRIEF-P or the revised BRIEF-P factor structure proposed by Duku and Vaillancourt, 2014), as rated by parents and teachers, predicted a child's level of physical and/or relational aggression. Based on the results of preliminary analyses (described in more detail below), separate analyses were conducted for boys and girls and for parent and teacher ratings.

Reliability Analysis

The internal consistency of all measures were analyzed using the Cronbach's alpha coefficient. Internal consistency is considered good if the Cronbach's alpha is above .7 (DeVillis, 2003), which was the case for all but two of the measures used in this study, for both parent and teacher informants. The exceptions were the parent relational aggression composite, which had an internal consistency of .64, and the Shifting III subscale with an internal consistency of .69, both of which are considered acceptable for research purposes. The original BRIEF factor structure was noted to have higher internal consistency than the Duku and Vaillancourt (2014) revised factor structure. Tables 4.1 and 4.2 present the variable means, standard deviations and reliabilities for all study variables.

Sex Differences

Preliminary analyses explored sex differences for all variables included in the present study using independent t-tests comparing male and female participants. The results are presented in Tables 4.1 and 4.2 below, for parent and teacher assessments, respectively.

Aggression. As expected, a significant sex difference was observed for physical aggression, as rated by both parents and teachers, both of whom rated boys as more physically aggressive than girls. There were no significant differences between boys and girls in terms of relational aggression, as rated by either parents or teachers. These results are consistent with research indicating that boys are more physically aggressive than girls, but are equally relationally aggressive. (e.g., Crick & Grotpeter, 1995; Rys & Bear, 1997).

Executive Functioning. In terms of sex differences on the EF measures, there were several differences noted by both parents and teachers. On the BRIEF-P revised factor structure (Duku & Vaillancourt, 2014), both parents and teachers rated boys as having greater difficulty than girls on the Inhibit 1 and Inhibit 2 subscales, the Shift 1 and Shift 3 subscales, the Emotional Control subscale, the Working Memory subscale and the Plan/Organize subscale. Neither parent nor teacher ratings on the Shift 2 subscale differed significantly across boys and girls. Similarly, boys were rated as having greater difficulty on almost all of the scales of the BRIEF-P when subscales based on the original factor structure were considered (Gioia et al., 2003). Specifically, both teachers and parents rated boys lower on the Inhibit, Emotional Control, Working Memory and Plan/Organize subscales. No significant sex differences were observed on the Shift subscale, as rated by parents, although teachers rated boys as having significantly more difficulty in shifting than girls. Overall, these results suggest that boys were generally viewed as having

more difficulty with executive functioning tasks, with the exception of their capacity for shifting (see Tables 4.1 and 4.2 below).

Table 4.1

Sex Differences in Parent Ratings

Measure	<i>Boys</i>			<i>Girls</i>		<i>Sex Differences</i>	
	Cronbach's Alpha	Mean	Standard Deviation	Mean	Standard Deviation	T-Test	Significance
Physical Aggression Composite	.79	0.55	0.48	0.34	0.44	$t(327) = -4.03$	$p < 0.00***$
Relational Aggression Composite	.64	.10	.20	.09	.19	$t(317) = -0.16$	$p = 0.87$
Duku and Vaillancourt (2014) Factor Structure							
Inhibit I	.76	7.37	1.79	6.62	1.96	$t(342) = -3.68$	$p < 0.00***$
Inhibit II	.86	19.69	5.07	16.64	3.70	$t(335) = -5.47$	$p = 0.00***$
Shift I	.77	7.35	2.23	6.55	3.70	$t(340) = -3.10$	$p < 0.00***$
Shift II	.80	6.12	1.98	6.03	1.92	$t(344) = 0.59$	$p = 0.55$
Shift III	.69	7.17	2.03	6.39	1.54	$t(339) = 3.45$	$p = 0.01**$
Emotional Control	.85	17.34	4.59	16.52	4.03	$t(343) = -2.32$	$p = 0.02*$
Working Memory	.90	24.49	6.33	22.46	4.79	$t(327) = 3.60$	$p < 0.00***$
Plan/Organize	.79	15.04	3.53	13.61	3.89	$t(340) = -2.96$	$p < 0.00***$
BRIEF-P Original Factor Structure							
Inhibit	.95	25.96	6.09	22.92	5.19	$t(340) = -4.98$	$p < 0.00***$
Shift	.82	14.79	4.11	14.01	3.74	$t(434) = -1.84$	$p = 0.07$
Emotional Control	.93	15.88	4.05	15.02	3.48	$t(342) = 2.11$	$p = 0.03*$
Working Memory	.95	24.51	6.39	22.31	4.58	$t(324) = -3.70$	$p < 0.00***$
Plan/Organize	.92	14.17	3.56	14.15	2.92	$t(339) = -1.84$	$p < 0.00***$

Note. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4.2

Sex Differences in Teacher Ratings

Measure	<i>Boys</i>			<i>Girls</i>		<i>Sex Differences</i>	
	Cronbach's Alpha	Mean	Standard Deviation	Mean	Standard Deviation	T-Test	Significance
Physical Aggression Composite	.87	.60	.61	.32	.51	$t(409) = -5.17$	$p < 0.00***$
Relational Aggression Composite	.81	.12	.27	-.18	.31	$t(379) = -1.9$	$p = 0.57$
Duku and Vaillancourt (2014) Factor Structure							
Inhibit I	.89	6.80	2.53	5.52	1.94	$t(410) = -5.80$	$p < 0.00***$
Inhibit II	.93	17.33	5.90	14.11	4.26	$t(407) = 6.25$	$p < 0.00***$
Shift I	.84	6.86	2.40	6.07	1.89	$t(411) = -3.40$	$p < 0.00***$
Shift II	.83	5.85	2.19	5.56	1.82	$t(419) = 0.70$	$p = 0.48$
Shift III	.77	6.80	2.20	6.06	1.76	$t(412) = -4.09$	$p < 0.00***$
Emotional Control	.93	14.75	5.29	13.38	4.21	$t(412) = 3.47$	$p < 0.00***$
Working Memory	.95	26.15	8.40	22.09	6.91	$t(414) = -5.50$	$p < 0.00***$
Plan/Organize	.87	15.63	4.93	13.60	3.89	$t(406) = 4.90$	$p < 0.00***$
BRIEF-P Original Factor Structure							
Inhibit	.95	25.61	8.66	20.98	6.10	$t(390.00) = -6.31$	$p < 0.00***$
Shift	.82	13.91	4.41	12.86	3.51	$t(404.50) = -2.68$	$p < 0.00***$
Emotional Control	.93	14.89	5.31	13.37	4.14	$t(402.75) = -3.24$	$p < 0.00***$
Working Memory	.95	25.88	8.26	22.03	6.80	$t(405.70) = -5.18$	$p < 0.00***$
Plan/Organize	.92	15.49	4.99	14.47	3.69	$t(396.61) = -4.71$	$p < 0.00***$

Note. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Parent vs. Teacher Ratings

Paired sample t-tests were conducted to determine whether parent and teacher ratings of children's physical and relational aggression and executive functioning were comparable. The results are presented in Table 4.3 below. No significant differences were observed between parent and teacher ratings of children's physical aggression. However, teachers rated the children as significantly more relationally aggression than did parents. In terms of parent and teacher differences in ratings of EF using the original BRIEF-P factor structure, no significant differences were observed between parent and teacher's ratings on the Working Memory scale or Plan/Organize scale, although parents rated children significantly higher (i.e., having more difficulty) on the Inhibit, Shift and Emotional Control scales than did teachers, regardless of whether the revised (Duku & Vaillancourt, 2014) or original factor structure of the BRIEF-P was considered. Given these statistically significant differences, parent and teacher ratings were analyzed separately in subsequent analyses.

Table 4.3

Parent and Teacher Means and Standard Deviations of Rating Scale Results

Measure	Parent		Teacher	
	Mean	Standard Deviation	Mean	Standard Deviation
Physical Aggression Composite	0.44	0.45	0.41	0.55
	0.089	0.18	0.15	.29
Relational Aggression Composite				
Duku & Vaillancourt (2014) Factor Structure				
Inhibit I	6.94	1.87	6.28	2.40
Inhibit II	16.63	4.22	16.05	5.56
Shift I	6.97	2.05	7.60	2.47
Shift II	6.07	2.00	5.69	2.02
Shift III	6.78	1.79	6.46	1.99
Emotional Control	15.51	3.78	14.09	4.74
Working Memory	23.54	5.70	24.16	7.95
Plan/Organize	14.67	3.28	14.63	1.64
BRIEF-P Original Factor Structure				
Inhibit	24.54	5.83	23.51	8.06
Shift	14.41	3.95	13.38	4.00
Emotional Control	15.51	3.78	14.09	4.74
Working Memory	23.54	5.70	24.16	7.95
Plan/Organize	14.67	3.28	14.63	1.64

Table 4.4

Comparison of Parent and Teacher Ratings

Measure	Paired Sample T-Test	Significance Level
Physical Aggression Composite	$t(319) = -0.71$	$p = 0.48$
Relational Aggression Composite	$t(302) = -2.95$	$p < 0.00$ ***
Duku & Vaillancourt (2014) Factor Structure		
Inhibit I	$t(334) = 4.49$	$p < 0.00$ ***
Inhibit II	$t(334) = 1.99$	$p = 0.04$ *
Shift I	$t(336) = 2.81$	$p = 0.01$ **
Shift II	$t(336) = 2.81$	$p = 0.01$ **
Shift III	$t(336) = 2.81$	$p = 0.01$ **
Emotional Control	$t(336) = 4.66$	$p < 0.00$ ***
Working Memory	$t(334) = -1.45$	$p = 0.15$
Plan/Organize	$t(335) = 0.18$	$p = 0.82$
BRIEF-P Original Factor Structure		
Inhibit	$t(342) = 2.46$	$p = 0.02$ *
Shift	$t(342) = 3.80$	$p < 0.00$ ***
Emotional Control	$t(334) = 4.63$	$p < 0.00$ ***
Working Memory	$t(331) = -1.63$	$p = 0.10$
Plan/Organize	$t(333) = 0.22$	$p = 0.22$

Note. * $p < 0.05$, ** $p < 0.01$ level, *** $p < 0.001$

Correlational Analyses

Aggression. Pearson Product Moment correlations (1-tailed) were conducted to examine the overlap of parent and teacher ratings of aggression. As shown in Table 4.4, parent and teacher ratings of both relational and physical aggression were significantly, but not highly correlated, with coefficients of small magnitude observed for ratings of relational aggression, and coefficients of modest magnitude observed for ratings of physical aggression. Given the weak to modest overlap, parent and teacher ratings were considered separately in subsequent analyses.

Table 4.5

Correlations (1-tailed) of Parent and Teacher Ratings of Physical and Relational Aggression

	Parent Ratings		Teacher Ratings	
	Relational	Physical	Relational	Physical
	Aggression	Aggression	Aggression	Aggression
Parent Ratings				
Relational Aggression	1			
Physical Aggression	.15*	1		
Teacher Ratings				
Relational Aggression	.16*	.06	1	
Physical Aggression	-.01	.34**	.15**	1

Note. * $p < 0.05$, ** $p < 0.01$ level

Teacher and Parent ratings of Executive Function. Correlational analyses were conducted to examine the relationships among EF subscales as rated by teachers and parents (considered separately). Results for subscales derived from the original BRIEF-P factor structure are presented in Table 4.5 and Table 4.6 for parent and teacher evaluations, respectively. As seen in the tables, all scales were significantly correlated, as expected, as they are all related to the overarching construct of executive functioning. Working Memory and Plan/Organize were highly correlated for both parents ($r = 0.81$) and teachers ($r = 0.92$).

Table 4.6

Pearson Correlations (1-tailed) for Parent Ratings on the BRIEF-P

	Inhibit	Shift	Emotional Control	Working Memory	Plan/Organize
Inhibit	1				
Shift	.35 **	1			
Emotional Control	.57 **	.59**	1		
Working Memory	.72 **	.41**	.51**	1	
Plan/Organize	.65 **	.39**	.51**	.81 **	1

Note. * $p < 0.05$, ** $p < 0.01$

Table 4.7

Pearson Correlations (1-tailed) for Teacher Ratings on the BRIEF-P

	Inhibit	Shift	Emotional Control	Working Memory	Plan/Organize
Inhibit	1				
Shift	.39 **	1			
Emotional Control	.64 **	.66 **	1		
Working Memory	.79 **	.51 **	.56**	1	
Plan/Organize	.75 **	.50 **	.54 **	.92 **	1

* $p < 0.05$, ** $p < 0.01$

Similar results were obtained regarding the correlations among EF subscales as computed using the more recent, Duku and Vaillancourt (2014) factor structure of the BRIEF-P, as shown in Table 4.7 for parent ratings and Table 4.8 for teacher ratings. As shown in the tables, all subscales were significantly correlated at the $p < 0.001$ level, as expected, as they are all related to the overarching construct of executive functioning. Several scales were highly correlated, suggesting that they may be redundant, particularly the Inhibit 1 and Inhibit 2 subscales and the Shift 1, Shift 2, and Shift 3 subscales, and this was particularly true for teacher ratings.

Table 4.8

Correlations (1-tailed) for Parent Ratings on Duku and Vaillancourt (2014) BRIEF-P Subscales

	Inhibit I	Inhibit 2	Shift 1	Shift 2	Shift 3	Emotional Control	Working Memory	Plan/Organize
Inhibit I	1							
Inhibit 2	0.62 **	1						
Shift I	0.39 **	0.35 **	1					
Shift 2	0.22 **	0.15	0.15	1				
Shift 3	0.42 **	0.42 **	0.66 **	0.56 **	1			
Emotional Control	0.56 **	0.51 **	0.84 **	0.47 **	0.62 **	1		
Working Memory	0.57 **	0.76 **	0.61 **	0.27 **	0.45 **	0.53 **	1	
Plan/Organize	0.51 **	0.66 **	0.40 **	0.26 **	0.40 **	0.51 **	**	1

* $p < 0.05$, ** $p < 0.01$

Table 4.9

Correlations (1-tailed) for Teacher Ratings on Duku and Vaillancourt (2014) BRIEF-P

Subscales

	Inhibit 1	Inhibit 2	Shift 1	Shift 2	Shift 3	Emotional Control	Working Memory	Plan/Organize
Inhibit 1	1							
Inhibit 2	.81 **	1						
Shift 1	.46 **	.40 **	1					
Shift 2	.21 **	.11 **	.77 **	1				
Shift 3	.55 **	.53 **	.86 **	.62 **	1			
Emotional Control	.62 **	.61 **	.68 **	.48 **	.71 **	1		
Working Memory	.76 **	.74 **	.52 **	.28 **	.64 **	.56 **	1	
Plan/Organize	.76 **	.71 **	.58 **	.29 **	.64 **	.55 **	.92 **	1

* $p < 0.05$, ** $p < 0.01$

Subsequent correlational analyses were conducted to evaluate the overlap across the original BRIEF-P subscales and those identified by Duku and Vaillancourt (2014), as reported by teachers (see Table 4.10) versus parents (see Table 4.11). As shown in the tables, the correlations between the original BRIEF-P Inhibit subscale and the Duku and Vaillancourt (2014) revised BRIEF-P Inhibit 1 and 2 subscales were quite high ($r = .85$ to $.98$), which is suggestive of redundancy among the subscales. Similarly, the magnitude of the correlations between the original BRIEF-P Shift subscale and the Duku and Vaillancourt revised BRIEF – P Shift 1, 2 and 3 subscales were also high ($r = .89$ to $.94$), again suggesting redundancy across the measures. Given this overlap, subsequent analyses were conducted only with the original BRIEF-P factor structure, as these subscales demonstrated higher internal consistency, and reflect the indices more commonly considered in both research and practice.

Table 4.10

Correlations (1-tailed) of BRIEF-P Subscales and Duku and Vaillancourt (2014) Revised BRIEF P Subscales – Teacher

	Inhibit 1	Inhibit 2	Shift 1	Shift 2	Shift 3	Emotional Control	Working Memory	Plan/Organize
Original BRIEF-P								
Inhibit	.85 **	.98 **	.43 **	.15 **	.56 **	.64 **	.79 **	.75**
Shift	.42 **	.34 **	.94 **	.89 **	.89 **	.66 **	.51 **	.50 **
Emotional Control	.61 **	.61 **	.68 **	.47 **	.71 **	.99**	.55 **	.54 **
Working Memory	.76 **	.74 **	.52 **	.28**	.65 **	.56 **	.99 **	.91 **
Plan/Organize	.76 **	.70 **	.52 **	.28 **	.64 **	.54 **	.92	.99 **

* $p < 0.05$, ** $p < 0.01$

Table 4.11

Correlations (1-tailed) of BRIEF-P Subscales and Duku and Vaillancourt (2014) Revised BRIEF P Subscales – Parent

	Inhibit 1	Inhibit 2	Shift 1	Shift 2	Shift 3	Emotional Control	Working Memory	Plan/Organize
Original BRIEF-P								
Inhibit	.89**	.98 **	.43 **	.15 **	.56 **	.64 **	.72 **	.69 **
Shift	.42**	.34 **	.93 **	.89 **	.89 **	.66 **	.41 **	.39 **
Emotional Control	.61**	.61 **	.68 **	.47 **	.71 **	.99 **	.52 **	.51 **
Working Memory	.76**	.74 **	.52 **	.28 **	.65 **	.56 **	.99 **	.81 **
Plan/Organize	.76**	.70 **	.12 **	.28	.28 **	.18**	.82 **	.99**

* $p < 0.05$, ** $p < 0.01$

Primary Analyses

The primary purpose of the present study was to explore the relationship between EF and both relational and physical aggression. To this end, a series of simultaneous multiple regression analyses were conducted predicting physical aggression and relational aggression from EF indices as measured by the original BRIEF-P subscales, considering parent and teacher ratings separately, and considering boys and girls separately.

Physical Aggression and Executive Functioning. Regarding parent ratings of EF predicting physical aggression, the results of the regression analysis indicated that the five EF subscales explained 27% of the variance in reported physical aggression for boys, and 11% of the variance for girls. For boys, parent ratings of difficulties with emotional control and inhibition emerged as significant predictors of physical aggression¹. There were no significant individual predictors in parent's ratings of girls. Thus, boys rated as more physically aggressive by their parents were also rated as having difficulties with inhibition and emotion control by their parents. Regarding teacher ratings of EF, results of the regression analysis indicated that the five EF predictors explained 6% of the variance in physical aggression for boys, and 45% of the variance for girls. As was the case for parent ratings, teacher's rated physically aggressive boys as demonstrating poor emotional control, poor shifting and poor inhibition. In teachers' ratings of girls, it was found that difficulties in both inhibition and shifting predicted ratings of physical aggression. These results are summarized in Table 4.12.

Relational Aggression and Executive Functioning. Results of the regression analysis indicated that parent ratings of the five EF subscales explained 9% of the variance in relational aggression for boys and 8% of the variance for girls. Emotional control significantly predicted parent ratings of relational aggression in girls, whereas for boys, emotional control emerged as a marginally significant predictor of relational aggression. Regarding teacher ratings of EF predicting relational aggression, the results of the regression analysis indicated that the five EF predictors explained 11% of the variance in relational aggression for boys, and 12% of the variance for girls. Only teacher ratings of difficulties with inhibition emerged as a significant

^{1 1} The regression analysis presented here are based on raw scores, rather than standardized t-scores. The same analyses were also conducted using t-scores and the results showed no notable differences. Thus, only the raw score results are presented

predictor of relational aggression for boys, whereas difficulties in inhibition, shifting and working memory predicted ratings of relational aggression for girls. These results are summarized in Table 4.13.

Table 4.12

Regression Analysis of Physical Aggression, predicted by BRIEF-P Parent and Teacher Ratings

	R^2	Unstandardized coefficient (β)	Unstandardized coefficient (Standard error)	Standardized coefficient (β)	F	df	t	p
Parent Ratings								
Boys	.268				11.94	5		< 0.00**
Inhibit		0.034	.008	-.007			4.03	0.00 **
Shift		1.001	.010	-.007			-0.007	.939
Emotional Control		0.026	.011	0.218			2.253	0.026 **
Working Memory		-0.009	.010	-.120			-.862	0.390
Plan/Organize		0.005	.018	0.038			0.278	0.782
Girls	.114				3.85	5		0.003 **
Inhibit		0.016	0.010	0.196			1.655	0.100
Shift		-0.009	0.011	-.077			-.846	0.399
Emotional Control		0.022	0.130	0.174			1.616	0.108
Working Memory		0.000	0.011	0.004			0.030	.976
Plan/Organize		0.008	0.017	0.056			0.490	0.625
Teacher Ratings								
Boys	.61				47.99	5		<0.00***
Inhibit		0.05	0.01	0.67			7.40	<0.00***
Shift		-0.43	0.01	-0.32			-4.27	<0.00***
Emotional Control		0.06	0.01	0.52			6.01	<0.00***
Working Memory		- 0.01	0.01	-0.13			-0.89	0.38
Plan/Organize		-0.01	0.02	-0.11			-0.81	0.42
Girls	.435				23.357	5		<0.00**
Inhibit		0.63	0.01	0.74			6.88	<0.00**
Shift		-0.04	0.01	-0.28			-3.06	<0.00**
Emotional Control		0.01	0.01	0.06			0.64	0.53
Working Memory		-0.02	0.01	-0.23			-1.42	0.16
Plan/Organize		0.02	0.02	0.17			1.12	0.27

Note. * $p < 0.05$, ** $p < 0.01$

Table 4.13

Regression Analysis of Relational Aggression, predicted by BRIEF-P Parent and Teacher Ratings

	R^2	Unstandardized coefficient (β)	Unstandardized coefficient (Standard error)	Standardized coefficient (β)	F	df	t	p
Parent Ratings								
Boys	0.85				2.24	5		0.05
Inhibit		0.003	0.004	0.12			0.828	0.41
Shift		0.002	0.005	0.05			0.419	0.68
Emotional Control		0.10	0.006	0.24			1.832	0.07 ^T
Working Memory		-.004	0.005	-.16			-.854	0.40
Plan/Organize		0.003	0.009	0.07			0.371	0.71
Girls	0.08				1.82	5		0.12
Inhibit		0.002	0.005	0.049			.332	0.74
Shift		-.009	0.006	-.173			-1.551	0.12
Emotional Control		0.015	0.007	0.288			2.116	0.03*
Working Memory		-.007	0.006	-.182			-1.222	0.22
Plan/Organize		0.009	0.009	0.150			1.060	0.29
Teacher Ratings								
Boys	0.11				3.824	5		0.00
Inhibit		0.011	0.004	0.39			2.01	0.04*
Shift		0.007	0.006	0.12			1.08	0.28
Emotional Control		0.004	0.006	0.09			0.71	0.48
Working Memory		-0.006	0.006	-0.21			-0.92	0.36
Plan/Organize		-0.006	0.010	-0.12			-0.51	0.56
Girls	0.12				3.60			0.00 **
Inhibit		0.022	0.007	0.46			3.25	0.00 **
Shift		0.018	0.009	0.23			1.97	0.05 **
Emotional Control		-0.01	0.008	-0.02			-0.13	0.90
Working Memory		-0.016	0.009	-0.40			-1.92	0.05 **
Plan/Organize		-0.10	0.015	-0.13			0.68	0.50

Note. * $p < 0.05$, ** $p < 0.01$, ^t $p < .10$, marginally significant

Chapter 5. Discussion

Overview

The primary goal of this study was to evaluate whether variations in executive functioning predicted reported physical and relational aggression differently for preschool-aged boys and girls, replicating and extending previous findings (Kozey, 2014). A secondary focus of the present study was to examine measurement issues related to assessing executive functioning skills and aggression. Specifically, of interest was comparing the relative utility of parent versus teacher ratings of EF, given the relatively low inter-rater reliability documented in previous studies of the BRIEF-P (Gioia, Espy, & Isquith, 2003).

Key Findings for Specific Research Questions

Research Question # 1: Do male and female children differ in terms of their physical and relational aggression levels?

As predicted, a significant sex difference was observed in physical aggression, as rated by both parents and teachers, with boys rated as more physically aggressive than girls. This is consistent with previous aggression research (e.g., Broidy et al., 2003; Crick et al., 1997; Stranger et al., 1997). The Gender Linked Model of Aggression would predict that male children would be more physically aggressive, and female children would be more relationally aggressive (Ostrov & Godleski, 2010). This prediction was supported in the present study for physical aggression but not relational aggression as there were no significant differences observed between boys and girls in relational aggression for either parent or teacher ratings in the current study. Both teachers and parents rated boys to be no more relationally aggressive than girls which is consistent with some research in the field (e.g., Bjorkvist et al., 1994; Campbell et al., 1997; Crick et al., 1997; McEvoy et al., 2003) and inconsistent with research that has identified

girls as more relationally aggressive than boys (e.g., Bjorkqvist et al., 1992; Crick et al., 1997; Owens, 1996; Salmiavalli, Kaukianen & Lagerspetz, 2000, Vaillancourt et al. 2005).

Research Question #2: Do parents and teachers differ in their ratings of children's executive functioning? Which group of raters is more predictive of physical and relational aggression?

The results of the present study indicate that parents and teachers do differ in their ratings of children's executive functioning. While no significant differences were observed between parent and teachers' ratings of Working Memory or Planning/Organization abilities, parents rated their children significantly higher on the Inhibit, Shift and Emotional Control scales when compared to teachers. In other words, parents viewed their children as having more difficulty with inhibition, shifting and controlling their emotions than did their teachers. This result is contrary to what was originally hypothesized, which was that teachers would rate children as having higher levels of dysfunction than parents, given teachers' experience with many different children with varying EF skills over the course of their careers, which might allow for more accurate ratings of such behaviours. One possible reason for this unexpected result is that preschool teachers spend less time with the children per day, and therefore may have less opportunity to observe executive dysfunction. The school setting also provides an external structure that influences the display of executive functions among preschool children. The organization, rules and management strategies established in the preschool classroom, may offer fewer opportunities to observe EF deficits as compared to the unstructured home environment. Additionally, parents have known their children since birth, and may be drawing on earlier developmental contexts to evaluate EF abilities.

The predictive utility of parent and teacher ratings varied by sex. In terms of physical aggression in boys, parent ratings of EF predicted a greater portion of the variance (27%) than did teacher ratings (6%). The opposite result was true for girls. Teacher ratings of EF predicted 45% of the variation in physical aggression, whereas parent ratings predicted 11%. These results suggest that teacher ratings of EF are more predictive of girls' level of physical aggression, whereas parent ratings of EF are more predictive of boys' level of physical aggression. Parent and teacher ratings of EF, in general, were less predictive of relational aggression than physical aggression. Teacher ratings of EF were marginally more predictive of relational aggression than parents.

It is important to note that *parent* ratings of EF predicted parent ratings of aggression, and teacher ratings of EF predicted *teacher* ratings of aggression. In both cases, there are concerns regarding shared method variance. Given that there was minimal overlap in parent and teacher ratings of aggression (see Table 4.4), there are limited conclusions one can make as to predictive utility of aggression as an overarching concept. Parents and teachers may view each child participant in very different ways, which limits the comparison of the two findings.

Although it was hypothesized that teacher ratings would be more predictive of aggression, this was only true for physical aggression in girls, and marginally true of relational aggression in general. This is consistent with previous research that teacher's ratings of children's behavior tends to be as accurate or more accurate than parent ratings (e.g., Wochos, Semerjian & Walsh, 2014; Verulst, Koot & Van der Ende, 1994). These results also emphasize the importance of examining sex differences as well as rater differences when assessing both aggression and executive functioning.

Research Question # 3: Do male and female children who are high in physical aggression differ in terms of executive functioning abilities?

The results of the present study are consistent with previous research indicating that both male and female children who are high in physical aggression show poorer executive functioning, particularly with regard to the “hot EF’s” (i.e., inhibition, shifting and emotional control) (e.g., Hawkins & Troubst, 2000; Hughes et al., 2000; Kozey, 2014; Morgan & Lilienfeld, 2000; Seguin et al., 1999). The present study indicated that emotional control and inhibition were lower in boys who were rated as physically aggressive, according to both parents and teachers, although teachers also rated physically aggressive boys as having more difficulty with shifting. According to teacher ratings, girls who were physically aggressive tended to have difficulty with inhibition and shifting. However, parent ratings indicated that physically aggressive girls did not have more difficulty with any particular executive functioning skill. Consistent with the current study, Kozey (2014) found that both boys and girls who were rated as physically aggressive by teachers had deficits in attention problems, working memory, inhibition and flexibility. Kozey (2014) found only a marginally significant link between inhibition and EF, due to an inadequate ceiling for the age of the study’s sample, which called for replication in future research. As predicated, this link was replicated in the current study. Kozey (2014) did not examine parent ratings of aggression.

However, the current study also indicated that *parent* ratings of physical aggression and EF deficits were different for boys and girls, suggesting that the relationship between sex and EF dysfunction and aggression is sex specific. For boys, difficulty with emotional control and inhibition was related to physical aggression, but for girls, there was no such relationship.

In contrast to results of previous research with kindergarten children by Kozey (2014), parent and teacher ratings of physical aggression were not predicted by deficits in “cold EFs” such as working memory and planning/organization. This result may be due to the measure used to assess executive functioning, which is based on parent/teacher reports, as opposed to objective, standardized assessment measures. Parents and teachers may not have had the opportunity to observe the children in tasks that require cold EFs, as these children are younger than those in Kozey’s (2014) study. The executive functioning demands in a preschool setting versus a kindergarten setting are different, with the academic and behavioral expectations for kindergarten students being greater, thus a higher need for cold EF skills and more opportunity to demonstrate EF dysfunction for a kindergarten student. There may have been less opportunity for parents and teachers to observe cold EF skills within this age group, limiting their exposure to cold EF deficits, and subsequently causing them to rate EF dysfunction as lower. Additionally, the developmental trajectory for different EFs is complex, and significant change occurs between ages 2 to 6 years old, particularly in terms of cold EF skills such as planning and organization. Since EFs grow and develop at different ages (Shing et al., 2010), it may be that some of the cold EFs were not fully differentiated in the younger children of the current sample, resulting in different results than Kozey (2014), where the sample ranged in age from 5 to 6.4 years.

Research Question # 4: Do male and female children who are high in relational aggression differ in terms of executive functioning abilities?

While Kozey (2014) found sex differences in the relationship between relational aggression and executive functioning, only marginal sex differences were found in the current study. Parents viewed relationally aggressive boys and girls as poor in emotional control (though this was only a trend for boys). In teacher’s ratings of boys, it was found that poor inhibition

significantly predicted ratings of relational aggression. In teacher ratings of girls, it was found that deficits in inhibition, shifting and working memory predicted ratings of relational aggression. This only partially replicates Kozey's (2014) results which indicated differential results for boys and girls. However, Kozey (2014) also found that girls high in proactive relational aggression demonstrated *strengths* in working memory and planning, whereas the current study found that teacher ratings of relational aggression were associated with *weaker* working memory, difficulty shifting and poor inhibition. These results point partially towards a sex specific model of EF and aggression, but the finding that strengths in EF may be related to higher relational aggression was not supported by the current study. This may be in part due to the measure used. The BRIEF-P is designed to detect weakness in EF, and a higher score simply demonstrates the absence of a weakness, as opposed to a strength in EF. This is not the case for individually administered, standardized tests of EF, which are able to detect normative strengths in EF. Another factor that may have contributed to the limited findings obtained is that relational aggression may not yet be well developed in the preschool age group. Additionally, Kozey (2014) used an aggression measure that evaluated both "proactive" and "reactive" aggression, where as this distinction was not made in the classic aggression measure used in the current study. It is possible that "proactive" relational aggression is related to strengths in EF, whereas "reactive" relational aggression is not. Further research exploring the links between both proactive and reactive forms of both physical and relational aggression are needed to explore this possibility further.

There have been minimal empirical findings to date on relational aggression and executive functioning, and no known studies that have investigated these topics at such a young age. Conceptualizing relational aggression at the preschool age is challenging, and arguably it is

not equivalent to relational aggression at later stages of childhood and adolescence. For example, a preschool child that refuses to play with another child on the playground may simply be acting in the moment, as opposed to an adolescent child who purposely excludes a peer as a form of punishment, a more cognitively complex form of aggression that requires more executive functioning. The current study supports the notion that executive function is related to both physical and relational aggression in some manner, and that this relationship is sex specific. However, the nature of the relationship may be more complex than originally hypothesized, and may change in direction as the child develops. It may be that relational aggression at this age does not occur in the same manner that it does when a child is older and thus the relationship looks different than in Kozey's (2014) study. It is clear that further research in this area is required.

Strengths and Limitations of the Study

The results of this study underscore the importance of considering sex differences in aggression-EF relationships and the need to study boys and girls separately. However, it was not without limitations. Many of the challenges commonly seen in studies of early childhood aggression and EF were observed in the current study, specifically issues related to the measurement of these constructs. First is the challenge of assessing EF in preschool children based on observed performance by informants. It was not possible in the present study to measure aggression and EF through other, more objective measures (e.g., direct one-on-one, standardized, Level C measurement tools, or direct observation). Instead, the results are based on the subjective ratings completed by the children's parents and preschool teachers. This approach presents several advantages (e.g., ease of administration, lower cost of assessment, wide availability). Additionally, it can be argued that the BRIEF-P measures EF in a more ecologically

valid manner, as opposed to the quiet, controlled setting of an office in which administration of standardized measures often occurs. However, rating scales also have their limitations. Most notably, they are based on the opinions and observations of individuals who are potentially biased in their responses, which is challenging to control for in a research setting, as opposed to a standardized measure that presents a (relatively) objective performance by the student themselves. Given that the observed relationship between EFs and relational aggression and physical aggression in the current study is different than that of the Kozey (2014) research that used individualized Level C instruments, it is fair to say they cannot be interchanged without consideration. It is likely that the BRIEF-P and individually administered EF tasks are measuring different aspects of EF. There is also the possible influence of context bias on the ratings given, which cannot be ignored as a limitation of the study. Additionally, there was little information available regarding the teacher raters. Specifically, their education level, years of experience and estimated hours spent with the children per week, may influence the quality and validity of their ratings of EF. It is challenging to make conclusive statements about the utility of parent versus teacher ratings when information about the qualifications of the teacher informants is unknown.

Another limitation of the study is the challenge of measuring executive functioning at this young age. Detection of small differences in EF abilities in preschool children is challenging. EFs are less differentiated at younger ages (Shing et al., 2010). The links between EF and aggression may not be as strong in younger children, given that the skills are less differentiated and thus may have been harder to assess. Additionally, physical aggression at younger ages is more normative (Tremblay & Nagin, 2005), and relational aggression, considered more cognitively complex, is just emerging. Thus, it is important to note that the assessment of

physical and relational aggression in the current study *may* not necessarily predictive of future aggressive behaviors.

Finally, it is important to note that the BRIEF-P has been criticized as an accurate measure of EF. As mentioned previously, there have been limited studies evaluating the validity of the BRIEF-P (Duku & Vaillancourt, 2014). As noted by Maricle and Avirett (2012), a significant limitation of the BRIEF-P is the representativeness of the norming sample, which was small and obtained from only one U.S. state. Some authors feel strongly that it should not be used as the sole measure of EF (e.g., Maricle & Avirett, 2012), although it does offer insight into EF in the real world setting, which cannot be observed within a standardized assessment scenario. It can be argued that the BRIEF-P captures “real-life” EF, as opposed to a more controlled measure of EF. Anderson et al. (2002) argue that the BRIEF-P adds important information to the clinical understanding of children, and is the most used executive functioning measure in the clinical setting. In the future, a study that examines EF as assessed by informant ratings, in addition to observation and standardized EF measurement tools, would allow a direct comparison of the results, as well as the examination of the validity and accuracy of the EF ratings scales used. A future study that allows for multi-modal measurement of aggression as well as EF would be more informative, reliable and accurate than the present study.

Conclusions

Findings from the present study contribute to our understanding of early aggression by exploring the links between specific subtypes of aggression and their relationship to EF, with three main conclusions. First, even in very young children, higher levels of all subtypes of aggression were associated with differences in EFs. This finding continues to underscore the importance of executive functioning in understanding aggressive behaviors in children,

particularly prior to formal school entry. The present results, along with previous studies (e.g., Broder, 2004, Ellis et al., 2009; Kozey, 2014) jointly display that the aggression – EF relationship is present in normative populations, including those as young as 25 months.

The second major conclusion is that although the BRIEF-P has been the recipient of some critique (e.g., Maricle & Avirett, 2012), it can predict aggressive behaviors and may be a useful tool in screening for difficulties in young children as they enter preschool, particularly with regard to physical aggression. If a parent/teacher evaluation can serve as an accurate proxy for the more involved, direct child measures, this could make for more efficient screening of children to allow for early identification of risk and intervention, prior to formal school entry. Additionally, the current study highlights the importance of examining both parent and teacher information, as it suggests that they are both useful and informative. The results of the current study suggest that school-based intervention programs that discourage aggression and promote the development of EF abilities (e.g., Diamond, 2012; Diamond & Lee, 2011) would be effective in combating aggression prior to school entry, and potentially reduce the substantial impact of childhood aggression on both victims and offenders.

A third major conclusion is that sex differences are important to evaluate when considering subtypes of aggression and their relationship to EF. Results of the present study and those of Kozey (2014) both demonstrate differential results for boys and girls, consistent with the notion that sex moderates the relationship between EF and aggression. Kozey (2014) found that only physically aggressive girls had EF deficits, whereas boys who were both physically aggressive and relationally aggressive tended to have EF deficits. The current study found that boys who were physically aggressive tended to have deficits in “hot EFs”, as rated by both parents and teachers. Girls who were physically aggressive had deficits in “hot EFs” as well, but

only as rated by teachers, and not parents. In terms of relational aggression, both parents and teachers rated boys who were relationally aggressive as having difficulty with “hot EFs” (for parents, emotional control deficits were indicated, and for teachers, inhibition deficits were indicated). For girls, parents rated relationally aggressive girls as having emotional control deficits, which is the same result as for boys. Teachers rated relationally aggressive girls as having deficits in inhibition and shifting. Although the pattern of findings differ somewhat across the two studies, and may be attributed to either or both developmental changes and/or variations in measurement approaches, findings to date clearly support arguments that the relationship between EF and aggression needs to be examined according to subtypes and sex. Further work is needed to replicate the results of this study with a larger sample, with samples in different settings (e.g., clinical), and with different measurement techniques.

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Appendix A



Department of
Psychology

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DATE

Dear Parent (s) or Guardian (s):

We are writing to ask your permission for you and your child to participate in a longitudinal (long-term) research project on preschool children's executive functioning skills (described below), language development, and its link to behaviors such as helpfulness and aggression. Executive functioning deals with flexibility and impulse control. It includes things such as being able to shift easily between activities, being able to plan and organize, and being able to control one's emotions. It also deals with something called working memory, which is the ability to remember 2 or more things at one time.

Studies of older children have shown that some children with poor executive functioning skills are less cooperative and more aggressive than children with better executive functioning skills. Further, studies of older children have shown that some children with weaker language skills have similar problems. In the present longitudinal study, we are interested in looking at younger children (aged 2½ to 4 years) who are just beginning to develop these skills (e.g., share and be friends) and to see how these skills develop over time.

The information we gain from this study will help us to come up with new ways to better manage young children's behavior in the preschool years, as well as, help children develop these important skills.

In order to conduct this study we need the participation of you, your child, and his/her teacher. While you know your child best, teachers are also an excellent source of information because they interact with so many different types of children and focus a great deal of attention on each child. Also, it is important to gather information from you and your child's teacher because children sometimes behave differently at home than at school where they are in a group situation.

It would be very helpful if you and your child participated in this valuable study. To assist you in this decision, we have provided you with a detailed description of the study and we ask that you indicate your decision on the consent form (see attached). Please return the signed form to your child's teacher in the envelope provided as soon as possible. Also, please seal the envelope to ensure that your decision concerning this study remains private.

Sincerely,

Dr. Tracy Vaillancourt

Dr. Larry Tuff

Dr. Jean Clinton



Department of
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DATE

Dear Teacher:

We are writing to ask you for your permission to participate in a longitudinal (long-term) research project on preschool children's executive functioning skills (described below), language development, and its link to behaviors such as helpfulness and aggression. Executive functioning deals with flexibility and impulse control. It includes things such as being able to shift easily between activities, being able to plan and organize, and being able to control one's emotions. It also deals with something called working memory, which is the ability to remember 2 or more things at one time.

Studies of older children have shown that some children with poor executive functioning skills are less cooperative and more aggressive than children with better executive functioning skills. Further, studies of older children have shown that some children with weaker language skills have similar problems. In the present longitudinal study, we are interested in looking at younger children (aged 2½ to 4 years) who are just beginning to develop these skills (e.g., share and be friends) and to see how these skills develop over time.

The information we gain from this study will help us to come up with new ways to better manage young children's behavior in the preschool years, as well as, help children develop these important skills.

As part of this study, we ask that you answer some questions about specific children's executive functioning skills and behavior. The children you will be asked to report on have all received parental permission to participate. We are asking for your participation because teachers represent an excellent source of information given that they interact with so many different types of children and focus a great deal of attention on each child. This variety and intensity gives teachers a good idea about typical childhood development, which represents an important source of information.

It would be very helpful if you participated in this valuable study. To assist you in this decision, we have provided you with a detailed description of the study and we ask that you indicate your decision on the consent form (see attached). Please return the signed form to your supervisor in the envelope provided. Also, please seal the envelope to ensure that your decision concerning this study remains private.

Sincerely,

Dr. Tracy Vaillancourt

Dr. Larry Tuff

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December, 2003

Study Title: Executive Functioning, Language Development, and Behavior Among Preschool Children

Principal Investigators: Tracy Vaillancourt, Ph.D., Assistant Professor, Department of Psychology, McMaster University; Larry Tuff, Ph.D., Assistant Professor, Department of Psychiatry and Neurosciences, McMaster University; Jean Clinton, M.D., Assistant Clinical Professor, Department of Psychiatry and Neurosciences, McMaster University. This study is conducted in partnership with McMaster University Children's Hospital and Affiliated Services for Children and Youth.

Research Sponsors: This study is being funded in part by the Department of Public Health and Community Services, Parent and Child Branch, City of Hamilton, the Hamilton Community Foundation, and the Trillium Foundation.

Purpose of Study: The purpose of this study is to examine the longitudinal (long-term) relationship between executive functioning skills, language development, and its links to behaviors such as helpfulness and aggression among preschool children. Executive functioning deals with flexibility and impulse control. It includes things such as being able to shift easily between activities, being able to plan and organize, and being able to control one's emotions. It also deals with something called working memory, which is the ability to remember 2 or more things at one time.

Study Procedures: In this phase of the study (Year 1), you and your child's teacher will be asked to fill out a few questionnaires about your child's behavior, executive functioning skills, and language development. Specifically, you and your child's teacher will be asked to fill out: 1) the Child Behavior Checklist, which is a questionnaire about childhood behavior, emotions, and language development, 2) the Behavior Ratings Inventory of Executive Functioning, which is a questionnaire about executive functioning (see above description), and 3) another questionnaire about your child's behavior which is taken from the National Longitudinal Study of Children and Youth. Examples of some of the questions being asked are: "How often would you say that _____ will try to help someone who has been hurt?"; "How often would you say that _____ becomes upset with new situations?"; How often would you say that _____ demands a lot of attention?". Finally, you will also be asked to fill out a background information questionnaire which asks you questions like "What language(s) do you speak most often to your child at home?". It should take you about 30-40 minutes to fill out these questionnaires.

In addition to obtaining this information about your child from you and his/her teacher, we would also like to get more information about his/her vocabulary development. To do this, a trained research assistant will use two tests from the Wechsler Preschool and Primary Scale of Intelligence™ - Third Edition (WPPSI-III) to assess your child's language skills. The WPPSI-III is an age-appropriate measure of language skills that has been used on many pre-school children in Canada. The two language tests will take about 7 minutes to complete. During these 7 minutes, the trained research assistant will first read a short, age-appropriate book to your child to ensure proper rapport has been built. Next, the trained research assistant will ask your child to point to the picture that best represents the word spoken (i.e., "point to the cat"). Finally, your child will be shown some pictures and will be asked what the picture represents (i.e., "what is this?" when shown a drawn picture of a ball). The reading of the book and the administration of the language tests will be done in a quiet

area of your child's classroom. The trained researcher and your child will always be in view of the classroom teacher(s).

Finally, because this is a longitudinal study, we would like to contact you again for participation at this time next year (2005) and in the following year (2006). As with this first phase of the study, we will provide you with a detailed description of the study and we will formally ask you for consent again. The procedures for years 2 and 3 of this study will be very similar to year 1 with a few minor changes. For example, we will include more age-appropriate questionnaires concerning your child's development.

Confidentiality: All information gathered from you, your child, and his/her teacher will be kept strictly confidential. We will only report group findings in reports. No individual results will ever be reported. Further, we will not identify the child care centre from which your child was recruited and we will not share any of the information obtained with your child's teacher or anyone else for that matter.

Potential Risks: While there are no known physical risks to participating in this study, some parents may feel a bit upset by filling out the questionnaires because the questions asked seem to highlight potential areas of concern. It is very clear that helping children early who have problems produces the best results. Should you have any concerns about your child's development you can contact *Heath Connections* at 905-546-3550 and speak with a public health nurse who can give you information about support in your community. Another potential risk of this study is that some children may feel uncomfortable answering questions posed by the trained research assistant. In the event that your child looks or behaves in a distressed manner (i.e., cries), the trained research assistant will immediately discontinue the task and thank him/her for participating. Moreover, should your child indicate that he/she does not want to participate their involvement with the study will end immediately.

Contact: This project has been reviewed and received ethics clearance through the McMaster Research Ethics Board. If you have any questions or desire further information about this study, please contact Dr. Tracy Vaillancourt at 905-525-9140 or by email at vaillat@mcmaster.ca. If you have any concerns about your or your child's treatment or rights as research participants, please contact Mr. Michael Wilson (McMaster Research Ethics Board) at 905-525-9140.

Consent: I understand that my participation in this study is entirely voluntary and that I may refuse to participate or withdraw from the study at any time without any consequences. I also understand I can withdraw my child from participating at any time during the course of the study by contacting Dr. Vaillancourt (using the information listed above). I understand that my child can also choose to withdraw from participating at any time (see potential risk section) without any consequences. Finally, I understand that I may keep the enclosed copy of this sheet for my own records. My decision regarding this study is indicated below.

☐ Yes, I agree to participate and my child has my permission to participate.

☐ No, I do not wish to participate and my child does not have my permission to participate.

Name of child _____ Age of child _____

Parent or Guardian Signature _____ Date _____

area of your child's classroom. The trained researcher and your child will always be in view of the classroom teacher(s).

Finally, because this is a longitudinal study, we would like to contact you again for participation at this time next year (2005) and in the following year (2006). As with this first phase of the study, we will provide you with a detailed description of the study and we will formally ask you for consent again. The procedures for years 2 and 3 of this study will be very similar to year 1 with a few minor changes. For example, we will include more age-appropriate questionnaires concerning your child's development.

Confidentiality: All information gathered from you, your child, and his/her teacher will be kept strictly confidential. We will only report group findings in reports. No individual results will ever be reported. Further, we will not identify the child care centre from which your child was recruited and we will not share any of the information obtained with your child's teacher or anyone else for that matter.

Potential Risks: While there are no known physical risks to participating in this study, some parents may feel a bit upset by filling out the questionnaires because the questions asked seem to highlight potential areas of concern. It is very clear that helping children early who have problems produces the best results. Should you have any concerns about your child's development you can contact *Heath Connections* at 905-546-3550 and speak with a public health nurse who can give you information about support in your community. Another potential risk of this study is that some children may feel uncomfortable answering questions posed by the trained research assistant. In the event that your child looks or behaves in a distressed manner (i.e., cries), the trained research assistant will immediately discontinue the task and thank him/her for participating. Moreover, should your child indicate that he/she does not want to participate their involvement with the study will end immediately.

Contact: This project has been reviewed and received ethics clearance through the McMaster Research Ethics Board. If you have any questions or desire further information about this study, please contact Dr. Tracy Vaillancourt at 905-525-9140 or by email at vaillat@mcmaster.ca. If you have any concerns about your or your child's treatment or rights as research participants, please contact Mr. Michael Wilson (McMaster Research Ethics Board) at 905-525-9140.

Consent: I understand that my participation in this study is entirely voluntary and that I may refuse to participate or withdraw from the study at any time without any consequences. I also understand I can withdraw my child from participating at any time during the course of the study by contacting Dr. Vaillancourt (using the information listed above). I understand that my child can also choose to withdraw from participating at any time (see potential risk section) without any consequences. Finally, I understand that I may keep the enclosed copy of this sheet for my own records. My decision regarding this study is indicated below.

- ☐ Yes, I agree to participate and my child has my permission to participate.
- ☐ No, I do not wish to participate and my child does not have my permission to participate.

Name of child _____ Age of child _____

Parent or Guardian Signature _____ Date _____

rapport has been built. Next, the trained research assistant will ask the child to point to the picture that best represents the word spoken (i.e., "point to the cat"). Finally, the child will be shown some pictures and will be asked what the picture represents (i.e., "what is this?" when shown a drawn picture of a ball). The reading of the book and the administration of the language tests will be done in a quiet area of your classroom. The trained researcher and the participating child should always be in your field of view.

Confidentiality: All information gathered from you will be kept strictly confidential. We will only report group findings in reports. No individual results will ever be reported. Further, we will not identify the child care centre from which children were recruited and we will not share any of the information obtained from you with the children's parents or anyone else for that matter.

Potential Risks: There are no known risks to participating in this study.

Compensation: In recognition of your participation in this study you will be paid \$5.00 per child for filling out the questionnaire package. Should you decide to stop participating, you will not receive any financial compensation

Contact: This project has been reviewed and received ethics clearance through the McMaster Research Ethics Board. If you have any questions or desire further information about this study, please contact Dr. Tracy Vaillancourt at 905-525-9140 or by email at vaillat@mcmaster.ca. If you have any concerns about your child's treatment or rights as a research participant, please contact Mr. Michael Wilson (McMaster Research Ethics Board) at 905-525-9140.

Consent: I understand that my participation in this study is entirely voluntary and that I may refuse to participate or withdraw from the study at any time without any consequences other than financial (see above compensation section). I understand that I may keep the enclosed copy of this sheet for my own records. My decision regarding this study is indicated below.

☐ Yes, I agree to participate in this study.

☐ No, I do not wish to participate in this study.

Name _____

Signature _____

Date _____

Appendix B

Background Information

The following Statistics Canada Census questions are asked because many psychological journals are now requiring that a description about participants' background is given so that the reader can make links to the populations they study and/or serve. For example, a study that includes only English speaking, African-Canadian children from wealthy homes may not represent the realities of children from other language or cultural groups. In order to see how the findings may relate to other groups of children we need to describe our participants' background, which is why we are asking the following questions.

This information will only be used for descriptive purpose. No individual information will be shared. Further, should your personal circumstances place you in a small group in which there are not many people, we will combine your group with another one to ensure your confidentiality.

1. What is the **highest** level of education you have ever attained? *Please Check ONE*

- ☐ Some High School
- ☐ Completed High School
- ☐ Some Trade, Technical or Vocational School or Business College
- ☐ Some Community College, CEGEP or Nursing School
- ☐ Some University
- ☐ Diploma or Certificate from Community College, CEGEP or Nursing School or University
- ☐ Diploma or Certificate from Trade, Technical or Vocational School or Business College
- ☐ Bachelor or Undergraduate Degree or Teacher's College (e.g., B.A., B.Sc. B.A.Sc., B.Ed.)
- ☐ Master's (e.g., M.A., M.Sc., M. Ed.)
- ☐ Degree in Medicine, Dentistry, Veterinary Medicine, Optometry or Law
- ☐ Earned Doctorate
- ☐ Other (Specify) _____

2. How would you describe your current employment position?

3. Please estimate in which of the following groups your household income falls?

<input type="checkbox"/> less than \$5,000	<input type="checkbox"/> less than \$40,000
<input type="checkbox"/> less than \$10,000	<input type="checkbox"/> less than \$50,000
<input type="checkbox"/> less than \$15,000	<input type="checkbox"/> less than \$60,000
<input type="checkbox"/> less than \$20,000	<input type="checkbox"/> less than \$70,000
<input type="checkbox"/> less than \$30,000	<input type="checkbox"/> > \$80,000

4. What is the primary language spoken to your child at home? The primary language spoken is the one you use most often when speaking to your child.

<input type="checkbox"/> English	<input type="checkbox"/> Persian (Farsi)
<input type="checkbox"/> French	<input type="checkbox"/> Polish
<input type="checkbox"/> Arabic	<input type="checkbox"/> Portuguese
<input type="checkbox"/> Chinese	<input type="checkbox"/> Punjabi
<input type="checkbox"/> Cree	<input type="checkbox"/> Spanish
<input type="checkbox"/> German	<input type="checkbox"/> Tagalog (Filipino)
<input type="checkbox"/> Greek	<input type="checkbox"/> Ukrainian
<input type="checkbox"/> Hungarian	<input type="checkbox"/> Vietnamese
<input type="checkbox"/> Italian	<input type="checkbox"/> Other (please specify) _____
<input type="checkbox"/> Korean	

5. How would you best describe your ethnic or cultural heritage?

☐ White
☐ Chinese
☐ South Asian (e.g., East Indian, Pakistani, Punjabi, Sri Lankan)
☐ Black (e.g., African, Haitian, Jamaican, Somali)
☐ Native/Aboriginal People (North American Indian, Métis or Inuit/Eskimo)
☐ Arab/West Asian (e.g., Armenian, Egyptian, Iranian, Lebanese, Moroccan)
☐ Filipino
☐ South East Asian (e.g., Cambodian, Indonesian, Laotian, Vietnamese)
☐ Latin-American
☐ Japanese
☐ Korean
☐ Other (please specify) _____

6. In what country were you born? _____

7. What is your current marital status?

☐ Single ☐ Common Law ☐ Married ☐ Legally Separated ☐ Divorced ☐ Widowed

8. How old are you?

<input type="checkbox"/> younger than 18 years	<input type="checkbox"/> 36-40
<input type="checkbox"/> 18-20	<input type="checkbox"/> 41-45
<input type="checkbox"/> 21-25	<input type="checkbox"/> 46-50
<input type="checkbox"/> 26-30	<input type="checkbox"/> 51-55
<input type="checkbox"/> 31-35	<input type="checkbox"/> 56-60
	<input type="checkbox"/> older than 61 years