

**Concurrent Risks and Developmental Antecedents to Relational and Physical Aggression
in Early Childhood**

Jennifer Hepditch

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School of Psychology
Faculty of Social Sciences
University of Ottawa

Abstract

The origins of aggression warrant extensive investigation given its substantial cost to both victims and perpetrators. However, only recently have researchers begun to understand the prevalence and harm associated with relational aggression, which is behaviour intended to damage another person's feelings, relationships, or social status, such as social exclusion or spreading rumors. Even with this heightened research interest in relational aggression there is a paucity of studies conducted with children prior to age four, the developmental period in which relational aggression begins to emerge.

In this dissertation we ascertain what unique lags in development or blossoming capacities coincide with the emergence of both physical and relational aggression during early childhood. In Study 1, we examined differential predictors (sex, age, prosocial behaviour, internalizing problems, and impulsivity) of teacher-rated aggression style (physically aggressive, relationally aggressive, or combined physically and relationally aggressive) among preschoolers ($N = 429$; $M = 41.29$, $SD = 8.14$) using multinomial logistic regression. Being a boy and being higher on impulsivity were both substantial risk factors for use of physical aggression (alone or combined with relational aggression). In Study 2, we explored longitudinal associations between preschoolers' ($N = 126$; $M_{age} = 39.15$ months, $SD = 6.67$) assessed language (receptive and expressive vocabulary), parent-rated working memory, and teacher-rated aggression (physical and relational) across one year using an autoregressive cross-lagged panel model.

Longitudinally, physical aggression showed stability and both better working memory and previously higher physical aggression predicted higher relational aggression over one year. There were no longitudinal links between language and aggression when simultaneously accounting for

working memory in the model, emphasizing the need to account for working memory in this association in future research. In Study 3, using four, separate multivariate multiple regressions, we examined the linear and interactive effects between negative emotionality and several aspects of self-regulation (inhibitory, emotional [soothability], attentional [attention span], and metacognitive [working memory] control) in the prediction of preschoolers' ($N = 198$; $M = 33.65$ months, $SD = 5.02$) physical and relational aggression. Poorer inhibitory and metacognitive control were associated with higher physical aggression regardless of trait negative emotionality, highlighting the importance of self-regulation rather than emotional reactivity in models of physical aggression. Poorer inhibitory control was also linked to higher relational aggression. Also, negative emotionality was most strongly linked to relational aggression at *higher* levels of emotional control or attentional control.

In summary, the results of the present dissertation support a skill-deficit model of preschool physical aggression (alone or in combination with relational aggression) and both a skill-deficit and developmental advancement model for preschool relational aggression.

Keywords: language, prosocial behaviour, internalizing problems, impulsivity, temperament, executive function, physical aggression, relational aggression, early childhood

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Preface

Authorial contributions:

Jennifer Hepditch (primary author): conceptualized the topic and analytical plan for each manuscript based on current theory and a thorough literature review of childhood aggression while keeping in mind the data available for the project in two previously collected datasets; refined articles based on feedback provided by the thesis committee on the research proposal; conducted the relevant literature review; selected the statistical analyses; performed the statistical analyses; interpreted the results of the statistical analyses; drafted and revised each manuscript in response to feedback provided by the second author.

Dr. Tracy Vaillancourt (second author, thesis supervisor of the primary author, and primary investigator of the two projects from which the data for all three manuscripts were drawn [listed below]): in the role of primary investigator, supervised and participated in the acquisition of funding, conceptualization, instrument selection, participant recruitment, and data collection/storage for the two projects from which the data for this dissertation was drawn; regarding the three articles comprising this dissertation, advised on each phase of article preparation (e.g., conceptualization, statistical analyses, manuscript preparation); edited each manuscript; approved each manuscript for submission to the thesis evaluation committee.

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Introduction

The intent of aggression by definition is to cause harm (Anderson & Bushman, 2002) and peer-directed aggression has received substantial research attention over the last several decades due to the severe consequences it can have for both victim and perpetrator (Heilbron & Prinstein, 2008; McDougall & Vaillancourt, 2015). The emergence of the concept of relational aggression in the literature has prompted the re-examination of the traditional view of aggression, which was historically focused on physical forms (e.g., hitting, kicking; Nagin & Tremblay, 1999) perpetrated by boys and men (Cross & Campbell, 2014; Vaillancourt, 2005; 2013). Relational aggression (also termed indirect or social aggression) is behaviour intended to damage relationships such as verbal and non-verbal social exclusion, gossip, and friendship manipulation (Crick, 1995; 1997; Crick & Grotpeter, 1995; Galen & Underwood, 1997; Lagerspetz, Björkqvist, & Peltonen, 1988; Underwood, 2003). Researchers have repeatedly demonstrated that physical aggression is used more by boys than girls (Card, Stucky, Sawalani, & Little, 2008) even in early childhood (e.g., Crick, Casas, & Mosher, 1997; Juliano, Stetson-Werner, & Wright-Cassidy, 2006). Sex differences in the use of relational aggression by older children are generally described as negligible (Card et al., 2008); however, it is possible that this association may vary with age (Vaillancourt, Miller, Fagbemi, Côté, & Tremblay, 2007) since several researchers have found that in early childhood, relational aggression is used more by girls than boys (e.g., Crick et al., 1997; Ostrov & Keating, 2004).

Physical aggression has long been viewed within a developmental psychopathology framework (Cicchetti, & Rogosch, 1996; Heilbron & Prinstein, 2008; Sroufe & Rutter, 1984) which is essentially an approach to understanding links between normative development and its maladaptive deviations (Achenbach, 1990). So, physical aggression may be normative to some

degree and at certain developmental periods, but it is considered abnormal when expressed with greater frequency or intensity, during atypical developmental periods, or when its expression impairs other developmental processes (Achenbach, 1990). Hence, moderate levels of physical aggression in early childhood are developmentally normative; perhaps this is because its emergence between the first and third years of life coincides with a brief window when children have acquired the physical skills required to use it, but lack the self-regulation to inhibit it or the language skills required to generate alternatives (Alink et al., 2006; Tremblay et al., 2004). However, early high use of physical aggression is associated with behaviour problems and peer difficulties and can be a concern for its chronic use (Ladd, Price, & Hart, 1988). Most children learn to inhibit physical aggression before middle childhood (referred to as childhood-limited aggression; Aguilar, Sroufe, Egeland, & Carlson, 2000; Côté, Vaillancourt, Leblanc, Nagin & Tremblay, 2006). For some, there is also a temporary peak of physical aggression during adolescence which is theorized to be influenced by peers and is normative (referred to as adolescence-limited; Moffitt, 1993). For the approximately, 2-4% of the population who remain physically aggressive beyond early childhood (referred to as life-course persistent; Moffitt, 1993), outcomes include chronic school adjustment, mental health, interpersonal, legal, and economic difficulties, in addition to the harm they continue to cause to others (Hill, Lochman, Coie, Greenberg, & Conduct Problems Prevention Research Group, 2004; Lee, Baillargeon, Vermunt, Wu, & Tremblay, 2007; Moffitt, Caspi, Harrington, & Milne, 2002; Obsuth, Eisner, Malti, & Ribeaud, 2015).

Historically, aggression was theorized to be a learned behaviour that children picked up by copying the behaviour of models in real life or in various forms of media, such as on television. This perspective of physical aggression was detailed in Bandura's (1973) Social

Learning Theory. If children learn to be physically aggressive then the frequency of their aggression should increase with age. However, the results of longitudinal studies aimed at analyzing the developmental trajectories of physical aggression have shown that it generally peaks in early childhood and declines with age, a direct contradiction to such strictly ‘nurture’ based theories (see Tremblay, Vitaro, & Côté, 2018 for a review).

Given evidence that children begin to exhibit physical aggression very early and that an important task of early childhood seems to be to learn to suppress it, more recently, researchers have focused on isolating genetic, epigenetic, and neuropsychological factors that may impair one’s ability to inhibit aggression, finding more support for ‘nature’ based theories and theories describing the interplay between nature and the environment to explain chronic aggression (see Tremblay, Vitaro, & Côté, 2018 for a review). For example, Tremblay et al. (2018) recently proposed a bio-psycho-social model for understanding chronic physical aggression which essentially stipulates that numerous factors (“assortative mating, genetic inheritance, and inheritance of physical and social environmental conditions that handicap brain development”, p. 401) can lead to deficits in an individual’s neurologically based cognitive and emotional development resulting in physical aggression (2018). Overwhelming evidence has mounted over the past several decades to support this concept that physical aggression is less a product of learned behaviour (nurture) than an instinctual response to anger (nature), which in the case of normative brain maturation, will subside over time as alternatives are learned (see Tremblay, Vitaro, & Côté, 2018 for a review). These findings align with the frustration-aggression hypothesis which stipulates that aggression is the consequence of the emotional experience of anger or frustration due to blocked attainment of a goal (Dollard, Miller, Doob, Mowrer, & Sears, 1939). If a child has deficits in important self-regulatory and social information processing

skills then that is when the typical developmental course goes awry and physical aggression can persist at problematic levels (Heilbron & Prinstein, 2008; Tremblay et al., 2018). This is consistent with a developmental psychopathology perspective in that it is only beyond a certain age that physical aggression is worrisome (Cicchetti, & Rogosch, 1996; Heilbron & Prinstein, 2008; Sroufe & Rutter, 1984). Guided by these theories, one goal of the present dissertation was to determine, as early as preschool when physical aggression is common, if individual differences in social competence (prosocial skills), language (expressive and receptive vocabulary), emotional reactivity (internalizing symptoms, negative emotionality), and self-regulatory abilities (impulsivity, temperament and neurocognitive-based [executive functions]) could identify children who were more physically aggressive than their same-aged peers.

These theories of aggression have been developed with reference to physical aggression, but there are numerous aspects of relational aggression that call into question their application to this form (Heilbron & Prinstein, 2008). For example, compared with physical aggression, relational acts are circuitous, often requiring a peer intermediary, and hence are theorized to require a more sophisticated set of skills. This is supported empirically. In early childhood, relational aggression, which begins as early as two and a half years of age, has been found to be associated with the language, social-cognitive, and self-control skills needed to use it (Carpenter & Nangle, 2006; Crick, Casas, & Mosher, 1997; Crick, Ostrov, Burr, Cullerton-Sen, Jansen-Yeh, & Ralston, 2006; Vaillancourt, Miller, Fagbemi, Côté, & Tremblay, 2007). Rates of relational aggression also increase with age (Vaillancourt et al., 2007) until it peaks at approximately 14 years (Karriker-Jaffe, Foshee, Ennett, & Suchindran, 2008). Hence, with the exception of during early childhood, relational aggression is more prevalent than physical aggression (Craig et al., 2009; Vaillancourt et al., 2010; Wang, Iannotti, & Nansel, 2009). Further distinguishing these

forms of aggression, relational aggression is more readily condoned and even linked to a number of positive outcomes, such as elevated peer status, resource control, and later access to mates (see Heilbron & Prinstein, 2008 for a review; Vaillancourt, 2005). Similar to physical aggression, relational aggression may also be a natural response to anger as it has been associated with emotion dysregulation in childhood (see Röll, Koglin, & Petermann, 2012 for a review). However, the low risk, high reward nature of relational aggression may provide the motivation to choose it over physical aggression if children possess the capacities to make a conscious choice and execute their behavioural goal.

Both its skillfulness and its association with desirable outcomes have pushed theorists to abandon the practice of viewing relational aggression from a developmental psychopathology lens focusing on skill deficits and maladjustment toward a more comprehensive view of relational aggression as adaptive (Heilbron & Prinstein, 2008). Evolutionary theorists assert that relational aggression is a form of intrasexual competition used particularly by girls and women to achieve power and visibility in the peer group as well as demean competitors, thereby ensuring dating popularity and mating success (Vaillancourt, 2005; 2013). In this way, relational aggression may be human nature and its early emergence may be practice behaviour for perfecting its execution given its theorized importance for reproductive fitness. Consistent with the frustration-aggression theory (Dollard et al., 1939), since status is an important goal due to its evolutionary benefits, relational aggression may be prompted by frustration when this goal is threatened. Those more prone to experience frustration, anger, and jealousy (i.e. negative emotions) may therefore be more likely to use relational aggression against those they perceive as standing in the way of their status goals. The main objectives of this dissertation were to determine if individual differences in the expression of relational aggression may be a product of

(a) individual variability in capabilities required to commit relational aggression, such as social competence (prosocial skills), language (expressive and receptive vocabulary), and self-regulation (impulsivity, temperament and neurocognitive-based [executive functions]), as well as, (b) individual variability in negative emotional reactivity.

Incorporating features of several of these important theories, the developmental theory of aggression integrates both forms of aggression (physical and relational) and considers the developmental period. The developmental theory of aggression stipulates that when children are young and relatively limited in their skills they rely on physical aggression, then, for some children, relational aggression actually replaces physical aggression as children develop the capacities to execute it (Björkqvist, Lagerspetz, & Kaukiainen, 1992; Björkqvist, Osterman, & Kaukiainen, 1992). Longitudinal studies support this and have shown that, in general, over time, physical aggression decreases, while relational aggression increases (e.g., Côté, Vaillancourt, Barker, Nagin & Tremblay, 2007; Vaillancourt, Brendgen, Boivin, & Tremblay, 2003). Given the substantial correlation between these forms of aggression (Card et al., 2008), it is also likely that some children use both physical and relational aggression, referred to as combined aggression users (Crick et al., 1997; Crick, Ostrov, & Werner, 2006). In summary, guided by the developmental hypothesis of aggression we sought to understand what capacities, which are typically maturing during preschool, would be associated with relational aggression during the life stage in which it first presents and begins to replace or be used in combination with physical aggression.

Although the emergence of relational aggression in preschool is associated with developmental advances (Carpenter & Nangle, 2006), it is important to remember it is not a benign form of aggression. In early childhood, relational aggression is associated with peer

rejection (Crick et al., 1997) and later on, with both externalizing and internalizing issues (Heilbron & Prinstein, 2008). Victims of relational aggression in early childhood experience poor peer relationships and internalizing problems (Crick, Casas, & Ku, 1999) and in later childhood experience internalizing issues, physical health problems, and neurological damage impairing learning and memory (Baldry, 2004; Bauman, 2008; Reijntjes et al., 2010; Vaillancourt et al., 2008; Vaillancourt et al., 2011; van der Wal, de Wit, & Hirasing, 2003). Furthermore, elevated rates of either physical or relational aggression have been linked to a stable pattern of mistreating others into adulthood (Côté et al., 2006; 2007; Moffit, 1993; Pepler, Jiang, Craig, & Connolly, 2008). Therefore, it is important to identify aggressive children as early as possible in order to interrupt a problematic trajectory.

In summary, the objectives of the present dissertation were to determine what deficits or lags in development, or what blossoming capacities, were associated with the emergence of each form of aggression during early childhood because of the substantial growth in emotional, cognitive, and social skills during this critical window (Boivin, 2005; Hammond & Brownell, 2015). Since research on relational aggression before age four is sparse, we turn to research on older children for clues as to what might differentiate between those who use one form of aggression or the other (or both) during early childhood. In their meta-analysis, Card et al. (2008) found that prosocial behaviour, internalizing problems, and impulsivity showed distinct associations with physical versus relational aggression. It is unclear if these factors relate differently to physical or relational aggression in preschoolers. In addition, little is known about combined users during this life stage, but findings from middle childhood and adolescence suggest they face substantial dysfunction and are a group deserving of research attention and early identification (Crick, 1997; Crick et al., 2006b; Underwood, Beron, & Rosen, 2011). Also,

the extensive body of research examining physical aggression which has accumulated during the last several decades has implicated a number of risks for its development including language and working memory deficits (Dionne, 2005; Séguin, Nagin, Assaad, & Tremblay, 2004; Séguin, Pihl, Harden, Tremblay, & Boulerice, 1995), a temperament characterized by negative emotionality or anger-proneness (Rubin, Burgess, Dwyer, Hastings, 2003), and problems with self-regulation (see Schoemaker, Mulder, Deković, & Matthys, 2013 for a meta-analysis). Further exploration is needed to determine if these are also important correlates of relational aggression, particularly during early childhood.

Differential Correlates of Aggression Forms

Prosocial behaviour benefits another person, such as voluntary comforting, sharing, or helping (Eisenberg et al., 1996; Eisenberg, Spinrad, Knafo-Noam, 2015). In older children, prosocial behaviour relates to lower physical aggression, but higher relational aggression (Card et al., 2008). Since relational aggression requires some social competence, as does prosocial behaviour, children who are capable of using prosocial behaviour, may chose relational aggression when they aggress against their peers, whereas those who lack such social abilities may be limited to using physical aggression. During early childhood there are a limited number of studies that control for the other form of aggression when examining the link between prosocial behaviour and either physical (see exception, Renouf, et al., 2010) or relational aggression (see exception, Vaillancourt et al., 2007), but those that do echo the findings from older children in that prosocial behaviour differentiates between forms of early aggression. However, given how few studies address this, these findings require replication.

Card et al.'s (2008) meta-analysis revealed that in older children internalizing problems are positively linked to relational aggression only. It seems that when accounting for children

who are combined aggression users, which is rarely done in the literature, internalizing problems are highest among this group and the association between internalizing difficulties and physical aggression (in the absence of relational aggression) is diminished (Crick et al., 2006b). This does not appear to be the case for internalizing problems starting in early childhood. They are protective against later physical aggression in middle childhood (Mesman, Bongers, & Koot, 2001) and a risk factor for concurrent relational aggression (Crick et al., 1997), as well as relational aggressor/victim status in early elementary school (Belden, Gaffrey, & Luby, 2012). Early internalizing issues may be akin to an inhibited temperament such that these children are fearful of using physical, but not relational aggression, perhaps since relational is less confrontational. Additional studies on internalizing difficulties, accounting for the overlap between physical and relational aggression, during early childhood are required to determine if these findings are robust to replication.

Impulsivity, failing to inhibit an initial response when behaving (Logan, Schachar, & Tannock, 1997), has been associated with physical aggression among older children, but when simultaneously accounting for the overlap between aggression forms, is not uniquely linked to relational aggression (Card et al., 2008). Findings in preschool, accounting for both forms are very limited and mixed. One study showed no link between impulsivity and relational aggression (Ostrov & Godelski, 2009) and another revealed age-two impulsivity predicted relational aggression at age 10, but only for girls (Vaillancourt et al., 2007). Additional studies are needed to clarify these discrepancies.

Language, Working Memory, and Aggression

Early childhood is a time of transformative language development with significant changes occurring in receptive and expressive abilities (Bowen, 2014). Such language capacity

increases children's ability to express their desires and emotions, as well as interact with their peers in previously undiscovered ways. Young children are often encouraged by caregivers to 'use your words' as an alternative to being physically aggressive, an expression that is consistent with research findings showing the co-occurrence of a peak in physical aggression during a time of limited language skills in late toddlerhood (Alink et al., 2006; Tremblay et al., 2004), as well as findings revealing a link between language deficits and physical aggression (Dionne, 2005). However, this well-intentioned advice may not be specific enough since better language skills have been shown to increase children's capacity for another hurtful behaviour - relational aggression (Bonica, Arnold, Fisher, Zeljo, & Yershova, 2003; Estrem, 2005 [boys only]; Hawley, 2003 [girls only]). It may be that age-appropriate improvements in language during early childhood give previously physically aggressive toddlers the means to commit more language dependent forms of aggression as preschoolers, such as relational. Yet, the results by Park et al. (2005), who found that poorer preschool receptive language preceded both *higher* physical and relational aggression in middle childhood, bring up the possibility that individual differences in early language abilities may negatively impact children's peer relationships for those who are less linguistically skilled. Perhaps, this is because language impairments limit children's ability to express their needs leading to aggression via frustration or prevent children from understanding the nuances of social exchanges leading to aggression via misattributions of a peer's intent. Alternatively, language and aggression may be linked because aggressive children face peer-rejection (McNeilly-Choque, Hart, Robinson, Nelson, & Olsen, 1996), and thus, are prevented from participating in the language-rich peer group.

Another possible explanation for the link between language and aggression is that language is linked to other cognitive abilities, such as working memory, which is important for

social competence and when deficient, is linked to externalizing problems in preschool (de Wilde, Koot, Lier, 2016; Rahbari & Vaillancourt, 2015; see Schoemaker et al., 2013 for a meta-analysis). Working memory involves holding information in mind for the purpose of completing a task (Sherman & Brooks, 2010). Also, working memory is a main component of executive function, which has been shown to fully mediate the link between verbal ability at age two and problem behaviour two years later (Hughes & Ensor, 2008). However, it is not entirely clear if working memory deficits are linked specifically to physical aggression, as opposed to other externalizing problems, during the early years when physical aggression is more normative (Tremblay et al., 2004) and working memory is under-construction (Diamond, 2002). In addition, the association between working memory and relational aggression in early childhood, controlling for physical aggression, has been under-explored. Given that early relational aggression has been associated with advanced socio-cognitive skills, namely prosocial skills (Vaillancourt et al., 2007) and theory of mind (the understanding of another's perspective; Renouf, et al., 2010), both linked to better working memory (Bierman, Torres, Domitrovich, Welsh, & Gest, 2009; Carlson, Moses, & Breton, 2002), research is needed to examine the possibility that *better* working memory may lead to higher early childhood relational aggression. In summary, the overlap between language and working memory and the parallels between the associations of each of these with aggression— namely a negative association with physical and a positive association with relational— prompts the need for a longitudinal examination of language and each form of aggression while accounting for working memory during preschool.

Temperament, Self-Regulation, and Aggression

Temperament, defined as relatively stable, constitutionally-based individual differences in reactivity and self-regulation, is a multidimensional construct with a neurobiological basis,

that can influence behaviour relatively consistently across time and contexts (see Rothbart, 2011 for a review). Reactivity refers to arousability of emotion and excitability of motor responses (Rothbart & Derryberry, 1981). Self-regulation refers to processes intended to alter reactivity (Rothbart & Derryberry, 1981). Negative emotionality, one aspect of reactivity, is a predisposition to experience negative emotions (e.g., anger, anxiety) easily, intensely, and for a lengthy period of time (Rettew & McKee, 2005). Soothability refers to the ability to recover from distress as a result of a caregiver's comforting techniques, such as cuddling or singing. Attention-span persistence is a form of attentional control and refers to the ability to select and attend to relevant information (Buss & Plomin, 1984). Several dimensions of temperament (e.g. negative emotionality) can be reliably measured as early as infancy (Gartstein & Rothbart, 2003) and are believed to be the initial manifestations of personality (see De Pauw & Mervielde, 2010 for a review).

Children's temperament can impact their peer interactions concurrently and beyond (Gartstein, Putnam, & Rothbart, 2012). For example, preschool externalizing issues are linked to negative emotionality stemming from infancy and toddlerhood, as well as concurrently (Gartstein et al., 2012). Given the importance of establishing good peer relationship skills in order to follow a healthy developmental trajectory, it is important to identify temperamental characteristics that may predispose children to social difficulties, such as aggression. This knowledge will be useful in designing interventions to target children who may be at risk of ongoing aggression and peer difficulties.

Several aspects of temperament have been linked to physical aggression in early childhood, such as negative emotionality (Harden et al., 2000; Ostrov, Murray-Close, Godleski, & Hart, 2013; Rubin et al., 2003), poor attentional control, and poor emotional control (i.e., low

soothability; Harden et al., 2000). Consistent with the frustration-aggression hypothesis, which stipulates that aggression is the consequence of the emotional experience of anger or frustration due to blocked attainment of a goal (Berkowitz, 1978; Dollard, Miller, Doob, Mowrer, & Sears, 1939), the association between physical aggression and negative emotionality may be a result of a predisposition to experience frustration or anger (Ostrov, et al, 2013; Rubin et al., 2003).

However, some researchers have failed to find a unique link between negative emotionality and aggression, suggesting a more complex explanation (e. g., Laible, Carlo, Panfile, Eye, & Parker, 2010).

It may be that self-regulation of one's emotional reactivity moderates the link between negative emotionality and aggression. For example, aggression has been theorized to result from limited or depleted self-regulatory abilities (Baumeister & Baumeister, 1997; DeWall, Baumeister, Stillman, & Gailliot, 2007; Gottfredson & Hirschi, 1990) and such limitations may worsen the risk associated with a temperament high in negative emotionality (Calkins, & Fox, 2002; Eisenberg et al., 1993; Moran, Lengua and Zalewski, 2013; Muris & Ollendick, 2005; Suurland et al., 2016). From a temperament perspective, aspects of self-regulation that may play a role include emotional and attentional control. For example, children who are higher in emotional control, such as soothability may recover more easily and be less likely to act aggressively when distressed. Similarly, attentional control (including the ability to shift and sustain attention as needed) is important for the regulation of emotions by allowing a child to focus on less distressing aspects of a social situation (Derryberry & Rothbert, 1988). Self-regulation research from a neural orientation has tended to emphasize executive functions, which are higher-order cognitive abilities required for intentional self-monitoring such as inhibitory control (i.e., the ability to suppress distracting information or inappropriate behaviour) and

metacognitive control, specifically working memory (i.e., the ability to hold information in mind for the purpose of completing a task; Anderson, 2002; Duku & Vaillancourt, 2014; Sherman & Brooks, 2010). Deficits in executive functions have been linked empirically to externalizing problems in preschoolers (see Schoemaker, et al., 2013 for a meta-analysis), perhaps because good inhibitory control allows children to stop and consider their actions and adequate working memory gives preschoolers the ability to keep important information, such as playground rules, in mind when deciding how to behave. Several researchers have pointed to the overlap between regulatory aspects of temperament and executive function as reason to consider their common and unique contributions to our understanding of the role of self-regulation in children (Bridgett Oddi, Laake, Murdock, & Bachmann, 2013; Liew, 2012; Zhou, Chen, & Main, 2012).

Only one study to date has explored the multiplicative effect of negative emotionality and self-regulation with regard to preschool physical aggression, rather than disruptive behaviour more broadly. Suurland et al. (2016) found evidence of an interaction such that high negative emotionality in the presence of low inhibitory control was a substantial risk for higher physical aggression among preschoolers. With regard to relational aggression, the only known study addressing this topic was conducted with adolescents. The investigators found that higher frustration-proneness (an aspect of negative emotionality) in the presence of *high* effortful control (including both inhibitory and attentional control) was a risk for higher relational aggression (Dane & Marini, 2014). Their findings suggest that children who have better self-regulation may opt for relational aggression in contrast to research showing that deficits in regulation lead to aggression as has been found for physical aggression. Given the paucity of literature addressing the multiplicative effects of negative emotionality and aspects of self-regulation on both preschool physical and relational aggression these results require replication.

Overview of the Present Studies

This dissertation is comprised of three studies aimed at identifying potential concurrent and longitudinal correlates of physical and relational aggression during early childhood, with a particular emphasis on ascertaining which factors are important risks for the development of relational aggression when it first emerges. With the first study, our aim was to examine prosocial behaviour, internalizing problems, and impulsivity among preschoolers to determine if they would be differentially associated with each form of aggression as was found by Card et al. (2008) in their meta-analysis focused on middle childhood and adolescence. We added to their work by differentiating combined users of physical and relational aggression from exclusively physical or exclusively relational aggression users in an attempt to identify factors that might distinguish this group. This was an important goal because research with older children has shown combined users may be especially at risk of maladjustment (e.g., delinquency, personality disorder features; Crick, 1997; Crick et al., 2006b; Underwood et al., 2011). With the second study, our aim was to determine if receptive language, expressive vocabulary, and working memory each conferred an independent risk or protective factor for preschoolers' use of physical and relational aggression using a longitudinal model. With the third study our aim was to examine the linear and interactive effects between negative emotionality and several temperament-based and neurocognitive-based aspects of self-regulation (inhibitory, emotional, attentional, and metacognitive control) in the prediction of preschool physical and relational aggression. Overall, our goal was to generate results that would offer insight into what the risk factors and developmental antecedents of physical and relational aggression are in order to aid the design of early interventions. The ultimate objective would be preventing toxic patterns of

relationship manipulation from becoming chronic and predisposing both perpetrators and targets to maladjustment.

Study 1: Differential Correlates of Preschoolers' use of Physical, Relational, and Combined Aggression

In order to determine if Card et al.'s (2008) findings from older childhood and adolescence would hold for preschool, we examined differential predictors (sex, age, prosocial behaviour, internalizing problems, and impulsivity) of teacher-rated aggression style (physically aggressive, relationally aggressive, or combined physically and relationally aggressive) using multinomial logistic regression. Participants included a community sample of children ($N = 429$; $M = 41.29$, $SD = 8.14$) who ranged in age from 25 to 74 months. As we predicted, and in line with the results of Card et al., (2008), after accounting for the overlap between physical and relational aggression, we found that prosocial behaviour was negatively linked to physical aggression and positively linked to relational aggression, internalizing symptoms were positively linked only to relational aggression, and impulsivity was positively linked only to physical aggression. After accounting for the overlap between all of the predictors, only participants' sex and teachers' reports of impulsivity differentiated between aggression styles. Specifically, being a boy and being higher on impulsivity were both substantial risk factors for physical aggression. Results suggested that preschoolers are physically aggressive due to a lack of impulse control rather than limited prosocial skills or internalizing problems. Also, combined users showed similar results to physically aggressive preschoolers, but were distinguishable from relationally aggressive preschoolers with regards to their higher impulsivity.

Study 2: Language, Working Memory, and Physical and Relational Aggression in Preschoolers: A Longitudinal, Multi-informant Approach

We explored longitudinal associations between preschoolers' ($N = 126$; $M_{age} = 39.15$ months, $SD = 6.67$) language (receptive and expressive vocabulary), working memory, and aggression (physical and relational) across one year using an autoregressive cross-lagged panel model. We examined the within- and across-time links between each of the variables while accounting for within-time correlations and the stability of each over a year. At both Time 1 and 2, language was formally assessed by trained researchers, working memory was rated by parents, and aggression was rated by daycare teachers, such that any results would be across reporter. We also accounted for possible effects of age, socioeconomic status, and sex in our analyses. Based on research showing a overlap between language and working memory we anticipated that after accounting for working memory in the model, the association between language and aggression might be diminished and this hypothesis was confirmed by our findings. Instead, longitudinally, previous physical aggression predicted its later use and for relational aggression, better working memory and previous engagement in physical aggression predicted its later use. Our findings emphasized the importance of accounting for working memory when examining associations between language and aggression and showed early relational aggression as associated with developmental advancements.

Study 3: The Interaction between Emotionality and Both Dispositional and Neurocognitive Aspects of Self-regulation in the Prediction of Preschool Aggression

Using a community preschool sample ($N = 198$; $M = 33.65$ months, $SD = 5.02$), we conducted four separate multivariate multiple regressions to examine the linear and interactive effects between negative emotionality and several aspects of self-regulation (inhibitory, emotional [soothability], attentional [attention span], and metacognitive [working memory] control) in the prediction of physical and relational aggression. Sex, age, and socioeconomic

status were accounted for in analyses. Consistent with the frustration-aggression hypothesis, we expected that negative emotionality would be positively linked to both forms of aggression. We also predicted that lower levels of all aspects of self-regulation would relate to more physical aggression and that negative emotionality would interact with self-regulation, such that higher negative emotionality would be linked to physical aggression more strongly in the case of poorer regulation. However, we found that poorer inhibitory and metacognitive control were associated with higher physical aggression regardless of trait negative emotionality. These results highlight the importance of self-regulation rather than reactivity in models of physical aggression.

Regarding relational aggression we predicted that negative emotionality would interact differently with each aspect of self-regulation. For example, we expected that poorer emotional control, but *better* metacognitive control would predict higher relational aggression given its expected association with emotion dysregulation and its known association with developmental advancements. However, our hypotheses were not entirely confirmed. Results did confirm that relational aggression in preschool was associated with both deficits (specifically in inhibitory control) and advancements in self-regulation. For example, negative emotionality was most strongly linked to relational aggression at *higher* levels of emotional control or attentional control.

Differential Correlates of Preschoolers' use of Physical, Relational, and Combined Aggression

Jennifer Hepditch¹ and Tracy Vaillancourt^{1,2}

¹School of Psychology, Faculty of Social Sciences, University of Ottawa; ²Counselling

Psychology, Faculty of Education, University of Ottawa

Authors' Note

Correspondence: Tracy Vaillancourt, Counselling Psychology, Faculty of Education, University of Ottawa, 145 Jean-Jacques-Lussier, Ottawa, ON K1N 6N5. E-mail: tracy.vaillancourt@uottawa.ca

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Abstract

We examined differential predictors (sex, age, prosocial behaviour, internalizing problems, and impulsivity) of teacher-rated aggression style (physically aggressive, relationally aggressive, or combined physically and relationally aggressive) in preschoolers ($N = 429$; $M = 41.29$, $SD = 8.14$) using multinomial logistic regression. Sex differentiated between aggression styles, such that being a boy was associated with an increased likelihood of being in the physically aggressive group relative to the non-aggressive group ($OR = 2.44$) or relative to the relationally aggressive group ($OR = 4.35$). Teacher's reports of impulsivity also differed significantly across aggression styles, such that higher impulsivity was associated with an increased likelihood of being in either of the two physically aggressive groups (exclusive or combined) relative to the non-aggressive group, ($OR = 11.21$, $OR = 16.65$, respectively), or the exclusively relationally aggressive group, ($OR = 4.28$, $OR = 6.35$, respectively). Results suggested that preschoolers are not physically aggressive due to a lack of prosocial skills or internalizing problems, but rather, due to a lack of control over impulses. Also, combined users emerged as a unique group from relationally aggressive preschoolers with regards to impulsivity, but were indistinguishable from physically aggressive preschoolers.

Keywords: physical aggression, relational aggression, early childhood, prosocial behaviour, internalizing problems, impulsivity

Differential Correlates of Preschoolers' use of Physical, Relational, and Combined Aggression

Aggression can be committed using various forms. Physical aggression includes actions that can cause physical damage to another person such as biting or kicking. Relational aggression includes social acts that can cause damage to another person's feelings, relationships, or social status such as threatening to end a friendship unless a peer complies with one's demands, exclusion, or spreading rumors (Crick & Grotpeter, 1995; Lagerspetz, Bjorkqvist, & Peltonen, 1988). Researchers have repeatedly demonstrated that boys use physical aggression more than girls (Card, Stucky, Sawalani, & Little, 2008) even in early childhood (e.g., Crick, Casas, & Mosher, 1997; Juliano, Stetson-Werner, & Wright-Cassidy, 2006). Sex differences in the use of relational aggression by older children are generally described as negligible (Card et al., 2008); however, it is possible that this association may vary with age (Vaillancourt, Miller, Fagbemi, Côté, & Tremblay, 2007). Findings regarding sex differences in relational aggression among preschool-aged children have been mixed, but the majority of studies suggest that relational aggression is used more by girls than boys (e.g., Crick et al., 1997; Ostrov & Keating, 2004).

Relational aggression makes up the vast majority of peer victimization incidences (Craig et al., 2009; Vaillancourt et al., 2010; Wang, Iannotti, & Nansel, 2009) and depending on the adjustment outcome measured, may cause more harm than physical aggression (Baldry, 2004; Bauman, 2008). Preschoolers' use of relational aggression has been shown to predict continued relational aggression use a decade later (Nelson, Coyne, Swanson, Hart, & Olsen, 2014). Its prevalence, persistence, and potential for harm make relational aggression an important focus for research and intervention; this is of particular importance during early childhood given that early identification of social problems can greatly reduce later adjustment difficulties. Although a considerable amount of research attention has been focused on studying the correlates of

physical aggression during early childhood, comparatively, very little is known about relational aggression *starting when it first emerges*.

The peak of physical aggression has been shown to occur in early childhood (Alink et al., 2006; Tremblay et al., 2004) and tapers prior to formal school entry for the majority of children (Côté, Vaillancourt, Leblanc, Nagin & Tremblay, 2006). Relational aggression has been observed as early as two and a half years of age (Crick, Ostrov, Burr, Cullerton-Sen, Jansen-Yeh, & Ralston, 2006a) and has been theorized to replace physical aggression as individuals develop the capacities (e.g., perspective-taking, language) required to execute it (Bjorkqvist, Lagerspetz, & Kaukiainen, 1992; Bjorkqvist, Osterman, & Kaukiainen, 1992). This developmental hypothesis has been supported empirically (e.g., Côté, Vaillancourt, Barker, Nagin, & Tremblay, 2007).

Although theoretically relational aggression should replace physical aggression as children mature, this transition may not be clear-cut. The high correlation between physical and relational aggression among older children (see Card et al., 2008 for a meta-analysis) alludes to the possibility that some children use *both* physical and relational aggression. Presumably some preschoolers exhibit a combination of physical and relational aggression, either for a short duration in development, or perhaps as a longer-term pattern. In fact, the results from two large longitudinal studies, collectively spanning preschool to early adolescence, highlight that only a few individuals use elevated levels of only one form of aggression (Cleverley, Szatmari, Vaillancourt, Boyle, & Lipman, 2012; Côté et al., 2007). This overlap between physical and relational aggression presents some practical and methodological issues when trying to identify distinct correlates to each form of aggression. Thus, rather than examining linear correlates to physical and relational aggression, researchers have been urged to compare children who are

grouped based on their style of aggression use (i.e., non-aggressive, physically aggressive, relationally aggressive, or combined physically and relationally aggressive; Crick et al., 1997; Crick, Ostrov, & Werner, 2006). This was the focus of the present study.

Differentiation between Forms of Aggression

Founded in biopsychological theories and supported by empirical findings, extreme levels of several temperament or early personality traits, in particular low helpfulness/reward dependence (prosocial behaviour), high fearfulness (anxiety), and high impulsivity have been deemed a risk for future maladjustment (Cloninger, 1986; 1987; Hay, & Pawlby, 2003; Côté, Tremblay, Nagin, Zoccolillo, & Vitaro, 2002), such as using aggression (Tremblay, Pihl, Vitaro, & Dobkin, 1994). In a meta-analysis of findings from middle childhood and adolescence, Card et al. (2008) found that these same factors – prosocial behaviour, internalizing problems, and impulsivity– showed distinct associations with physical versus relational aggression. Specifically, they found that low prosocial behaviour was commonly associated with physical aggression, but *high* prosocial behaviour was associated with relational aggression. Also, internalizing behaviour was only uniquely associated with relational aggression and Attention Deficit Hyperactivity Disorder (ADHD) type symptoms, such as impulsivity, were only uniquely related to physical aggression. It is not clear if these same patterns are found in early childhood.

Prosocial behaviour and aggression. Prosocial behaviour is defined as voluntary behaviour that benefits another person, such as comforting, sharing, or helping (Eisenberg et al., 1996; Eisenberg, Spinrad, Knafo, 2015). In addition to adequate self-regulation and concern for others, social competence underlies prosocial behaviour (Eisenberg et al., 1996). Similarly, the ability to execute relational aggression, at least effectively, and especially in preschool, appears dependent on social skills (Carpenter & Nangle, 2006), including an ability to empathize with the

perspective of others (Ostrov, Murray-Close, Godleski, Hart, 2013) and form intimate relationships (Grotzinger & Crick, 1996; Sebanc, 2003). Thus, overlap between preschool prosocial behaviour and relational aggression seems logical and has been supported longitudinally (Vaillancourt et al., 2007). This link is not without disagreement. However, those who have found a negative association between prosocial behaviour and relational aggression in preschoolers have not controlled for the substantial overlap between physical and relational aggression in their analyses (e.g., Crick et al., 1997; Poland, Monks, & Tsermentseli, 2015).

In middle childhood and adolescence, physical aggression may result from a deficit in social skills (Crick & Dodge, 1994; Harvey, Fletcher, & French, 2001) or from a lack of concern for others (callous-unemotional traits; Crapanzano, Frick, Terranova, 2010), and hence, may be incompatible with prosocial behaviour. In contrast, during early childhood, a stage when physical aggression is more normative, prosocial behaviour seems to co-occur with both relational and physical forms of aggression (Hawley, 2002; 2003; Nantel-Vivier, Pihl, Côté, & Tremblay, 2014; Roseth, Pellegrini, Bohn, Van Ryzin, & Vance, 2007; Roseth et al., 2011). Consistent with resource control theory (Hawley, 1999), young children may use a combination of affiliative (e.g., prosocial) and aggressive strategies to negotiate power (e.g., the chance to be ‘teacher’ during dramatic play) and control resources (e.g., toys). However, in the studies of early childhood that have shown that some children use both prosocial and physically aggressive strategies (Hawley, 2002; Nantel-Vivier et al., 2014; Roseth et al., 2007; 2011), the significant overlap between physical and relational aggression has not been accounted for. We suspect that children who were high in both prosocial behaviour and physical aggression in previous studies may in fact, have been combined users of physical and relational forms of aggression, an overlooked association when relational aggression was not examined. We suggest that, when

behaving aggressively, preschool children with the social skills to display prosocial behaviour will opt for relational aggression, even use relational aggression with physical aggression under certain conditions (e.g., when the teacher is not present). Conversely, children who have a limited repertoire of prosocial skills may rely on physically aggressive strategies to express emotion and achieve their goals because they simply lack the skills to aggress otherwise. There is empirical support for a link between less prosocial behaviour and more physical aggression in early childhood. For example, Renouf, et al., 2010 found that controlling for relational aggression, concurrent prosocial behaviour and physical aggression were negatively linked in a sample of 400 kindergarten-aged children.

Internalizing problems and aggression. Anxiety is characterized by poor emotion regulation (Shaw, Keenan, Vondra, Delliquardi, Giovannelli, 1997), specifically fear (Keltner, Moffitt, & Stouthamer-Loeber, 1995). In direct contrast, fearlessness, or low fear, is a well-established risk factor for physical aggression (Raine, Reynolds, Venables, Mednick, & Farrington, 1998). Early anxiety has also been described as akin to an inhibited constitution or temperament (Mesman, Bongers, & Koot, 2001) and high behavioural inhibition is protective against physical aggression even among preschoolers (Kimonis et al., 2006). This may be why anxiety in children ages three to five years is protective against later physical aggression in middle childhood (Mesman et al., 2001).

Theoretically, emotional dysregulation, which is central to internalizing problems, may lead to aggression. However, children high on internalizing problems may be more likely to rely on relational aggression than physical aggression given it is less confrontational and therefore may run less risk for retaliation. Alternatively, rather than choosing relational over physical aggression out of fear, a dose of inhibition may give anxious children a moment to pause and

deliberate their actions before responding, allowing them to choose the form of aggression more condoned by caregivers (Li, Coplan, Archbell, Bullock, & Chen, 2016).

There is empirical support for a link between internalizing symptoms and relational aggression. For example, preschool anxiety confers an *elevated* risk of relational aggressor/victim status in early elementary school (Belden, Gaffrey, & Luby, 2012). Similarly, preschool depression has also been shown to be associated with concurrent relational aggression (for girls; Crick et al., 1997) and a six-fold increased risk of relational aggressor/victim status in elementary school (Belden et al., 2012). In a middle childhood sample, Crick et al. (2006b) found that anxiety/depression symptoms differentiated between extreme aggression groups (physical only, relational only, combined physical and relational aggression). Specifically, combined users were more anxious/depressive than physically aggressive or non-aggressive children. Furthermore, controlling for physical aggression, higher anxiety/depression was uniquely related to relational aggression.

Impulsive behaviour and aggression. Impulsivity is characterized as behaving with little forethought or failing to inhibit an initial response (Logan, Schachar, & Tannock, 1997). It has been linked consistently with physical aggression, but less consistently with relational aggression (Crapanzano et al., 2010; Kerig & Stellwagen, 2010). Among older children (Card et al., 2008) and in the very limited research with preschoolers (Ostrov & Godelski, 2009), the overlap between impulsivity and relational aggression was diminished entirely when simultaneously accounting for physical aggression. However, Vaillancourt et al. (2007) did find that age-two impulsivity predicted engagement in relational aggression at age 10, but only for girls. Although early childhood acts of relational aggression may be less purposeful or covert than in later childhood (Monks, 2005), they do tend to coincide with developmental

advancements, giving relational aggression the reputation of being a skilful, calculated offense (Carpenter & Nangle, 2006). Therefore, more research is needed to determine if impulsivity and relational aggression are linked in early childhood accounting for physical aggression and sex.

Present Study

In the present study, our aim was to replicate the work of Card et al. (2008) in differentiating between aggression forms by studying the differential association between physical and relational aggression by examining prosocial behaviour, internalizing problems, and impulsivity using a developmental stage underrepresented in their meta-analysis—preschool-aged children. We expanded upon their work by distinguishing combined users of both physical and relational aggression from those who used exclusively one form of aggression because, in comparison, this group has been shown to be distinguishable from other aggression styles and to face unique risks for maladjustment (e.g., delinquency, personality disorder features) in middle childhood and adolescence (Crick, 1997; Crick et al., 2006b; Underwood, Beron, & Rosen, 2011).

We accounted for the effects of prosocial behaviour, internalizing problems, and impulsivity simultaneously in order to tease out the unique contributions of each to the prediction of aggression style given that the predictors are related. For example, less regulated (i.e., more impulsive) children are less prosocial (Eisenberg et al., 1996), likely because impulsivity interferes with the development of prosocial skills (Hay, Hudson, Liang, 2010). Also, across infancy and preschool, anxiety and impulsivity are negatively associated (Aksan & Kochanska, 2004) and prosociality, anxiety, and impulsivity in preschoolers have been shown to collectively predict antisocial behaviour in middle childhood, but with varying strength of prediction (Tremblay et al., 1994).

We accounted for age and sex in our analyses because all predictors and each form of aggression show developmental changes and sex differences during preschool (Côté et al., 2002; 2009; Crick et al., 1997; Nantel-Vivier et al., 2014; Persson, 2005; Romano, Tremblay, Boulerice, & Swisher, 2005; Vaillancourt et al., 2007).

We made several hypotheses. Regarding prosocial behaviour as a predictor of aggression group membership, we expected that higher prosocial behaviour would be associated with a relational aggression or combined aggression style compared with other aggression styles and that lower prosocial behaviour would be associated with a physical aggression style compared with other aggression styles. We made these predictions based on research showing that social skills, which are positively associated with preschool relational aggression (Carpenter & Nangle, 2006) and negatively associated with physical aggression (Crick & Dodge, 1994; Harvey et al., 2001), are central to prosocial behaviour (Eisenberg et al., 1996). We expected prosocial behaviour to be predictive of use of relational aggression by preschool children, even in combination with physical aggression, because relational aggression use among young children has been described as a developmental advance, perhaps an indicator of early blooming social competence (Carpenter & Nangle, 2006).

Regarding internalizing problems as a predictor of aggression group membership, we predicted that higher internalizing symptoms would be associated with a combined aggression style compared with other aggression styles as has been found with older children (Crick et al., 2006b). We expected that higher internalizing symptoms and the elevated use of both forms of aggression would reflect overall emotion dysregulation, consistent with evidence that combined users show maladjustment, such as more antisocial and personality disorder features than other aggression styles in middle childhood (Crick et al., 2006b; Underwood et al., 2011). We also

expected internalizing symptoms to be associated with an elevated chance of being in the relationally aggressive group (compared with the non or physically aggressive group) based on the thinking that preschoolers who are more inhibited or anxious would be more emotionally dysregulated than non-aggressive children, but only comfortable aggressing in a comparatively subtler manner.

Finally, we predicted that impulsivity would be related to physical aggression (alone or combined with relational), but not uniquely related to relational aggression; this supposition is consistent with the findings of Ostrov and Godelski (2009) in one of the few other studies to have explored the association between impulsivity and relational aggression in preschoolers. The present study is the first to our knowledge to explore impulsivity among preschoolers employing various aggression styles, while also including combined users of both physical and relational aggression.

Method

Participants

Data were collected on a community sample of 429 preschoolers (201 girls) using early childhood educator reports from forty daycare facilities in a city in Southern Ontario, Canada. Participating children ranged in age from 25 to 74 months ($M = 41.29$, $SD = 8.14$), were English speaking (96%), Caucasian (86%), and most were from households with parents that had completed college or university (70%). The sample household median income was equivalent to the median income level for the city at the time of data collection (Statistics Canada, 2006).

Measures

Prosocial behaviour. Teachers completed selected items from the prosocial behaviour (eight items; e.g., “Will try to help someone who has been hurt.”) subscale of the Canadian

National Longitudinal Survey of Children and Youth (NLSCY) caregiver form (Statistics Canada, 2012, adapted from the Preschool Social Behaviour Questionnaire by Tremblay, Vitaro, Gagnon, Piché, & Royer, 1992). Respondents reported on a three-point scale for each item (*Never* = 0, *Sometimes* = 1, *Often* = 2). Items were averaged within a subscale, such that higher scores indicated higher levels of prosocial behaviour. The prosocial behaviour subscale showed good internal consistency ($\alpha = .91$) in the present study.

Internalizing behaviour. Teachers completed the anxiety/depression (eight items; e.g., “Feelings are easily hurt.”) subscale of the Child Behavior Checklist (CBCL; Achenbach & Rescorla, 2000). Respondents reported using a three point scale (*Not true* = 0, *Somewhat true* = 1, *Always true* = 2). Items were averaged and higher scores indicated higher levels of internalizing symptoms. The subscale showed good ($\alpha = .75$) internal consistency in the present study.

Impulsivity. Teachers completed selected items from the child behaviour scale of the NLSCY caregiver form to assess hyperactivity-impulsivity (five items following Romano, Baillargeon, & Tremblay, 2002; e.g., “Has difficulty awaiting turn in games or group situations.”). Teachers reported on the frequency of the behaviour using a three-point scale (*Never* = 0, *Sometimes* = 1, *Often* = 2). Items were averaged within a subscale, such that higher scores indicated higher levels of impulsivity. The impulsivity subscale showed good internal consistency ($\alpha = .87$) in the present study.

Aggression. Teachers completed selected items (three items following Tremblay, 2000; e.g., “Kicks, bites, hits other children) from the Child Behavior Checklist (CBCL; Achenbach & Rescorla, 2000) to represent a physical aggression subscale. Respondents reported on a three-point scale for each item (*Not true* = 0, *Somewhat true* = 1, *Always true* = 2). Relational

aggression (five Items; e.g., “When mad at someone, tries to get others to dislike that person.”) was assessed by teachers using the relational aggression subscale of the NLSCY caregiver form (Statistics Canada, 2012, adapted from Lagerspetz, et al., 1988). Respondents reported on a three-point scale for each item (*Never* = 0, *Sometimes* = 1, *Often* = 2). Items were averaged within a subscale, such that higher scores indicated higher levels of that form of aggression. Teacher reports showed good internal consistencies in the present study for the physical ($\alpha = .87$) and relational ($\alpha = .81$) aggression scales.

These two scales were used to classify preschoolers’ use of specific aggression styles into four distinct groups as follows: (1) non-aggressive (less than .75 standard deviations [*SD*] above the sample mean on scores of physical and relational aggression), (2) physically aggressive (equal or greater than .75 *SD* on physical aggression), (3) relationally aggressive (equal or greater than .75 *SD* on relational aggression), or, (4) combined physically and relationally aggressive (equal or greater than .75 *SD* above the sample mean on scores of physical and relational aggression). This cutoff was chosen following conventions used in the field (e.g., Hawley, 2003; Ladd & Burgess, 2001) and to prevent too small cell sizes for analyses because we expected relational aggression to be low frequency behaviour in this young community sample consistent with the findings of others (e.g., Juliano et al., 2006).

Procedure

The measures were given to educators to complete and then returned. Teachers received monetary compensation for each completed and returned questionnaire package (\$5 per child). Parents provided demographic information via a paper and pencil questionnaire. Parental consent and child assent were obtained prior to data collection. Participating families were given a children’s book.

Results

Descriptive Statistics

Bivariate correlations between both forms of aggression, age, prosocial behaviour, internalizing problems, and impulsivity are summarized in Table 1 for boys and girls separately. Significant bivariate correlations between the predictors were in the expected direction with two exceptions. First, internalizing symptoms were positively associated with impulsivity for boys and girls, indicating that in preschool, higher internalizing symptoms were linked to higher impulsivity. Second, for preschool boys, impulsivity and relational aggression were significantly positively associated, indicating that boys who were more impulsive were more relationally aggressive. Only the correlation between age and internalizing symptoms was statistically significantly different for boys and girls ($z = 2.39$ $p = .017$), such that, for girls, being older was associated with higher internalizing symptoms but for boys, there was no association between age and internalizing symptoms. Overall, physical and relational aggression were significantly ($r = .19$, $p < .001$) correlated and there was no significant statistical difference (using a Fischer Z test) in the strength of this association by sex. Partial correlations accounting for the alternate form of aggression (e.g., physical aggression controlling for relational aggression) are also displayed in Table 1 to represent the unique association between each form of aggression and the variables of interest. Examination of partial correlations revealed that the significant positive association between impulsivity and relational aggression for boys was diminished when accounting for the overlap between relational and physical aggression. All significant partial correlations were in the expected direction. The partial correlation between impulsivity and physical aggression (controlling for relational aggression) was statistically significantly different for boys and girls ($z = 1.74$ $p = .041$), such that the strength of association was stronger for boys

than for girls, suggesting that higher impulsivity may confer a greater risk for physical aggression for boys than it does for girls.

Means and standard deviations for variables of interest are presented in Table 1 and are also presented by aggression group in Table 2 for the whole sample and for boys and girls separately. Several variables showed a non-normal distribution (e.g., skewness and kurtosis). Independent samples t-tests were utilized to compare mean scores for boys and girls on all variables of interest; however, in the case of unequal variances (i.e., a significant Levene's test) and non-normality, A Mann-Whitney test was used to compare the distribution of scores for boys to girls. Sex differences emerged for aggression, with boys ($Mdn = .33$) rated as being more physically aggressive than girls ($Mdn = 0$), $U = 16009.0$, $Z = -5.30$, $p < .001$, $\eta^2 = 0.07$, and girls ($Mdn = 0$) being more relationally aggressive than boys ($Mdn = 0$), $U = 20009.0$, $Z = -2.12$, $p = .034$, $\eta^2 = 0.01$. Sex differences also emerged for impulsivity, with boys being rated as higher ($Mdn = .40$) than girls ($Mdn = .20$), $U = 16859.5$, $Z = -4.27$, $p < .001$, $\eta^2 = 0.04$. Conversely, girls were rated as more prosocial than boys, $t(421) = -5.36$, $p < .001$, $d = 0.53$.

In order to compare the relative proportion of boys and girls in the high aggression groups, we ran a chi-square goodness of fit test crossing sex with aggression style (e.g., combined, relational only) and interpreted the adjusted standardized residuals. Aggression style was statistically significantly different by sex, $\chi^2(3, N = 422) = 24.76$, $p < .001$. We examined adjusted standardized residuals ($z > 2$; Sharpe, 2015) to determine which pattern of aggression use was dependent on sex. More boys (and fewer girls) than expected by chance ($z = 4.6$) were in the physically aggressive only group. Of those that were physically aggressive (19.5% of the sample), 75.9% were boys. Also, more girls (and fewer boys) than expected by chance ($z = 3.0$) were in the non-aggressive group. Of those that were non-aggressive (65% of the sample),

52.1% were girls. There were more girls (and fewer boys) than expected by chance ($z = 2.0$) in the relationally aggressive group. Of the children that were classified as only relationally aggressive (10.5% of the sample), 61.4% were girls. The remaining 5% of the sample were combined aggression users.

To address our main objective, we compared the four aggression styles using constructs (prosocial behaviour, internalizing problems, and impulsivity) that have been differentially associated with physical and relational aggression in past research by conducting a multinomial logistic regression using *Mplus* software Version 7.4 (Muthén & Muthén, 2012-2015). Sex and age were entered as covariates. Maximum likelihood robust (MLR) estimation is the default for multinomial logistic regression analysis due to its robustness to non-normal data. The results (> 2) of a design effect calculation indicated that estimates of the standard errors for at least one variable (i.e., SES) would be biased due to interdependence between certain daycare rooms; thus we accounted for nesting in all further analyses using TYPE = COMPLEX and CLUSTER = CLASS (Satorra & Muthén, 1995).

Prior to conducting the multinomial logistic regression, assumptions (e.g., multicollinearity, linearity of the logit, adequacy of expected frequencies) were tested. A regression analysis was run to screen for multicollinearity among the predictors, including the covariates. The resulting variance inflation factors (VIFs) were low enough (< 4) to rule out excessive multicollinearity. Results from the Box-Tidwell approach to test for linearity of the logit revealed no violations. We examined cross-tabs tests for all discrete variables (i.e., sex, aggression style) and all expected frequencies were greater than five, suggesting adequate sampling and power for detecting an effect in analyses (Tabachnick & Fidell, 2007).

Results of the multinomial logistic regression analyses for the whole sample and boys

and girls separately are summarized in Table 3 separately. In order to determine if the six predictors as a group were statistically significantly related to aggression style we conducted a Chi-square difference test comparing loglikelihood values for an unconstrained model and a model where all slopes were constrained to zero. The predictors (sex, age, prosocial behaviour, internalizing problems, and impulsivity) as a group were significantly related to aggression style for the whole sample, $\Delta\chi^2(14) = 132.18, p < .001$ and for boys, $\Delta\chi^2(11) = 79.99, p < .001$, and girls, $\Delta\chi^2(11) = 44.09, p < .001$.

We followed up on the significant overall result by testing the significance of each predictor. For each predictor, this was accomplished by setting the slopes equal for each aggression style and examining the Wald statistic produced employing the Model Test command. A significant Wald was taken as evidence that the predictor in question significantly differentiated between the four styles of aggression. Then, using the unconstrained model the odds ratios were examined only for those predictors that were determined to be significant in the previous step. Odds ratios less than one were transformed to be greater than one (i.e., $1/OR$) for ease of interpretation (Tabachnick & Fidell, 2007).

For the whole sample, holding all other variables constant, sex significantly differentiated between aggression styles ($Wald(2) = 7.39, p = .02$). Being a boy was associated with an increased likelihood of being in the physically aggressive group relative to the non-aggressive group ($OR = 2.44$) or in the physically aggressive group relative to the relationally aggressive group ($OR = 4.35$). Therefore results are presented for the whole sample and boys and girls separately. For the whole sample, impulsivity differed significantly across aggression styles ($Wald(2) = 72.42, p < .001$), such that higher impulsivity was associated with an increased odds of being in either of the two physically aggressive groups (exclusive or combined) relative to the

non-aggressive group, (OR = 11.21, OR = 16.65, respectively), or the exclusively relationally aggressive group, (OR = 4.28, OR = 6.35, respectively). The pattern of results was mostly the same for boys as it was for girls, but the magnitude of associations was different. For boys, impulsivity significantly differentiated aggression styles (Wald(2) = 53.19, $p < .001$), such that higher impulsivity was associated with an increased likelihood of being in either of the two physically aggressive groups (exclusive or combined) relative to the non-aggressive group, (OR = 12.08, OR = 22.94, respectively) and an increased likelihood of being in the combined group relative to the relationally aggressive group (OR = 6.71). For girls, impulsivity significantly differentiated aggression styles (Wald(2) = 33.24, $p < .001$), such that higher impulsivity was associated with an increased likelihood of being in either of the two physically aggressive groups (exclusive or combined) relative to the non-aggressive group, (OR = 11.27, OR = 12.24, respectively) and an increased likelihood of being in the combined group relative to the relationally aggressive group (OR = 5.68). The one exception to the similar pattern for boys and girls was that for boys, but not girls, being younger was associated with an increased likelihood of being physically aggressive versus relationally aggressive (OR = 1.09).

Discussion

The main goal of the present study was to explore what differentiated (i.e., prosocial behaviour, internalizing problems, and impulsivity) between aggression style groups (i.e., non-aggressive, physically aggressive, relationally aggressive, and combined physically and relationally aggressive) among preschool-aged children.

Consistent with the findings of others researchers addressing early childhood aggression (Côté et al., 2007; Vaillancourt, Brendgen, Boivin, & Tremblay, 2003), we found that during preschool, physical and relational aggression were significantly, but only weakly correlated

suggesting that among preschoolers, physical and relational forms of aggression are somewhat overlapping, but nevertheless, distinct for both boys and girls.

Sex differences emerged for the association between age and internalizing symptoms, with older girls, but not boys, exhibiting higher internalizing problems. This is consistent with findings that levels of internalizing problems steadily rise over the course of early childhood (Côté et al., 2009) and that as early as kindergarten, girls are slightly overrepresented in high anxiety trajectories (Côté et al., 2002).

Using a preschool sample, we replicated the distinct associations found by Card et al. (2008) between each form of aggression with prosocial behaviour, internalizing problems, and impulsivity as shown by partial correlational analysis controlling for the alternate form. For example, in line with other research in this age group, after accounting for the overlap between physical and relational aggression, we found that higher prosocial behaviour was linked with lower physical aggression (Crick et al., 1997) and higher relational aggression (for boys only in our sample; Vaillancourt et al., 2007), internalizing symptoms were uniquely linked only to relational aggression (Belden et al., 2012; Crick et al., 1997), and higher impulsivity was linked to physical aggression only (Ostrov & Godelski, 2009). For boys the importance of controlling for the alternative form of aggression was especially apparent given that the association between prosocial behaviour and relational aggression was suppressed and a false association between impulsivity and relational aggression was found before controlling for physical aggression in analyses.

Several of our findings suggest that internalizing behaviour in preschool is not akin to behavioural inhibition as others have suggested (Mesman et al., 2001), a theory that guided some of our hypotheses. First, counter to our expectation and previous findings regarding preschool

internalizing problems (Mesman et al., 2001), it did not appear to be protective against engagement in concurrent physical aggression. One possible explanation is that our measure included both anxiety and depression, and while anxiety is protective against externalizing problems, such as physical aggression (Mesman et al., 2001), depression has been shown to co-occur with externalizing problems (Boylan, Vaillancourt, & Szatmari, 2012). There is also evidence that externalizing problems precede internalizing problems. For example, in a recent study of youth assessed yearly from age 10 to 17, Blain-Arcaro and Vaillancourt (2016) found that engaging in physical and relational aggression predicted subsequent depression. Second, we found that internalizing symptoms and impulsivity were significantly positively associated. This was inconsistent with longitudinal models showing their inverse link during their co-development over early childhood (Aksan & Kochanska, 2004). However, our finding is consistent with studies showing substantial comorbidity of ADHD, characterized by impulsivity, with anxiety disorders in preschoolers and school age children (Wilens et al., 2002).

We replicated findings that boys were overrepresented among physically aggressive children (Crick & Grotpeter, 1995; Crapanzano et al., 2010; Juliano et al., 2006). Also, consistent with the findings of others, among those who used higher levels of relational aggression, girls were the majority (e.g., Juliano et al., 2006). In our sample, being a girl was also protective against engagement in physical aggression compared with no aggression or relational aggression, suggesting that even in early childhood (two to six years old) when physical aggression is relatively normative compared to middle childhood (Côté et al., 2006), it is far less normative for girls than boys (Crick, 1997). Despite noted sex differences on prosocial behaviour (medium effect) and impulsivity (small effect), we found that when simultaneously accounting for age, prosocial behaviour, internalizing problems, and impulsivity, sex still played

a significant role in predicting aggression style. The implication of these findings may be that sex differences in traits, such as impulsivity (favouring boys) and prosocial behaviour (favouring girls) alone are not enough to account for sex differences in aggression. Other researchers (e.g., Crick, Bigbee, Howes, 1996) have suggested that instead they may stem from differences between boys and girls regarding their social values (e.g., dominance, intimacy) and therefore what they view as harmful. For example, boys interpret physical attacks as harmful and girls interpret relational attacks as harmful (Crick, 1995).

After accounting for all of the variables in the model, our finding that impulsivity, but not prosocial or internalizing behaviour, was an important risk factor for using physical aggression (either alone or in combination with relational aggression) compared with exclusively relational aggression or no aggression, suggests that preschoolers are not physically aggressive due to a lack of prosocial skills or low internalizing problems, but rather, due to a lack of control over impulses. This is consistent with the finding that of all three predictors, early impulsivity was the strongest predictor of engagement in antisocial behaviour later in childhood (Tremblay et al., 1994). Our findings may further clarify the work of others studying preschool prosocial behaviour and aggression. For example, in a three-year longitudinal study accounting for prosocial and aggressive behaviour at several time points, Persson (2005) found lower altruistic prosocial behaviour predicted higher levels of impulsive forms of aggression (e.g., reactive), but not calculated, goal-driven forms of aggression (e.g., instrumental). In light of our findings, it seems that had Persson accounted for impulsivity, the longitudinal link between prosocial behaviour and aggression may not have been found. Our results are also in accordance with research showing that after controlling for ADHD (characterized in part by impulsivity), prosocial behaviour was no longer related to aggression in preschoolers, instead, aggression and

ADHD tended to co-occur (Hay et al., 2010). Also, in preschoolers, impulsivity-hyperactivity has been found to predict increases in physical aggression over time controlling for relational aggression (Ostrov & Godelski, 2009). The co-occurrence of high impulsivity and high physical aggression beginning in early childhood and persisting into middle childhood is well established (NICHD Early Child Care Research Network, 2004). In contrast, and consistent with our predictions, impulsivity was only associated with relational aggression in our sample when preschoolers simultaneously displayed high physical aggression.

Combined users may be similar to physical aggression users since they could not be differentiated from physically aggressive preschoolers by the factors explored in this study. In contrast, impulsivity differentiated preschoolers who used a combined aggression style from those who used a uniquely relationally aggressive style. These findings are consistent with that of previous researchers who have found combined aggression users are a unique group not to be overlooked in research due to their elevated risk for maladjustment (Crick, 1997; Crick et al., 2006b; Underwood, Beron, & Rosen, 2011). This point is further supported by our finding that for every unit increase in impulsivity preschoolers were 12 (girls) to 23 (boys) times more likely to exhibit a combined aggression style than to be non-aggressive. Perhaps their early higher impulsivity may place these children at an increased risk of engagement in both physical and relational aggression and that impulsivity, or the ensuing consequences of their aggression, may account for the antisocial behaviour, internalizing problems, and personality disorder features that have been observed among this group in middle childhood and adolescence by other researchers (Crick et al., 2006b; Underwood et al., 2011). Future longitudinal research should be directed at determining if preschoolers who are combined aggression users are the same

individuals who maintain this pattern later in childhood since their later elevated risk may necessitate early intervention.

When examining the results for boys and girls separately, some interesting differences between the sexes emerged regarding the prediction of a relational aggression style. For boys, regarding the prediction of preschool relational aggression, accounting for any overlap between the predictors in the model, only age mattered in differentiating a relationally aggressive style from a non-aggressive or physically aggressive style. Specifically, only for boys, being older was associated with higher relational aggression use compared with higher physical aggression use and compared with no aggression. This is consistent with expected developmental changes in aggression (Bjorkqvist et al., 1992ab). That age differentiated between a relational and physical aggression style for boys only does bring into question whether the developmental hypothesis of aggression applies for young girls. Perhaps, some aggressive preschool girls show relational aggression without prior physical aggression. This is counter to the theory that relational aggression replaces physical aggression for girls (Bjorkqvist et al., 1992ab), but longitudinal exploration should be undertaken to be certain. For girls, relationally aggressive preschoolers were indistinguishable from physically aggressive or non-aggressive preschoolers. Researchers should continue to investigate early risk factors for exclusive use of relational aggression among preschool girls, in order to guide early intervention efforts and prevent its devastating effects for both those aggressing and those being victimized (Crick et al., 1996; Crick & Grotpeter, 1996).

Interpretation of our findings should be done in light of several limitations of the present study. First, we used .75 *SD* as our cutoff to classify preschoolers into aggression style groups due to the expected low frequency of relational aggression among this young sample. It may be that our findings would have been different if we used more extreme scores of aggression or a

clinical sample. For example, low prosocial skills may be more common among those following the highest aggression trajectory compared with more moderate aggression (Nantel-Vivier et al., 2014). Second, because the expected frequencies for combined users were small (though adequate) our analyses suffered from less precision in predictions as evinced by wide confidence intervals. Third, this was a cross-sectional study and therefore the direction of associations cannot be concluded with certainty. However, previous longitudinal research lends support to our conclusion that impulsivity precedes physical aggression rather than aggressive behaviour leading to impulsivity (e.g., Ostrov & Godelski, 2009).

The present study had several strengths that made it an important contribution to the existing literature. First, we added to the limited research exploring the link between impulsivity and relational aggression in preschool while accounting for the overlap between relational and physical aggression. We confirmed the results of one of only two other studies (Ostrov & Godelski, 2009; Vaillancourt et al., 2007) known to have explored this link, namely, that impulsivity is not an important unique predictor of relational aggression use among preschoolers (Ostrov & Godelski, 2009). Second, we used teachers as reporters of aggression. Since preschoolers are limited in their ability to report accurately on each other's behaviour, daycare teachers have the best opportunity to observe peer-directed aggression, especially in the case of low frequency behaviour like preschool relational aggression, which may be missed by occasional behavioural observation methods. While the use of teacher reports was a strength of this study, our results may have been different using another informant because teachers (who were predominantly female) have been shown to possess gender biases when reporting on prosocial behaviour and aggression (Ostrov, Crick, & Keating, 2005). Third, to our knowledge, this was the first study of differential correlates (i.e., sex, age, prosocial behaviour, internalizing

problems, and impulsivity) of physical and relational aggression in early childhood accounting for combined users of both forms of aggression as a distinct group.

Overall, our results support the distinctness of combined aggression users from relational aggression users and non-aggressive preschoolers, suggesting that, rather than a normative aggression style exhibited by children as they age out of physical aggression and adopt the more accepted use of relational aggression, preschool children who combine physical and relational aggression may do so because they are impulsive and are accessing any aggressive strategy in their repertoire. Furthermore, we found that when also accounting for sex, age, prosocial behaviour, and internalizing symptoms, higher impulsivity was an important risk for the use of higher physical or combined aggression relative to being non-aggressive or using relational aggression exclusively.

Table 1

Summary of intercorrelations for aggression, age, and prosocial behaviour, internalizing problems, and impulsivity for girls and boys separately

Measure	1	2	3	4	5	6	M	SD
Bivariate correlations								
1. Physical aggression	-	.24**	-.09	-.26**	.14*	.65**	.60	.61
2. Relational aggression	.20**	-	.29**	.10	.19**	.18**	.13	.29
3. Age	-.06	.24**	-	.24**	.00	-.10	41.17	8.64
4. Prosocial behaviour	-.15*	.06	.22**	-	-.10	-.26**	.74	.49
5. Internalizing problems	.04	.15*	.23**	-.15*	-	.20**	.34	.33
6. Impulsivity	.55**	.12	-.11	-.26***	.15*	-	.60	.57
M	.32	.19	41.25	1.00	.31	.39		
SD	.51	.33	7.54	.49	.30	.49		
Partial correlations controlling for alternate aggression form								
1. Physical aggression	-		-.16*	-.30***	.11	.65***		
2. Relational aggression		-	.32***	.18**	.17*	.04		
3. Age	-.12	.26***	-					
4. Prosocial behaviour	-.17*	.10		-				
5. Internalizing problems	.01	.14*			-			
6. Impulsivity	.54***	.02				-		

Note. Intercorrelations for boys (n = 225) are presented above the diagonal, and intercorrelations for girls (n = 198) are presented below the diagonal. Means and standard deviations for boys are presented in the vertical columns and means and standard deviations for girls are presented in the horizontal rows. Only age and internalizing problems did not shown mean sex differences. Partial correlations with physical aggression control for relational aggression and partial correlations with relational aggression control for physical aggression.

* p<0.05. ** p<0.01. *** p<0.001

Table 2

Summary of means and standard deviations for age and prosocial behaviour, internalizing problems, and impulsivity by aggression style

Predictor	Non-aggressive			Physically aggressive			Combined			Relationally aggressive		
	Full Sample (n = 273)	Boys (n = 130)	Girls (n = 143)	Full Sample (n = 82)	Boys (n = 62)	Girls (n = 20)	Full Sample (n = 21)	Boys (n = 13)	Girls (n = 8)	Full Sample (n = 44)	Boys (n = 17)	Girls (n = 27)
Age (months)	40.74 (8.17)	40.98 (8.59)	40.51 (7.80)	39.35 (7.08)	39.40 (7.45)	39.20 (5.93)	43.29 (7.64)	43.00 (7.53)	43.75 (8.33)	46.09 (8.44)	47.24 (11.84)	45.38 (5.49)
Prosocial	.93 (.51)	.82 (.50)	1.03 (.49)	.61 (.46)	.57 (.46)	.77 (.42)	.82 (.37)	.76 (.40)	.91 (.31)	.96 (.52)	.79 (.51)	1.06 (.50)
Internalizing	.30 (.30)	.30 (.30)	.29 (.30)	.33 (.34)	.34 (.36)	.30 (.28)	.51 (.39)	.54 (.36)	.45 (.46)	.41 (.33)	.40 (.38)	.41 (.30)
Impulsivity	.32 (.41)	.36 (.41)	.29 (.42)	.98 (.53)	.99 (.56)	.93 (.58)	1.10 (.61)	1.19 (.70)	.95 (.44)	.47 (.46)	.58 (.52)	.39 (.41)

Table 3

Multinomial logistic regression analysis of aggression style predicted by prosocial behaviour, internalizing problems, and impulsivity

	Odds Ratio			95% Confidence Interval					
	Total Sample	Boys	Girls	Lower			Upper		
				Total Sample	Boys	Girls	Total Sample	Boys	Girls
<i>Relational vs. Non- aggressive</i>									
Sex	1.74	-	-	.68	-	-	4.48	-	-
Age	1.08	1.08	1.08	1.02	1.02	1.00	1.15	1.14	1.18
Prosocial	.95	.77	1.08	.17	.11	.21	4.83	5.55	5.63
Internalizing problems	1.99	2.08	1.86	.45	.18	.31	8.72	24.34	11.15
Impulsivity	2.62	3.42	2.16	.80	.52	.57	8.60	22.39	8.15
<i>Physical vs. Non-aggressive</i>									
Sex	.41	-	-	.18	-	-	.96	-	-
Age	1.00	.99	1.00	.95	.94	.92	1.04	1.05	1.09
Prosocial	.51	.50	.54	.25	.19	.20	1.07	1.30	1.94
Internalizing problems	.61	.71	.39	.16	.14	.04	2.34	3.52	4.33
Impulsivity	11.21	12.08	11.27	4.51	4.29	2.35	27.85	34.05	54.16
<i>Combined vs. Non-aggressive</i>									
Sex	.75	-	-	.23	-	-	2.60	-	-
Age	1.06	1.04	1.09	.98	.97	.93	1.15	1.12	1.27
Prosocial	1.27	1.59	.93	.55	.37	.21	3.23	6.90	4.17
Internalizing problems	2.40	2.56	1.68	.45	.51	.04	12.72	12.84	67.62
Impulsivity	16.65	22.94	12.24	4.33	4.25	3.96	50.36	123.94	37.82
<i>Physical vs. Relational</i>									
Sex	.23	-	-	.06	-	-	.94	-	-
Age	.92	.92	.93	.86	.85	.85	.99	.99	1.01
Prosocial	.54	.65	.50	.07	.06	.06	3.99	7.47	4.51
Internalizing problems	.31	.34	.21	.07	.32	.01	1.48	3.65	3.53
Impulsivity	4.28	3.54	5.23	1.09	.46	.96	16.78	26.92	28.65
<i>Combined vs. Relational</i>									
Sex	.43	-	-	.10	-	-	1.97	-	-
Age	.98	.97	1.00	.89	.88	.87	1.07	1.05	1.16
Prosocial	1.33	2.06	.86	.19	.15	.09	9.58	27.87	7.91
Internalizing problems	1.21	1.23	.90	.23	.11	.03	6.44	13.34	31.89
Impulsivity	6.35	6.71	5.68	2.07	1.11	1.64	19.45	40.56	19.69

Note. Boldfaced odds ratios indicate 95% confidence intervals that exclude 1.0. Non-significant results are not shown for the contrast of Physical vs. Combined.

*Reference group for sex is male.

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Language, Working Memory, and Physical and Relational Aggression in Preschoolers: A
Longitudinal, Multi-informant Approach

Jennifer Hepditch¹ and Tracy Vaillancourt^{1,2}

¹School of Psychology, Faculty of Social Sciences, University of Ottawa; ²Counselling
Psychology, Faculty of Education, University of Ottawa

Authors' Note

Correspondence: Tracy Vaillancourt, Counselling Psychology, Faculty of Education, University of Ottawa, 145 Jean-Jacques-Lussier, Ottawa, ON K1N 6N5. E-mail: tracy.vaillancourt@uottawa.ca

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Abstract

In order to determine if language (receptive and expressive vocabulary) and working memory each conferred an independent risk or protective factor for preschoolers' ($N = 126$; $M_{age} = 39.15$ months, $SD = 6.67$) use of aggression (physical and relational), longitudinal associations were explored across one year using an autoregressive cross-lagged panel model. No longitudinal links between language (formally assessed) and aggression (teacher-rated) were found when accounting for working memory (parent-rated) in this multi-informant model. Instead, only previous physical aggression predicted its use a year later. Longitudinally, better working memory and previous engagement in physical aggression predicted higher relational aggression. No effects were changed when accounting for age, socioeconomic status, or sex. The final model accounted for 32.8% of the variance in physical aggression and 25.1% of the variance in relational aggression. Results highlighted the importance of accounting for working memory when examining associations between language and aggression, as well as supported the perspective that early relational aggression may be an indication of developmental advancements rather than deficits.

Keywords: receptive language, expressive language, working memory, physical aggression, relational aggression, early childhood

Language, Working Memory, and Physical and Relational Aggression in Preschoolers: A Longitudinal, Multi-informant Approach

Accompanying the increased mobility that comes during the toddler years, for many children, physical aggression emerges and increases between the first and third years of life (Alink et al., 2006; Tremblay et al., 2004) and then declines for most children across childhood (Côté, Vaillancourt, LeBlanc, Nagin & Tremblay, 2006). According to Björkqvist et al., who proposed a theory coined the developmental hypothesis of aggression (Björkqvist, 1994; Björkqvist, Lagerspetz, & Kaukiainen, 1992; Björkqvist, Osterman, & Kaukiainen, 1992; Lagerspetz, Björkqvist, & Peltonen, 1988), while physical aggression (e.g., hitting others) decreases over time, it is replaced by relational aggression (e.g., excluding others, spreading rumours; Crick & Grotpeter, 1995). This change is presumed to correspond with the development of language, social-cognitive, and self-regulatory skills needed to use relational aggression. Although these authors spoke with regards to middle childhood, empirical support for this developmental hypothesis has been found in early childhood (e.g., Côté, Vaillancourt, Barker, Nagin & Tremblay, 2007; Vaillancourt, Miller, Fagbemi, Côté, & Tremblay, 2007).

Under-developed language skills in the typically developing toddler may be partially responsible for the elevated rates of physical aggression before age three, compared to later in childhood, when rates of aggression are lower and language skills more advanced. For children who follow a typical developmental trajectory of decreasing physical aggression beyond the early years (Côté et al., 2006), the accompanying growth in language skills is one factor predicted to give them the option to use alternatives to physical aggression, such as prosocial behaviour or even comparatively more language-dependent forms of aggression, such as

relational aggression (Björkqvist et al, 1992ab; Dionne, 2005; McNeilly-Choque, Hart, Robinson, Nelson, & Olsen, 1996).

The development of working memory, the ability to hold information in mind during the completion of a task, is intricately linked to the development of language during the preschool period (Fuhs & Day, 2011). Similarly, age three, the time when physical aggression starts to decrease for most children, has been shown to be a pivotal time in the development of working memory (Garon, Bryson, & Smith, 2008). Based on this, we wondered if working memory was an additional competency to account for when considering antecedents to early childhood aggression. However, research on the early co-development of language, working memory, and aggression is sparse. Hence, in the present study we focused on examining the ways in which these capacities and this behaviour changed over time among preschoolers. We improved on past research by including relational aggression, which first emerges in preschool (Crick, Casas, & Mosher, 1997; Ostrov & Keating, 2004; Vaillancourt et al., 2007), and has been nearly unexplored in research intended to discover the ways that early, developing capacities, such as language and working memory, relate to aggression use. Unlike physical aggression, which is disproportionately used by boys, relational aggression rates appear similar across the sexes, or even higher in preschool girls (Juliano, Werner, & Cassidy, 2006), making its inclusion in the present study important so as not to neglect the social development of young girls.

Language and Aggression

By two years of age, children have been shown to exhibit individual differences in expressive language that meaningfully relates to numerous indicators of adjustment years later, including externalizing issues (Morgan, Farkas, Hillemeier, Hammer, & Maczuga, 2015). Language deficits may be partially to blame for one-sixth of preschool children who remain high

users of physical aggression into adolescence (Côté et al., 2006), since poor language skills have been consistently linked to physical aggression (see Dionne, 2005 for a review). A few researchers have found an association between better receptive language (Estrem, 2005 [boys only]; Hawley, 2003 [girls only]) or expressive language (Bonica, Arnold, Fisher, Zeljo, & Yershova, 2003; Estrem, 2005 [boys only]) and concurrent relational aggression in preschoolers. These findings provide support for the developmental hypothesis with relational aggression beginning when language competencies come ‘online’.

Alternatively, relationally aggressive children may make greater gains in language because they engage in the social network (Xie, Swift, Cairns, & Cairns, 2002). Children with a bold temperament, a correlate of relational aggression (Park et al., 2005; Russell, Hart, Robinson, & Olsen, 2003), have been shown to have significantly better receptive and expressive language skills than shy children (Spere, Schmidt, Theall-Honey, & Martin-Chang, 2004). However, longitudinal examination of preschool language skills and relational aggression are rare with one notable exception. Park et al. (2005) found poorer preschool receptive language was associated with higher physical and relational aggression use in middle childhood. This replicated Estrem’s (2005) cross-sectional findings that in preschool, for girls only, it was *poorer* expressive language that related to relational aggression, after controlling for physical aggression. Given the conflicting findings regarding language and relational aggression these links require further investigation.

It may be that receptive language impairments prevent children from understanding the nuances of social exchanges, particularly if they are ambiguous (McCabe & Meller, 2004), leaving them more likely to misattribute hostile intent to a playmate, which is known to relate to aggressive responses (Orobio de Castro, Veerman, Koops, Bosch, & Monshouwer, 2002).

Expressive language limitations may cause frustration in children or limit their abilities to express themselves verbally, leading to aggression to vent frustration or to accomplish desired goals, such as being the first in line to ride a playground tractor. Alternatively, since high use of aggression impairs children's social relationships, leading them be ostracized (McNeilly-Choque et al., 1996), it may prevent them from participating in the language-rich peer group.

Longitudinal studies are required to determine the directionality of these effects.

Another possible explanation is that the association between language and aggression is due to language being related to other cognitive abilities, such as working memory (Rahbari & Vaillancourt, 2015), which has been shown to be relevant to social competence (de Wilde, Koot, Lier, 2016). For example, Hughes and Ensor (2008) found that at age three, executive function (an umbrella term for the cognitive abilities under which working memory falls), fully mediated the link between prior verbal ability at age two and later problem behaviour at age four. Their work provides support for the idea that language and working memory should be considered in consort in the prediction of preschool aggression.

Working Memory and Language

Working memory has been central to theories of language acquisition (Baddeley, 1986; Baddeley, Gathercole, & Papagno, 1998). Relevant to aggression, working memory allows for the manipulation and organization of relevant information during problem solving and young children use language, specifically self-talk, to self-regulate during such tasks (Berk, 1999; Vygotski, 1978; Winsler, Diaz, McCarthy, Atencio, & Chabay, 1999). Most experimental tasks used to measure working memory for the purpose of research have suffered from task impurity in that they are also dependent heavily on language abilities and other cognitive skills (Zelazo, Carter, Reznick, & Frye, 1997). This has complicated the work of delineating the two concepts.

For the present study, parent reports of children's working memory were used because they are based on multiple observations of behaviour in a real-world context in contrast to the language-dependent laboratory tasks commonly used to measure working memory.

Working Memory and Aggression

Individuals with working memory deficits have demonstrated difficulty narrowing down response choices in a social context (Hoaken, Shaughnessy, & Pihl, 2003) and have been shown to misinterpret social cues (Arsenault, & Foster, 2012). Such limited capacities for processing social information could lead to inappropriate responses like aggression (Crick & Dodge, 1996). Even after controlling for symptoms of ADHD, Séguin et al. (Séguin, Nagin, Assaad, & Tremblay, 2004; Séguin, Pihl, Harden, Tremblay, & Boulerice, 1995) found working memory impairments among persistently physically aggressive children from kindergarten to adolescence. Empirical evidence for a link between poorer working memory and externalizing issues in early childhood has been found (see meta-analysis by Schoemaker, Mulder, Deković, & Matthys, 2013); however, more research is needed to determine if deficits in working memory are linked specifically to physical aggression among children so young because physical aggression among preschoolers is more normative than later on in childhood (Tremblay, et al., 2004) and working memory is still developing during this age (Diamond, 2002).

Furthermore, if working memory and physical aggression are related in preschool, the directionality of this relation needs to be determined. In a recent study on early elementary aged children, de Wilde et al. (2016) found evidence of a bidirectional relation between working memory and conflict in children's relationships, alluding to the possibility that during a time when working memory is malleable, children's social relationships mold or impair its development. Their findings were consistent with a Vygotskian (1978) model of development,

highlighting the importance of more competent peers in scaffolding children's development. Since physical aggression has been associated with peer rejection (McNeilly-Choque et al., 1996), its high use may be particularly detrimental to socio-cognitive development.

There is a lack of research on working memory and relational aggression, particularly in early childhood. Controlling for physical aggression, deficits in working memory have been linked to relational aggression in only two studies, both conducted using middle childhood samples (Granvald & Marciszko, 2015; McQuade, Murray-Close, Shoulberg, & Hoza, 2013). To our knowledge, there is no published research on working memory and relational aggression in early childhood controlling for physical aggression, although, early relational aggression use has been associated with advanced socio-cognitive skills, namely prosocial skills (Vaillancourt et al., 2007) and theory of mind (the understanding of another's perspective; Renouf, et al., 2010), which have both been related to better working memory (Bierman, Torres, Domitrovich, Welsh, & Gest, 2009; Carlson, Moses, & Breton, 2002). Therefore, we predicted that in early childhood relational aggression would be associated with *better* working memory.

Caution is warranted in over-reacting to moderate levels of physical aggression in early childhood since its use is developmentally normative (Tremblay et al., 2004). Similarly, although the emergence of relational aggression in preschool is associated with developmental advances (Carpenter & Nangle, 2006), it is important to remember it is not a benign form of aggression. Both forms of aggression have been shown to cause substantial harm to victims (see Heilbron & Prinstein, 2008 for a review). Furthermore, elevated rates of each have been linked to a stable pattern of mistreating others into adulthood (Côté et al., 2006; 2007; Moffit, 1993; Pepler, Jiang, Craig, & Connolly, 2008). Therefore, it is important to identify aggressive children as early as possible in order to interrupt a problematic trajectory. Knowing if receptive language, expressive

language, working memory, or some combination, is predictive of elevated aggression can direct early childhood interventions and policy as to the best use of resources. Similarly, it is essential to have a clear picture of what emerging skills accompany the typical decrease in physical aggression and increase in relational aggression during normative development.

Present Study

We examined the within- and across-time links between language (receptive and expressive vocabulary), working memory, and preschool aggression (physical and relational), while accounting for within-time correlations and the stability of each over a year. This served two purposes. First, we wanted to ascertain the directional effects between language and aggression in early childhood. Second, we wanted to determine if language and working memory each conferred an independent risk or protective factor for aggression or if the link with aggression for either working memory or language was due to their overlap. The possible effects of age, socioeconomic status (SES), and sex were also assessed to ensure that no relations between language, working memory, and aggression were accounted for by these possible third-variable confounds. All variables of interest have shown rapid developmental changes during early childhood and hence age was considered a covariate for analyses. Also, higher SES and female sex have been demonstrated to relate to higher language (Park et al., 2005; Raaijmakers et al., 2008), working memory (Raaijmakers et al., 2008; Wiebe, et al., 2011), and relational aggression, as well as lower physical aggression (McNeilly-Choque et al., 1996; Ostrov & Keating, 2004). Furthermore, not accounting for working memory, poorer language skills have been shown to relate more strongly to peer difficulties for preschool boys than for girls (Stowe, Arnold, & Ortiz, 1999).

We made several hypotheses: (1a) Higher physical aggression would predict higher

relational aggression, consistent with the developmental hypothesis that physical aggression is replaced by relational aggression over time (Björkqvist et al., 1992a); (1b) Also consistent with the developmental hypothesis of aggression, relational aggression would not predict physical aggression; (2) Working memory and language would be strongly related within- and across-time since their co-development has been closely linked (Fuhs & Day, 2011); (3) Consistent with the findings of several other researchers, better language skills would relate to lower physical aggression (Dionne, Tremblay, Boivin, Laplante, & Périusse, 2003) and higher relational aggression (Bonica et al., 2003; Estrem, 2005; Hawley, 2003), but perhaps not above and beyond the links between language and working memory or working memory and aggression because executive function has been shown to mediate the link between early language and later problem behaviour (Hughes & Ensor, 2008); (4) Higher earlier rates of physical aggression would negatively impact gains in language and working memory made over time consistent with Vygotsky's theory (1978); and, (5) Higher earlier rates of relational aggression would positively impact later competencies in working memory and language (receptive and expressive). This was expected because using relational aggression has been linked to embedment and even prominence in the social network (Xie et al., 2002), providing more opportunities for socio-cognitive development (Vygotsky, 1978).

Method

Participants

Data were collected on a community sample of 126 (46% girls) preschoolers across two time points. They were recruited from daycare facilities in a city in Southern Ontario, Canada. Participants who planned to remain at the daycare facility over the two years of data collection were selected from a larger sample of 404 preschoolers for the longitudinal leg of the present

study. At Time 1, the participants from the present sub-sample ranged in age from 27 to 59 months ($M = 39.15$, $SD = 6.67$) and at Time 2, approximately 12-15 months later, they ranged in age from 40 to 75 months ($M = 54.45$, $SD = 7.28$). Children were predominantly English speaking (96%) and Caucasian (90%). Most parents (70%) had completed college or university and the sample household median income was consistent with the median income level for the city at the time of data collection (Statistics Canada, 2006).

A missing data analysis was conducted comparing participants retained for Time 2 with the full sample. Results indicated that participants from Time 2 were not significantly different than those who did not participate in Time 2 with regard to demographic variables, receptive and expressive vocabulary, working memory, or physical and relational aggression.

Measures

Language. Language was assessed with the Verbal subtests (Receptive Language and Picture Naming [expressive language]) of the Wechsler Preschool and Primary Scale of Intelligence (WPPSI-III; Wechsler, 2002). The measure has demonstrated reliability and validity. For the Receptive Vocabulary subtest, children had to choose from four pictures on a page by pointing to the one that corresponded to the spoken word of the experimenter. Correct answers were scored with one point and incorrect responses scored a zero. The assessment included 38 pages, for a maximum score of 38. For the Picture Naming subtest children had to name the one item per page they were shown. Scoring was the same as in the subtest above. Thirty items were included, such that the maximum score was 30. Higher scores on each subtest indicated better language skills.

Executive function. Parents reported on executive function using the Behavior Rating Inventory of Executive Function-Preschool Version (BRIEF-P; Gioia, Espy, & Isquith, 2003), a

63-item measure. The *Working Memory* scale was employed to assess one's ability to retain information for the purpose of completing a task, an essential component of problem solving and following multi-step instructions (16 items; e.g., "Has trouble concentrating on games, puzzles or play activities."). Items were rated on a three-point scale (*Never* = 1, *Sometimes* = 2, *Always* = 3). The rating scale for items was reversed to create a summary score of working memory such that higher scores represented better working memory. This was done to be consistent with language measures used in this study, such that higher scores represented greater competencies. The subscales of BRIEF-P have been shown to have good internal consistency (.80 to .97), adequate to high test-retest reliability (.65 to .94), high content validity, and good convergent validity (Gioia et al., 2003; Duku & Vaillancourt, 2014). The *Working Memory* scale showed good internal consistency in the present study at Time 1 ($\alpha = .90$) and Time 2 ($\alpha = .92$).

Aggression. Teachers completed selected items (three items following Tremblay, 2000; e.g., "Kicks, bites, hits other children.") from the Child Behavior Checklist (CBCL; Achenbach & Rescorla, 2000) to represent a physical aggression subscale. A three point scale was used (*Not true* = 0, *Somewhat true* = 1, *Always true* = 2). Relational aggression (five Items; e.g., "When mad at someone, tries to get others to dislike that person.") was also assessed by teachers using the relational aggression subscale of the National Longitudinal Survey of Children and Youth (NLSCY) parent form (Statistics Canada, 2012 adapted from Lagerspetz, et al., 1988). Respondents reported on a three-point scale for each item (*Never* = 0, *Sometimes* = 1, *Often* = 2). Items were averaged within a subscale, such that higher scores indicated higher levels of that form of aggression. The Time 1 and Time 2 physical ($\alpha = .87$; $\alpha = .90$) and relational aggression ($\alpha = .81$; $\alpha = .87$) scales showed good internal consistencies in the present study.

Socioeconomic status (SES). Maternal education level and household income were standardized, averaged, and then re-standardized. The resulting composite score was utilized in analyses as socioeconomic status, with higher scores indicating higher average maternal education level and household income.

Procedure

With research ethics board approval, at Time 1 and Time 2, in a quiet room, trained experimenters administered both receptive and expressive language subscales of the WPPSI-III. A child psychologist trained the experimenters and also scored the results. The CBCL and relational aggression scale from the NLSCY were given to educators to complete and then returned upon completion each year. Educators received monetary compensation for returned scales. The completed BRIEF-P form and demographic information were provided by parents in a similar manner. Prior to data collection, parental consent and child assent were obtained. Participants received a children's book.

Analytical Plan

Hypotheses were tested via an autoregressive cross-lagged panel model using *Mplus* software Version 7.4 (Muthén & Muthén, 2012-2015). Maximum likelihood robust (MLR) estimation was employed due to its robustness to non-normal data. A design effect (DEFF) value was calculated for each variable to determine if there was interdependence of children nested within the same daycare classroom. No DEFF values exceeded 2, suggesting that estimates of the standard errors and chi-square would not be biased due to interdependence (Muthén & Satorra, 1995). Therefore, nesting was not accounted for in further analyses. In order to test the direction of effects between types of language skills (receptive and expressive vocabulary) and forms of aggression (physical and relational), we modeled the relations of these four variables over two

time points during early childhood using an autoregressive, cross-lagged panel design. Working memory was also included in the model at both time points to explore its role as a third-variable cause. The hypotheses that were tested by fitting a series of nested models are indicted in Figure 1.

Given that the sample size was relatively small (< 250 participants), although large for a preschool sample that included direct measures, decisions regarding model fit were based on the standardized root mean square residual (SRMR; Browne & Cudeck, 1993), the Tucker–Lewis index (TLI), and the comparative fit index (CFI; Hu & Benter, 1999). Following recommendations from other researchers (Hu & Benter, 1999; Little, Henrich, Jones, & Hawley, 2003; Ostrov, Murray-Close, Godleski, & Hart, 2013), model fit was considered adequate if the SRMR value was .08 or lower and the CFI and TLI were .90 or above. For nested model comparisons, the corrected chi-square difference test (Satorra & Bentler, 2001) was used as is appropriate when employing MLR.

The final model was tested to determine if concurrent relations, longitudinal stabilities, and longitudinal cross-domain effects persisted after covariates were controlled for. This was done as separate steps due to the small sample size. We included age, SES, and sex separately as covariates to control for their impact in analyses. Zero-order correlations between age, SES, and sex were examined to determine if they correlated significantly ($p < .05$) with the other variables of interest and should therefore be included in the path model. If deemed a relevant covariate, we re-examined the relations in the final model with the time-invariant covariate included. This meant that within-time correlations were estimated, as were direct paths from the covariate at Time 1 to later outcomes (i.e., Time 2 language, working memory, and aggression).

Results

Descriptive Statistics and Bivariate Correlations

The means and standard deviations are reported in Table 1. Examination of skew and kurtosis values indicated that Time 1 relational aggression was non-normally distributed. Results indicated that boys had significantly higher teacher-reported physical aggression at Time 1 ($M = .62$, $SD = .60$; $t(118) = -2.88$, $p = .005$, $d = 0.52$) and Time 2 ($M = .47$, $SD = .65$; $t(87) = -2.71$, $p = .008$, $d = 0.55$) compared to girls' average scores within the same time point (Time 1, $M = .34$, $SD = .47$; Time 2, $M = .17$, $SD = .41$). No other sex differences were found.

A regression analysis was run to screen for multicollinearity among the predictors, including the covariates. The resulting variance inflation factors (VIFs) were low enough (< 4) to rule out excessive multicollinearity. An examination of intercorrelations (see Table 1) revealed that Time 1 expressive language was related concurrently and over time with physical aggression, such that those who had poorer expressive vocabulary were higher on physical aggression within and over separate time points. The opposite was true for relational aggression, with those showing better expressive language concurrently showing higher relational aggression at Time 1. Receptive and expressive language skills were significantly positively related to each other and working memory at both time points.

Age was positively correlated with Time 1 relational aggression ($r = .38$, $p < .001$) and Time 1 and 2 receptive ($r = .42$, $p < .001$; $r = .39$, $p < .001$) and expressive ($r = .49$, $p < .001$; $r = .33$, $p < .001$) vocabulary, indicating that older preschoolers showed higher relational aggression, as well as better language skills at both time points. Higher SES was related to better receptive language over time ($r = .27$, $p = .005$), as well as concurrently and over time to better working memory ($r = .26$, $p = .005$; $r = .31$, $p = .004$) and lower physical aggression ($r = -.22$, $p = .02$; $r =$

-.23, $p = .029$).

Model-fitting and Hypothesis Testing

The series of nested models used to test our hypotheses, including the baseline model are depicted in Figure 1. For Model 1, we fitted a baseline model, which included within-time covariance terms, autoregressive paths for all language, working memory, and aggression variables, as well as within-domain, cross-lagged paths between language variables that were not relevant to our hypotheses (e.g., Time 1 expressive language to Time 2 receptive language). Then, we tested a series of nested models by adding cross-lagged paths according to our hypotheses (refer to Figure 1). Model fit indices and the results from nested model comparison tests are displayed in Table 2. Model 5 was retained as the final model (see Figure 2 for the standardized results).

Final Model

The final model depicted in Figure 2, accounted for the following proportions of variance in the Time 2 outcome variables: 49.6% of receptive vocabulary, 57.2% of expressive vocabulary, 52.8% of working memory, 32.8% of physical aggression, and 25.1% of relational aggression.

Physical and relational aggression. Only prior levels of physical aggression were relevant in predicting its use one year later ($b = .52, p < .001$). Being higher on physical aggression at Time 1 (or increasing in physical aggression over time) predicted increased relational aggression later on ($b = .34, p = .001$) accounting for prior levels of relational aggression. Relational aggression was not stable over time. Both forms of aggression remained significantly positively correlated at Time 2 after accounting for all of the other variables in the model.

Language and working memory. After adjusting for the other relations in the model, at Time 1, receptive and expressive language skills remained correlated with each other and with working memory, such that better receptive and expressive language and better working memory tended to co-occur. Receptive ($b = .19, p = .011$) and expressive ($b = .52, p < .001$) language and working memory ($b = .73, p < .001$) were highly stable over time. For both receptive ($b = .28, p = .001$) and expressive ($b = .13, p = .017$) language, greater gains in language over time were predicted by better working memory at Time 1. Receptive language was also influenced by Time 1 expressive language skills ($b = .41, p < .001$). Both forms of language remained significantly positively correlated at Time 2 even after accounting for their stability and all other relationships in the model.

Competencies (language and working memory) and aggression. With regard to the link between language and aggression, after accounting for the other variables in the model, at Time 1, expressive vocabulary remained correlated with physical and relational aggression, such that higher expressive vocabulary was associated with lower physical aggression and higher relational aggression. However, after controlling for all other effects in the model, no longitudinal paths between earlier language and later aggression were significant in the final model.

Relatively higher working memory at Time 1 (or increases in working memory over time) was linked to higher relational aggression approximately one year later ($b = .03, p = .009$). At Time 2, working memory was negatively associated with physical aggression, suggesting that better working memory remained concurrently related to lower physical aggression after accounting for everything else in the model.

Covariate Analysis

The correlations between the variables of interest and age, SES, and sex were considered to determine if they were important covariates. Since age was significantly correlated with both aggression and language, SES with all of the variables of interest, and sex with physical aggression, they were each deemed relevant for inclusion in analyses. Therefore, we re-examined the final model to determine whether the cross-sectional, autoregressive, and longitudinal paths were changed accounting for the effects of age, SES, and sex separately. None of the significant relations in the final model were attenuated by the inclusion of any of the covariates.

Discussion

The main goal of the present study was to determine the directional effects between language and aggression in early childhood, accounting for working memory and changes in each over time (as well as the covariates of age, SES, and sex separately). Using a community sample of preschoolers, we examined concurrent and short-term longitudinal links between language (receptive and expressive vocabulary), working memory, and aggression (physical and relational) using an autoregressive cross-lagged panel model. Such models are not used to measure intra-individual change, but rather the ranking of individuals on a specific trait with reference to each other over time (Selig & Preacher, 2009). With this in mind, our finding regarding the high stability of physical aggression over one year in preschool indicated that one's initial level of physical aggression related to one's level of physical aggression later on. This is consistent with the findings of others (e.g., Côté et al., 2007; Tremblay, et al., 2004) who have found that one's initial levels of physical aggression in early childhood related to which developmental trajectory they followed (e.g., high and increasing, moderate and increasing, low and stable), including when accounting for the co-development of relational aggression (e.g.,

high and stable, low and stable, intermediate and decreasing). Receptive and expressive language and working memory also demonstrated stability in that one's later expression of these capacities was linked to previous levels. Since these capacities generally grow over early childhood, rather than regress, our findings suggest that over the course of a year, levels of language and working memory stayed similar or increased for most children.

Later relational aggression was not found to relate to previous levels, but rather, previous levels of physical aggression were most relevant. At Time 1 our participants were just over three years old, on average, with some as young as two years old. The lack of significance on the autoregressive path for relational aggression indicates a reshuffling of scores over time (Selig & Preacher, 2009). Since relational aggression has a low prevalence rate before age four (Côté et al., 2007) and teacher reports have indicated significant increases in relational aggression use between age three and four (Morine et al., 2011), several children may have just begun expressing relational aggression during the delay between time points. That higher physical aggression predicted higher later relational aggression is consistent with previous findings in preschoolers (e.g., Vaillancourt et al., 2007) and the developmental hypothesis that physical aggression is replaced by relational aggression over time (Björkqvist et al., 1992a); or alternatively, since physical aggression was stable, it may even be used in conjunction with relational aggression in later preschool. Crick et al. (1997) found that a third of aggressive preschoolers were combined users of both forms. Similarly, Côté et al. (2007) found that very few children between the ages of four to eight years old specialized in exclusively relational aggression. Instead, those that used high levels of aggression used both forms frequently.

With regard to the overlap between language and working memory, our second hypothesis was supported, in that we found that both receptive and expressive vocabularies were

strongly related to previous working memory. This is consistent with the findings that working memory and receptive language are longitudinally associated during preschool (Schneider, Lockl, & Fernandez, 2013). Our findings of a longitudinal path between working memory and expressive vocabulary extends the cross-sectional findings of Adams and Gathercole (1995) who found that preschool children with better working memory produced more grammatically complex utterances and larger vocabularies than those with poorer working memory.

Regarding language and aggression, with our cross-sectional findings at Time 1 we replicated previous research indicating that better expressive language skills relates to lower physical aggression (Dionne et al., 2003) and higher relational aggression (Bonica et al., 2003; Estrem, 2005). For physical aggression, our finding was consistent with the literature documenting that better language ability, particularly expressive vocabulary, was associated with better psychological adjustment, including being protective against early behaviour problems (Carson, Klee, Perry, Muskina, & Donaghy, 1998; Keenan & Shaw, 1997). Our findings supported the notion that some relationally aggressive acts, such as spreading malicious gossip (e.g., “She pees her pants.”) rely on, or are facilitated by, concurrent verbal skills even in preschool (McNeilly-Choque et al., 1996). However, consistent with our third hypothesis, when working memory was simultaneously accounted for in the model, there were no longitudinal associations between language and aggression. Taken together, with our finding that working memory was closely linked with receptive and expressive language, our results indicate that the previously documented relations between language and aggression (e.g., Bonica et al., 2003; Dionne, 2005) may need to be re-examined accounting for working memory as a possible third-variable cause.

The finding that working memory still remained associated with physical aggression at

Time 2 even after accounting for age, SES, sex, and language (all strongly linked to physical aggression in prior research), affirms the importance of poor concurrent working memory as a risk for participation in higher physical aggression (Granvald & Marciszko, 2015; Hofmann, Gschwendner, Friese, Wiers, & Schmitt, 2008; McQuade et al., 2013; Séguin, et al., 1995, 2004). The exact nature of this link is not clear. McQuade et al. (2013) found that working memory was related to poorer social competence and peer rejection via problem solving deficits. However, they focused on middle childhood and only used cross-sectional data. Further longitudinal research is needed to determine the exact mechanism and direction of the association between working memory and physical aggression during preschool. We did not find significant cross-lagged paths to support our prediction that working memory deficits would lead to physical aggression (Hypothesis 3) or that physical aggression would negatively impact working memory gains (Hypothesis 4). There was an improved model fit when paths were added from capacities (working memory and language) to aggression, but not when paths were added from aggression to later capacities. This could indicate that the link is neither predictive over time nor reciprocal during preschool. This is inconsistent with the reciprocal effect hypothesis between executive function development and peer interactions that has recently been proposed by Dishion (2016) concerning older children. The reciprocal effect hypothesis is that social experiences impact neurocognitive development (e.g., executive functions such as working memory) and also that individual differences in neurocognitive development impact one's capacity for developing healthy relationships. Recent studies support this hypothesis with older children (see Dishion, 2016 for a review), but our results suggest that it may not apply to physical aggression and working memory in preschoolers, at least not over the course of one year.

We did however find evidence that better working memory predicted higher (or

increasing) relational aggression over time during preschool. This link persisted when accounting for age, SES, and sex. Our findings make a contribution to the literature because the unique link between working memory and relational aggression (controlling for physical aggression) has never been explored during preschool. Though they failed to control for the overlap between physical and relational aggression, our findings are consistent with those of a recent cross-sectional study on children three through six years of age, in that working memory was positively associated with relational aggression even after controlling for age, sex, and verbal ability (Poland, Monks, & Tsermentseli, 2015). Furthermore, this gives support to the idea that relational aggression, even in preschool, is linked to the development of a sophisticated skill-set (Carpenter & Nangle, 2006). Replication of this longitudinal association and exploration of the mechanism underlying this link should be the focus of future research. Theory of mind is linked to both working memory and relational aggression and is one possible reason for their association (Carlson et al., 2002; Renouf, et al., 2010). Since the relation is either the target of a relationally aggressive attack or the weapon used to cause harm (Crick et al., 1999), execution of relational aggression depends on the ability to understand and keep in mind the mental states of another individual in order to know which relationships are meaningful to them and therefore vulnerable to attack or manipulation. Alternatively, it may be through its association with better inhibitory control (Garon et al., 2008) that working memory is linked with relational aggression, allowing a preschooler to use a more circuitous form of aggression. Integrating these ideas, working memory may be predictive of relational aggression because a preschooler can only pull off relational aggression once he or she is capable of keeping the goals and vulnerabilities of others and one's own goals in mind simultaneously, while also accounting for the whereabouts of the teacher in order to avoid detection.

Our fifth hypothesis, that participation in relational aggression would lead to gains in language and working memory, was not supported by our results. Although we did find evidence of this with regards to language in our across-time correlation results, model fit was not significantly improved by the addition of cross-lagged paths from relational aggression to language and working memory. Our sample size was large given the resource-intensive data collected on our very young participants (e.g., individually-administered language tests), but power to detect an effect in a complex model may have been limited by our sample size. Replication of our findings using a larger sample of preschoolers is recommended because relationally aggressive children are typically well-immersed in the peer social network (Xie et al., 2002) and this may give them additional opportunities to practice language.

Several limitations of the present study should be considered in interpretation of our findings. First, given the time-intensive data collected (e.g., language tests), our sample size is small for the complexity of the model and analysis method used, and as such, our analyses may be underpowered. Second, our participants were selected from quality-controlled, licensed daycare facilities. This is an important consideration because participation in such an early childhood intervention may impact cognition, including language and memory (Nores & Barnett, 2010), and social behaviour (see Huston, Bobbitt, & Bentley, 2015 for a review). Consequently, our findings may not generalize to all populations.

The present study had several strengths that make it an important contribution to the current body of literature. First, it is one of few studies addressing relational aggression before age four. Second, we accounted for physical and relational aggression simultaneously which is important given the overlap between these forms of aggression and their seemingly opposing link to both language and working memory. Third, we used a multi-infomant, multi-measure

method (assessments, parents, teachers) to eliminate shared method variance. Thus, the links we found were across multiple measures.

In summary, the present study adds to the current literature in that we are the first to examine the longitudinal links between language and both relational and physical aggression during preschool, while accounting for working memory. When the overlap between language and working memory were accounted for in our analyses, no longitudinal links between either receptive or expressive language and physical or relational aggression persisted. Physical aggression and working memory positively predicted preschool relational aggression. Only previous use of physical aggression predicted its use the following year. On the one hand, concurrent impairments in expressive vocabulary (Time 1) and working memory (Time 2) related to higher physical aggression. On the other hand, *advancements* in concurrent expressive vocabulary (Time 1) and prior working memory related to relational aggression. In general, our findings that competencies in language and working memory were related to lower physical aggression and higher relational aggression support the notion of a deficit model of physical aggression even in preschool when moderate levels of physical aggression are relatively common. In contrast, early relational aggression appears to be a symptom of developmental advancements, particularly working memory, during early childhood.

Table 1

Summary of intercorrelations, means, and standard deviations for language, working memory, and aggression

Measure	1	2	3	4	5	6	7	8	9	10
1. Physical aggression T1	-									
2. Relational aggression T1	.10	-								
3. Receptive language T1	-.05	.07	-							
4. Expressive language T1	-.21*	.25**	.68**	-						
5. Working memory T1	-.08	.10	.22*	.30**	-					
6. Physical aggression T2	.58**	.18	-.05	-.22*	-.14	-				
7. Relational aggression T2	.38**	.15	-.11	-.14	.22*	.49**	-			
8. Receptive language T2	-.10	.26**	.50**	.66**	.42**	-.15	.01	-		
9. Expressive language T2	-.12	.30**	.40**	.71**	.32**	-.05	-.03	.66**	-	
10. Working memory T2	-.22*	.11	.11	.18	.67**	-.33**	.22	.26*	.42**	-
<i>M</i>	.49	.11	16.89	14.63	41.85	.33	.37	20.70	23.97	41.98
<i>SD</i>	.56	.22	5.89	5.35	5.03	.57	.47	3.93	5.33	4.99

* $p < 0.05$. ** $p < 0.01$.

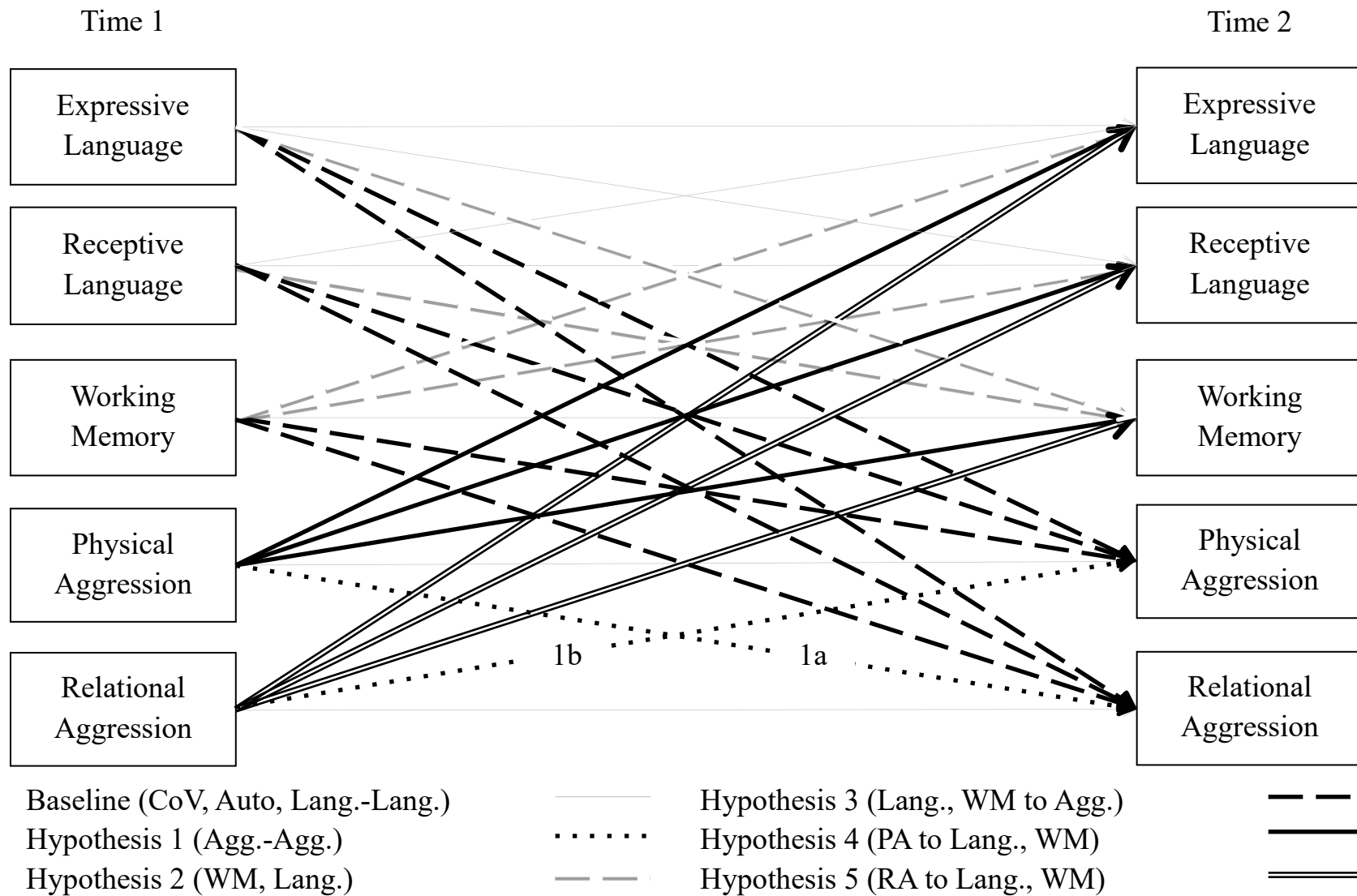


Figure 1. Proposed nested model tests and associated hypotheses regarding the relationship between language, working memory, and aggression.

Table 2

Model fit tests and nested model comparison tests regarding the relationship between language, working memory, and aggression.

<i>Model (Corresponding Hypothesis)</i>	<i>Model fit</i>			<i>Nested model comparisons</i>			
	<i>CFI</i>	<i>TLI</i>	<i>SRMR</i>	<i>Model</i>	$\Delta\chi^2$	<i>df</i>	<i>p</i>
Model 1: Baseline	.88	.78	.11	-	-	-	-
Model 2: PA to RA (1a)	.93	.85	.09	2 vs. 1	9.62	1	.002
Model 3: RA to PA (1b)	-	-	-	3 vs. 2	-	-	<i>ns</i>
Model 4: WM to EV, RV; EV, RV to WM (2)	.95	.87	.07	4 vs. 2	11.48	4	.02
Model 5: EV, RV, WM to PA, RA (3)	.99	.95	.03	5 vs. 4	18.32	6	.006
Model 6: PA to EV, RV, WM (4)	-	-	-	6 vs. 5	-	-	<i>ns</i>
Model 7: RA to EV, RV, WM (5)	-	-	-	7 vs. 5	-	-	<i>ns</i>

Note. PA = physical aggression, RA = relational aggression, WM = working memory, EV = expressive vocabulary, RV = receptive vocabulary.

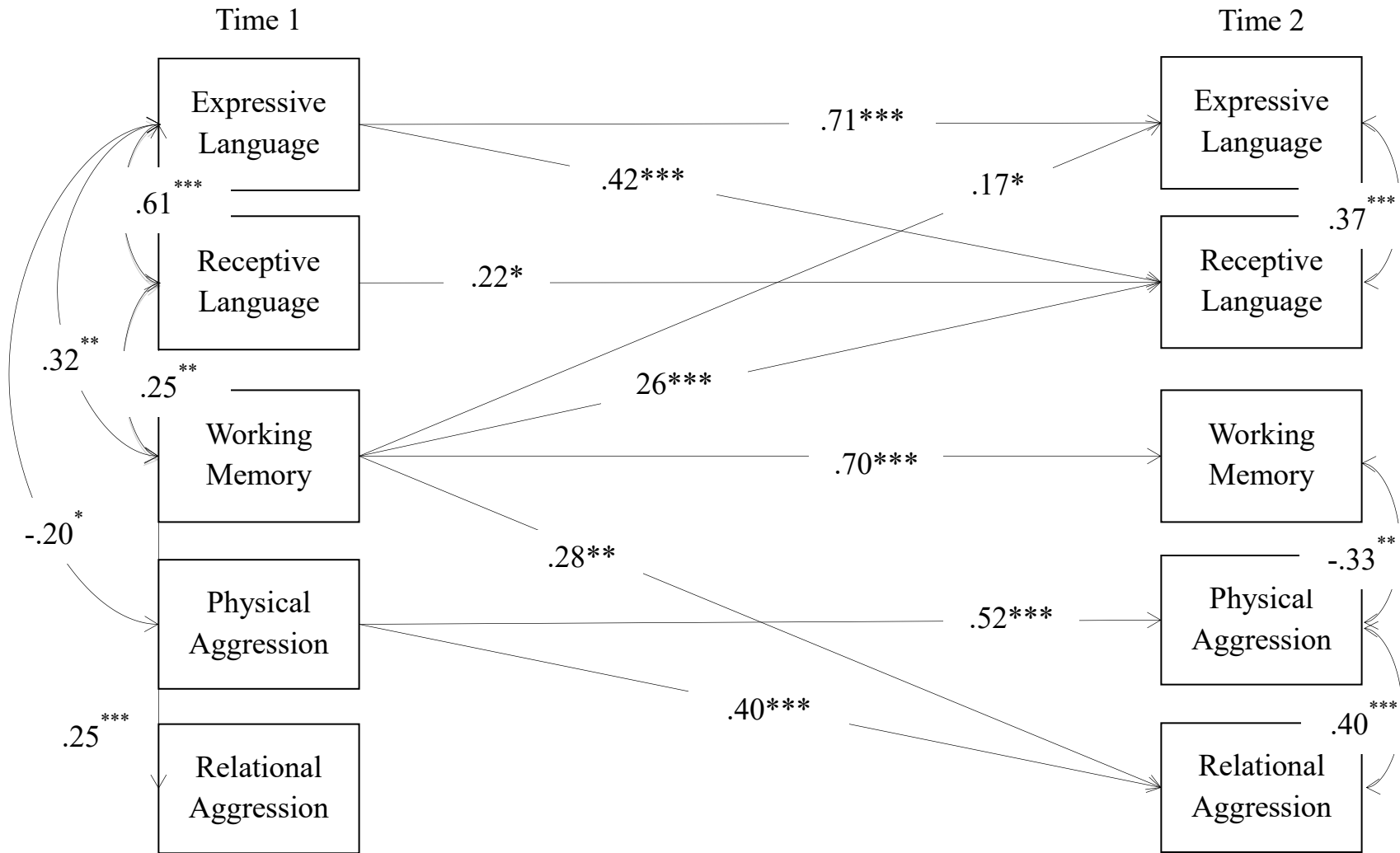


Figure 2. Standardized covariances, autoregressive, and cross-lagged paths for the relations between preschool language, working memory, and aggression.

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The Interaction between Emotionality and Dispositional and Neurocognitive Aspects of Self-
Regulation in the Prediction of Preschool Aggression

Jennifer Hepditch¹ and Tracy Vaillancourt^{1,2}

¹School of Psychology, Faculty of Social Sciences, University of Ottawa; ²Counselling
Psychology, Faculty of Education, University of Ottawa

Authors' Note

Correspondence: Tracy Vaillancourt, Counselling Psychology, Faculty of Education, University of Ottawa, 145 Jean-Jacques-Lussier, Ottawa, ON K1N 6N5. E-mail: tracy.vaillancourt@uottawa.ca

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Abstract

Using four separate multivariate multiple regressions we examined the linear and interactive effects between negative emotionality and several aspects of self-regulation (inhibitory, emotional, attentional, and metacognitive control) in the prediction of physical and relational aggression using a community preschool sample ($N = 198$; $M = 33.65$ months, $SD = 5.02$). A multiple comparison statistic was applied and results were assessed for significance using $p < .0125$. Regardless of trait negative emotionality, poorer inhibitory control was associated with higher physical and higher relational aggression and poorer metacognitive control (i.e., working memory) was associated with higher physical aggression. Negative emotionality interacted with both emotional control (specifically soothability) and attentional control in the prediction of relational aggression, such that higher negative emotionality was related to higher relational aggression when preschoolers were simultaneously *higher* on emotional control or attentional control.

Keywords: self-regulation, temperament, negative emotionality, soothability, attention span persistence, executive control, inhibitory control, working memory, physical aggression, relational aggression, early childhood

The Interaction between Emotionality and Both Dispositional and Neurocognitive Aspects of Self-regulation in the Prediction of Preschool Aggression

Aggression is defined as behaviour that is intended to harm and includes physical (e.g., hitting; Nagin & Tremblay, 1999) and relational forms (e.g., social exclusion; Crick & Grotpeter, 1995; Lagerspetz, Björkqvist, & Peltonen, 1988). Sex differences in the use of aggression during early childhood, though less pronounced than later on in life, do resemble the pattern in middle childhood and adolescence (Côté, Vaillancourt, Barker, Nagin, & Tremblay, 2007; Crick, Casas, & Mosher, 1997; Ostrov & Keating, 2004); namely, relational aggression is the predominant form of aggression used by girls (Lagerspetz, et al., 1988) and boys use both physical and relational aggression (Card, Stucky, Sawalani, & Little, 2008). The use of moderate amounts of aggression in early childhood is developmentally normative and may be a typical way for preschool children (age two to five years) to express emotion, direct play, and access resources such as toys (Koot, Van den Oord, Verhulst, & Boomsma, 1997; Tremblay et al., 2004; Vaughn, Vollenweider, Bost, Azria-Evans, & Snider, 2003).

Most children learn to inhibit physical aggression during preschool (e.g., Côté, Vaillancourt, Leblanc, Nagin & Tremblay, 2006). Rapid development of self-regulation, the ability to control one's emotions, cognitions, and behaviour, occurs throughout early childhood (Karoly, 1993). Given that these changes overlap, it may be that age-related improvements in self-regulatory skills account for decreases in physical aggression over time in the majority of children (Lemery, Essex, & Smider, 2002). Relational aggression first emerges as early as two and a half years of age (Crick, Ostrov, Burr, Cullerton-Sen, Jansen-Yeh, & Ralston, 2006a), coinciding with the development of the language, social-cognitive, and self-regulatory skills needed to use it (Crick et al., 1997; Vaillancourt, Miller, Fagbemi, Côté, & Tremblay, 2007).

A minority of children exhibit high levels of physical aggression in preschool and continue using problematic levels of aggression into childhood and adolescence (Côté et al., 2006; 2007); this group is at-risk for substantial dysfunction, such as chronic mental health, interpersonal, legal, and economic difficulties, in addition to the harm they continue to cause to others (Moffitt, Caspi, Harrington, & Milne, 2002). Similarly, relational aggression, alone (Crick et al., 1997; Crick et al., 2006; Ostrov, Woods, Jansen, Casas, & Crick, 2004), or in combination with physical aggression (Crick, Ostrov, & Werner, 2006b; Underwood, Beron, & Rosen, 2011), can be detrimental to both perpetrator and targets (McDougall & Vaillancourt, 2015).

Given the damage associated with aggression it is important to determine early individual risk factors associated with its elevated use to inform timely intervention efforts. The findings from research on physical aggression point to temperament, particularly emotional reactivity, and a deficit in the self-regulatory skills required to modulate one's emotional response as substantial risk factors for aggression (Lemerise & Dodge, 2000). However, whether these predictors are related to relational aggression, especially when it first emerges in preschool, has been relatively unexplored. This was the focus of the present study.

Negative Emotionality and Aggression

Negative emotionality, a predisposition to experience negative emotions easily, intensely, and for a lengthy period of time (Rettew & McKee, 2005) has been associated with physical (Harden et al., 2000; Ostrov, Murray-Close, Godleski, & Hart, 2013; Rubin, Burgess, Dwyer, Hastings, 2003) and relational aggression (Evans, Nelson, & Porter, 2012) in studies of preschool-age children. The association between aggression and negative emotionality is possibly due to the tendency for such individuals to experience emotions such as frustration or anger, which may lead to physical or relational aggression (Ostrov, et al, 2013; Marsee & Frick,

2007; Rubin et al., 2003). This is consistent with the frustration-aggression hypothesis, which stipulates that aggression is the consequence of the emotional experience of anger or frustration due to blocked attainment of a goal (Berkowitz, 1978; Dollard, Miller, Doob, Mowrer, & Sears, 1939). However, some researchers have not found a unique link between negative emotionality and aggression (e. g., Laible, Carlo, Panfile, Eye, & Parker, 2010). There are two possible explanations for this that were addressed in the present study. First, studies have not traditionally focused on female-relevant forms of aggression, such as relational aggression, in this association. Perhaps girls, who are predisposed to negative emotionality, behave in a relationally aggressive manner since physical aggression is gender non-normative behaviour for girls (Crick, 1997). Second, regulation of one's emotional reactivity may moderate the link between negative emotionality and aggression, such that the experience of negative emotions only leads to aggression for those who cannot soothe their emotional response or manage their behavioural expression of negative emotions. In this study, we tested this moderation hypothesis with attention paid to both physical and relational aggression to ensure sensitivity to the experiences of young girls, as well as boys.

Self-regulation

Historically, research on self-regulation has been approached from diverse frameworks within different sub-disciplines of psychology (Bridgett, Oddi, Laake, Murdock, & Bachmann, 2013). On one hand, developmental investigators conceptualize self-regulation within a temperament-based framework, focusing on constitutionally-based individual differences in reactivity and self-regulation (e.g., Posner & Rothbart, 2000). On the other hand, cognitive, neuroscience, and clinical investigators conceptualize self-regulation within a neural framework, focusing on the interplay between various brain structures in the control of attention, cognition,

and emotional reactivity (Bush, Luu, & Posner, 2000; Drevets & Raichle, 1998; Groenewegen & Uylings, 2000).

With regard to temperament, reactivity refers to arousability of emotion and excitability of motor responses, whereas self-regulation refers to processes intended to alter reactivity, such as mechanisms involving inhibition, attentional modulation, and approach/avoidance (Rothbart & Derryberry, 1981; Thompson, 1991). Compared with less reactive individuals, more reactive individuals may have a greater need for optimal regulation to offset their inborn tendency to ‘overreact’ to stimuli; alternatively, their reactivity may more easily overwhelm their self-regulatory abilities, putting them at risk for maladjustment (Rothbart & Bates, 2006).

From a temperament perspective, much of the research on self-regulation has focused on effortful control, which is characterized by inhibitory control (the ability to inhibit one’s behaviour) and attentional control (the ability to focus and shift one’s attention; Posner & Rothbart, 2000). The ability to direct and sustain attention on less distressing aspects of a social situation may help a child reduce negative feelings, such as frustration or anger (Derryberry & Rothbart, 1988). Lack of attentional control may impair modulation of negative emotions (Derryberry & Rothbart, 1988).

Other researchers have explored soothability as a marker of emotion regulation (Gartstein, Putnam, & Rothbart, 2012; Harden et al., 2000; Rubin, Coplan, Fox, & Calkins, 1995). Soothability is defined as the ability to recover from distress as a result of a caregiver’s comforting techniques, such as cuddling or singing (Buss & Plomin, 1975). During early childhood, parents’ soothing behaviour is a form of co-regulating, which plays an important role in scaffolding the skills of self-regulation a child will then use independently, in part, because these interactions impact specific areas of the brain that aid in controlling emotional reactivity

(Posner & Rothbart, 2000; Thompson, 1991)

From a neural perspective, much of the work on self-regulation has emphasized executive functions, higher-order cognitive abilities required to self-regulate thoughts, emotions, and behaviour (Anderson, 2002). Even during the preschool years, executive function is comprised of several interacting, but unique, domains required for top-down, intentional self-monitoring (Duku & Vaillancourt, 2014). Several sub-domains of executive function include inhibitory control and working memory (Sherman & Brooks, 2010). Inhibitory control refers to the ability to suppress distracting information or inappropriate behaviour. Working memory is defined as the ability to hold information in mind for the purpose of completing a task.

Recently several researchers have noted the substantial overlap between regulatory aspects of temperament and executive function and have emphasized the need to consider their common and unique contributions to our understanding of the role of self-regulation in children's adaptive functioning in order to advance the field (Bridgett et al., 2013; Liew, 2012; Zhou, Chen, & Main, 2012). Therefore, in the present study, we considered both temperament-linked aspects of self-regulation in addition to neurocognitive aspects of self-regulation known as executive functions.

Negative Emotionality x Self-regulation

In addition to the frustration-aggression hypothesis, aggression has been theorized to result from limited or depleted self-regulatory abilities (Baumeister & Baumeister, 1997; DeWall, Baumeister, Stillman, & Gailliot, 2007; Gottfredson & Hirschi, 1990). Hence, beyond negative emotionality, lagging skills in temperament-based and executive function-based self-regulation are a risk factor for early problem behaviour, such as aggression (Eisenberg et al., 2009; Raaijmakers et al., 2008; Séguin, Nagin, Assaad, & Tremblay, 2004; Utendale & Hastings,

2011) and may further exacerbate the risk associated with a temperament high in negative emotionality (Calkins, & Fox, 2002; Eisenberg et al., 1993; Moran, Lengua and Zalewski, 2013; Muris & Ollendick, 2005; Suurland et al., 2016). The most promising explanation for this link is that social-informational-processing (SIP) may be impaired by self-regulatory deficits and in turn lead to aggression, at least in the case of physical aggression (Crick & Dodge, 1996; Hoaken, Shaughnessy, & Pihl, 2003), and perhaps, especially in the context of intense negative emotions.

Studies exploring the interaction between negative emotionality and self-regulation in early childhood, with regard to physical aggression specifically, rather than broader measures of disruptive behaviour, are limited. In the only study examining the interactive effect of negative emotionality and inhibitory control in the prediction of preschool aggression, Suurland et al. (2016) found that preschoolers who were high in negative emotionality and low in inhibitory control were the most physically aggressive. This may be because inhibition is important for regulating expressions of emotion (Bridgett et al., 2013; Carlson & Wang, 2007) and suppressing an automatic response in favour of a longer-term goal (Bodnar, Prahme, Cutting, Denckla, & Mahone, 2007).

Whether or not the relation between negative emotionality and relational aggression is also moderated by self-control, as seems to be the case for physical aggression, is not clear. To our knowledge, only one study to date has been focused on exploring this multiplicative effect with regard to relational aggression (Dane & Marini, 2014). In adolescence, increased frustration-proneness (an aspect of negative emotionality) was related to relational aggression, but only when individuals were *high* on a measure of inhibitory and attentional control (i.e., effortful control). This means that when frustrated, an individual may chose relational aggression over more overt aggression, but only if able to actively regulate one's impulses and attention.

Considering the substantial growth in emotional, cognitive, and social skill development during the early years (Boivin, 2005; Hammond & Brownell, 2015), it may be an opportune time to determine what deficits or capacities may be associated with the emergence of aggression at both typical and atypical levels.

Present Study

We examined the linear and interactive effects between negative emotionality and several aspects of self-regulation (inhibitory, emotional, attentional, and metacognitive control) in the prediction of physical and relational aggression using a preschool sample.

We made several hypotheses: (1) Consistent with the frustration-aggression theory (Dollard et al., 1939) and research demonstrating that emotion dysregulation is a risk factor for both physical and relational aggression in childhood (see Röhl, Koglin, & Petermann, 2012 for a review), we expected that both high negative emotionality (emotional reactivity) and low soothability (emotional regulation) would be linked to both forms of aggression; (2) Lower scores on all domains of self-regulation would be related to higher physical aggression since among young children, externalizing issues (Gartstein et al., 2012; see Schoemaker, Mulder, Deković, & Matthys, 2013 for a meta-analysis) and physical aggression have been previously associated with deficits in self-regulation, such as deficits in inhibitory control (Raaijmakers et al., 2008; Utendale & Hastings, 2011), emotion regulation (see Röhl et al., 2012 for a review), attentional control (Harden et al., 2000), and working memory (Séguin et al., 2004); (3) Associations between aspects of self-regulation and relational aggression would differ depending on the self-regulation measure in question as has been observed in older children (Granvald & Marciszko, 2015).

With regards to relational aggression in early childhood, no known studies have been aimed at exploring its association with temperament-based aspects of self-regulation and the few studies aimed at exploring its association with neurocognitive aspects of self-regulation have failed to control for physical aggression (O'Toole, Monks, & Tsermentseli, 2016; Poland, Monks, & Tsermentseli, 2016). Therefore, our hypotheses regarding self-regulation and preschool relational aggression were based on relevant theory and empirical studies conducted on older children. Specifically, we expected that: a) after controlling for physical aggression, poorer inhibitory control would show no significant association with relational aggression, consistent with findings in middle childhood (Granvald & Marciszko, 2015) and findings in preschoolers that impulsivity is not uniquely linked to relational aggression (Ostrov & Godleski, 2009); b) poorer attentional control would be associated with higher relational aggression as has been shown longitudinally in adolescence (Atherton, Tackett, Ferrer & Robins, 2017). Relational aggression has been linked with ruminating about social encounters (Goldstein, 2011) and fixating attention on relationally aggressive scenes (Arsenault & Foster, 2012). Poorer attentional control may be linked to relational aggression because it is tied to reduced emotion regulation (Derryberry & Rothbert, 1988), likely through the inability to direct attention to less distressing thoughts or events; c) higher levels of metacognitive control (such as working memory) would relate to higher relational aggression because these skills are central to the execution of goal-directed behavior (Barkley, 1997) and relational aggression, particularly due to its covert nature (Cillessen & Mayeux, 2004) and association with a sophisticated set of skills (Björkqvist, 1994; Heilbron & Prinstein, 2008), can be used unprovoked, in the pursuit of a goal, such as acquiring a desired resource or power among peers (Heilbron & Prinstein, 2008, for a review). This may be especially true of early childhood since its early emergence may be a signal of overall

developmental advancements (Carpenter & Nangle, 2006); (4) Negative emotionality would interact with self-regulation skills (except inhibitory and metacognitive control) such that those who were high on emotionality and low on regulation would be the most at risk for both forms of aggression, consistent with findings regarding physical aggression in preschoolers (Suurland et al., 2016) and older children (Laible et al., 2010); and, (5) In the case of metacognitive control, we expected negative emotionality would be most strongly associated with relational aggression at high levels of metacognitive skills as has been shown in adolescence (Dane & Marini, 2014).

Method

Participants

Data were collected on a community sample of 198 (49.5% girls; $M = 33.65$ months, $SD = 5.02$) preschoolers using parent ($n = 155$; 93.5% mothers) and early childhood educator (teacher; $n = 73$) reports. Participants were recruited from daycare facilities in a city in Southern Ontario, Canada. For the most part (89.6%), children lived in a two-parent household. The majority of parents (77.6%) reported a household income above the median income level for the city at the time of data collection (Statistics Canada, 2015).

Measures

Socioeconomic status (SES). A composite of household income and maternal education level was used for socioeconomic status because household income alone tends to fluctuate during early childhood when parental employment status may be modified by child-rearing leaves from work. Parent-reported maternal education level and household income were standardized, combined, and then re-standardized. The resulting composite score was used in our analyses. Higher SES scores related, in general, to a combination of higher household incomes and higher maternal education attainment.

Aggression. Teachers rated physical aggression (three items; e.g., “Hits others.”) using selected items specific to physical aggression (following Tremblay, 2000) from the Child Behavior Checklist (CBCL; Achenbach & Rescorla, 2000). A three-point scale was used (*Not true* = 0, *Somewhat true* = 1, *Always true* = 2). Teachers also reported on relational aggression (three items; e.g., “Will keep a peer from being in the play group if he/she is mad at them.”) using selected items from the relational aggression subscale of the Preschool Social Behaviour Scale (PSBS-T; Crick et al., 1997). Respondents reported on a five-point scale for each item (0=*Never or Not at all true* to 4=*Always or very true*). Items were summed within a subscale, such that higher scores indicated higher levels of that form of aggression. For the present study, internal consistencies were high on the physical ($\alpha = .88$) and relational ($\alpha = .82$) aggression measures.

Temperament. The Colorado Child Temperament Inventory (CCTI; Buss & Plomin, 1984; Rowe & Plomin, 1977), a 30-item instrument was completed by teachers. The subscales of the CCTI are measured using five items each and include: *Negative emotionality* (e.g., “Child cries easily.”), *Soothability* (e.g., “If talked to, child stops crying.”), and *Attention span/persistence* (e.g., “Child plays with a single toy for long periods of time.”). Each item was rated on a 5-point Likert scale ranging from 1 (*strongly disagree; not at all like the child*) to 5 (*strongly agree; a lot like the child*). The items from each subscale were summed and higher scores indicated more expression of a temperament trait (e.g., higher attention span). The subscales of the CCTI have been shown to have good internal consistency (.73 to .88) and adequate to high test–retest reliability with the exception of *Soothability* (.43; Rowe & Plomin, 1977). Internal consistencies for the present study were good: *Negative emotionality* ($\alpha = .82$); *Attention span persistence* ($\alpha = .80$); and *Soothability* ($\alpha = .78$).

Executive function. Teachers reported on executive function using the Behavior Rating Inventory of Executive Function-Preschool Version (BRIEF-P; Gioia, Espy, & Isquith, 2003), a 63-item measure. Individual clinical scales on the BRIEF-P represent different domains of executive function with higher scores indicating more problems. The *Inhibit* scale was used to measure impulsivity and behavioural control (16 items; e.g., “Is impulsive.”). The *Working Memory* scale was employed to assess one’s ability to retain information for the purpose of completing a task, an essential component of problem solving and following multi-step instructions (16 items; e.g., “Has trouble concentrating on games, puzzles or play activities.”). Items were rated on a three-point scale (*Never* =1, *Sometimes* =2, *Always* =3). The subscales of the BRIEF-P have been shown to have good internal consistency (.80 to .97), adequate to high test–retest reliability (.65 to .94), high content validity, and good convergent validity (Gioia et al., 2003; Sherman & Brooks, 2010; Duku & Vaillancourt, 2014). Subscales scores were reversed such that higher scores on each subscale of the BRIEF-P indicated *better* executive function for that dimension (e.g., higher levels of inhibitory control). This was done to maintain consistency in the pattern of scores between the temperament and executive function measures of self-regulation. Internal consistencies were as follows for the present study: *Inhibit* scale ($\alpha = .95$); *Working Memory* scale ($\alpha = .91$).

Procedure

Daycare teachers received a paper and pencil style questionnaire, which included the CBCL, the PSBS-T, the CCTI, and the BRIEF-P. Teachers completed the measures and returned the package to the experimenters upon completion. Parents provided demographic information via a similar procedure. Parental consent and child assent were obtained prior to data collection. Research ethics board approval was obtained for this study. As compensation for participation

teachers received a book for their classroom and monetary compensation for each completed and returned questionnaire package (\$5 per child) and families received a five-dollar gift certificate and a storybook.

Analytical Plan

Four separate multivariate multiple regressions were conducted to examine the linear and multiplicative association between negative emotionality and four domains of self-regulation (inhibitory, emotional [soothability], attentional [attention span], and metacognitive [working memory] control) in the prediction of physical and relational aggression in preschool (see Figure 1 for a depiction of the generic model tested). Sex was included as a covariate due to documented sex differences in aggression, some aspects of temperament, and executive function (Card et al., 2008; Gagne, Miller, Goldsmith, 2013; Raaijmakers et al., 2008). Due to the substantial developmental changes in aggression and self-regulation during preschool (Côté, et al., 2007; Diamond, 2013) and the established link between SES and both self-regulation and aggression (McNeilly-Choque, Hart, Robinson, Nelson, & Olsen, 1996; Raver, Blair, & Willoughby, 2013), age and SES were also included as covariates in analyses. Participants were nested in daycare classrooms and several variables were non-normally distributed; therefore, analyses were conducted using *Mplus* software Version 7.4 (Muthén & Muthén, 2012-2015) utilizing maximum likelihood estimation with robust standard errors (MLR) due to its robustness to non-normal data and Type=Cluster to account for nesting.

All continuous predictors were mean centered in order to facilitate interpretation of interactions. In preparation for testing the interaction between negative emotionality and each of the four domains of self-regulation, using four separate multivariate multiple regressions, two-way interactions terms were created between negative emotionality and each measure of self-

regulation (inhibitory control, soothability, attention span persistence, working memory; e.g., negative emotionality x inhibitory control). Following that, four separate analyses (Models 1-4) were conducted to test the effects of the covariates and the main effects and interactions between negative emotionality and each domain of self-regulation: (1) Inhibitory control including emotionality x inhibitory control; (2) Emotional control including emotionality x soothability; (3) Attentional control including emotionality x attention span persistence; and, (4) Metacognitive control including emotionality x working memory. A Bonferroni correction for multiple comparisons was applied and results were assessed for significance using $p < .0125$ ($p = \alpha/4 = .05/4 = .0125$; Bland & Altman, 1995).

All significant interactions were explored following procedures outlined by Aiken and West (1991). For example, a simple slopes analysis was conducted in *Mplus* to determine if the slope between negative emotionality and aggression was statistically significantly different from zero at high (1 SD above the mean) and low (1 SD below the mean) levels of the relevant self-regulation measure (e.g., soothability).

Results

Descriptive Statistics and Bivariate Correlations

Means and standard deviations are presented in Table 1. Several variables showed skewness or kurtosis, indicating a non-normal distribution. Independent samples t-tests were utilized to compare mean scores for boys and girls on all variables of interest unless a significant result for Levene's test was found, indicating unequal variances in the distribution of scores for boys and girls; in the case of non-normality and unequal variances, A Mann-Whitney test was used to compare the distribution of scores for boys to girls. Sex differences emerged on several dimensions of executive function. Girls generally had better inhibitory control $t(193) = 2.07, p =$

.040, $d = 0.30$, and better working memory ($Mdn = 26$) compared to boys ($Mdn = 25$), $U = 3930.5$, $Z = -2.09$, $p = .036$, $\eta^2 = 0.02$. Sex differences also emerged for aggression, with boys ($Mdn = 0$) rated as being more physically aggressive than girls ($Mdn = 0$), $U = 3659.0$, $Z = -3.24$, $p = .001$, $\eta^2 = 0.05$.

An examination of intercorrelations (see Table 1) by sex revealed that for girls, the covariates of SES and age were unrelated to any other variables. Age was also unrelated to other study variables for boys; however, age was retained as a covariate because being older was associated with higher relational aggression for the overall sample. For boys, higher SES was associated with lower physical aggression, lower negative emotionality, and higher scores on all temperament- and executive function-based measures of self-regulation.

Sex differences emerged for the association between physical and relational aggression ($z = 1.71$, $p = .044$), such that both forms of aggression were significantly positively correlated for girls but not boys. Sex differences also emerged regarding the strength of association between negative emotionality with soothability ($z = 1.69$, $p = .046$), such that negative emotionality was more strongly linked to lower soothability for boys than for girls.

A temperament characterized by higher negative emotionality was significantly related to higher physical aggression for boys and higher on both forms of aggression for girls. In addition, higher negative emotionality was significantly associated with poorer scores on all aspects of self-control for both boys and girls. Higher attention span persistence (boys only), soothability (boys only), inhibitory control, and working memory were associated with less physical aggression. Higher inhibitory control was also linked with less relational aggression (girls only). Sex differences emerged regarding the strength of association between physical aggression with attention-span persistence ($z = 2.18$, $p = .015$), with inhibitory control ($z = 1.78$, $p = .038$), and

with working memory ($z = 1.76, p = .039$), such that higher attention-span persistence, inhibitory control, and working memory were more strongly linked to lower physical aggression for boys than for girls.

Self-regulation as a Moderator of Negative Emotionality and Aggression

Inhibitory Control. In Model 1, we regressed both forms of aggression on the covariates, negative emotionality, inhibitory control, and the interaction of emotionality by inhibitory control. Overall, this set of predictors accounted for 42.6% of the variance in physical aggression and 15.1% of the variance in relational aggression. Sex was significantly associated with both forms of aggression, such that being a boy was associated with higher physical aggression ($b = .41, p = .003$) and being a girl was associated with higher relational aggression ($b = -.85, p = .008$). Better inhibitory control was associated with less physical aggression ($b = -.12, p < .001$) and less relational aggression ($b = -.09, p < .001$). No evidence of inhibitory control moderating the link between negative emotionality and either form of aggression emerged.

Emotional Control. Soothability, a measure of emotion regulation, was substituted for inhibitory control for Model 2. Overall, the set of predictors accounted for 13.9% of physical aggression and 11.6% of relational aggression. Sex ($b = .66, p = .003$) was significantly associated with physical aggression, such that being a boy was associated with higher physical aggression. The interaction of negative emotionality and soothability was significantly related to relational aggression ($b = .02, p = .006$). Among those higher on soothability (1 SD above the mean), those who were higher on negative emotionality were more relationally aggressive than those who were lower on negative emotionality (see Figure 2). For those lower on soothability (1 SD below the mean), one's level of relational aggression did not vary by level of negative

emotionality. Post hoc examination of simple slopes confirmed that the effect for negative emotionality was significant under conditions of high soothability ($b = .16$, $SE = .06$; $p = .011$), but not under conditions of low soothability ($b = .02$, $SE = .04$; $p = .627$, *ns*).

Attentional Control. To test if the relation between negative emotionality and each form of aggression was impacted by attentional control aspects of self-regulation, Model 3 included the covariates, negative emotionality, attention span persistence, and the interaction between emotionality and attention span persistence. Overall, the set of predictors accounted for 16% of physical aggression and 11% of relational aggression. Sex ($b = .61$, $p = .004$) was significantly associated with physical aggression, such that being a boy was associated with higher physical aggression. Being higher in negative emotionality was associated with higher relational aggression ($b = .08$, $p = .011$). The interaction between negative emotionality and attention span ($b = .01$, $p = .004$) was also significantly related to relational aggression. Figure 3 depicts the relation between negative emotionality and attention span persistence as it relates to relational aggression. Negative emotionality was related to relational aggression at high attention span persistence ($b = .14$, $SE = .04$; $p < .001$), but not at low attention span persistence ($b = .02$, $SE = .04$; $p = .524$, *ns*).

Metacognitive Control. The influence of metacognitive aspects of self-regulation, specifically working memory, on the relation between negative emotionality and both forms of aggression was explored in Model 4. Covariates, the main effects, and the two-way interaction between emotionality and working memory were included. This set of predictors accounted for 27.7% of the variance in physical aggression and 9.6% of the variance in relational aggression. Being male ($b = .47$, $p = .007$) and lower working memory were both associated with higher

physical aggression ($b = -.09, p < .001$). There were no significant effects in the prediction of relational aggression at the $p < .0125$ level.

Discussion

The primary objective of the present study was to examine the linear and multiplicative association between preschoolers' temperament-based emotional reactivity (namely negative emotionality) and four domains of self-regulation (inhibitory, emotional, attentional, and metacognitive control) in the prediction of physical and relational aggression. We explored these linkages in a community sample of preschoolers using four separate multivariate multiple regressions. In an attempt to integrate the various fields of study that address the topic of self-regulation, we included both temperament-linked and neurocognitive (i.e., executive functions) aspects of self-regulation. We made several discoveries. First, in partial support of our hypotheses, we found that regardless of trait negative emotionality, poorer inhibitory control was associated with higher physical and higher relational aggression and poorer metacognitive control (i.e., working memory) was associated with higher physical aggression. Second, we found evidence of an interaction between negative emotionality and both emotional control (specifically soothability) and attentional control in the prediction of relational aggression, such that higher negative emotionality was related to higher relational aggression when preschoolers were simultaneously *higher* on emotional control or attentional control. These interactions were the opposite of what we had predicted for emotional and attentional control, but in line with our predictions regarding metacognitive control.

We replicated preschool sex differences regarding dimensions of executive function, with boys exhibiting modestly more impairment in inhibition and working memory than girls (Cohen, 1988; Raaijmakers et al., 2008). We also replicated small (Cohen, 1988) sex differences in

physical aggression, favoring boys, as has been shown in preschool (Côté, 2007; Crick, et al., 1997; Ostrov & Keating, 2004) and older childhood (Card et al., 2008). Similarly, sex, specifically being a boy, was a significant risk factor for engagement in higher physical aggression in the multivariate analyses. It may be that boys exhibit more physical aggression during preschool because they have poorer inhibition and working memory, on average, than girls. Furthermore, we found that lower attention-span persistence, inhibitory control, and working memory were each a more substantial risk for higher physical aggression for boys than for girls, suggesting the link between impaired self-control and higher physical aggression mattered most for boys.

A weak association between forms of aggression during preschool, as we found (girls only), was consistent with the work of others examining this link in very young children (e.g., Côté et al., 2007). Specifically, our finding that physical and relational aggression were only significantly positively correlated for girls but not boys was consistent with Vaillancourt et al.'s (2007) results for children at age four and six. These findings may indicate when young girls aggress more frequently they tend to do so using both forms. This may be because in early childhood physical aggression is more common and more tolerated for girls than it is in middle childhood when it becomes gender non-normative (Crick, 1997). For young boys, those who aggress physically may differ from those who aggress relationally. Given that on average, girls may exhibit higher levels, or earlier development, of the socio-cognitive and language skills relevant to relational aggression (Raaijmakers et al., 2008; Walker, 2005), preschool boys who exhibit early relational aggression may be especially advanced in these skills compared with their same-sex, age-mates and distinct from the poorly regulated (in inhibition and working memory) boys who exhibit physical aggression at this age. This finding is the opposite of what

has been found in older children when both forms of aggression are more strongly associated in boys compared with girls (Card et al., 2008).

Our correlational results were consistent with our first group of hypotheses and previous research linking negative emotionality to preschool relational aggression (Evans et al., 2012; Ostrov, et al., 2013; girls only in our sample) and physical aggression (Harden et al., 2000; Ostrov, et al., 2013; Rubin, et al., 2003). However, our finding that negative emotionality was no longer related to physical aggression once the substantial overlap between emotionality and regulation was accounted for parallels work done in adolescence (Laible et al., 2010) and was counter to our predictions based on the frustration-aggression hypothesis. In fact, we found negative emotionality to be substantially negatively associated with all aspects of self-control, consistent with a body of research showing that negative emotionality can impair the development of self-regulation (e.g., Bridgett et al., 2009; Leve et al., 2013). Further longitudinal study should be undertaken to confirm, but our findings allude to the possibility that rather than a direct link, any link between negative emotionality and physical aggression may be indirect in that the intense experience of emotions in children who are high in negative emotionality may impair their self-regulation to the extent that they are prone to physical aggression.

An alternative possibility for not finding a linear relation between negative emotionality and aggression after accounting for self-regulation in analyses may be because our measure of negative emotionality was not specific to anger or frustration, which may be the most relevant emotions for aggression. Instead, negative emotionality in this study may have captured so-called moral emotions such as guilt and anxiety, which may be protective against engagement in aggression (Mesman, Bongers, & Koot, 2001). A more nuanced examination of dispositional proneness to specific emotions relevant to aggression may elucidate a direct link between

negative emotionality and aggression consistent with the frustration-aggression hypothesis (Dollard et al., 1939).

Overall, poorer inhibitory control and poorer working memory were predictive of higher physical aggression consistent with our second hypothesis that limited regulation would be tied to physical aggression and consistent with the work of numerous others (Raaijmakers et al., 2008; Séguin et al., 2004; Utendale & Hastings, 2011). This finding is also supportive of Gottfredson and Hirschi's General Theory of Crime (Gottfredson & Hirschi, 1990), which stipulates that crime, including violent crime such as aggression, results from individual differences in self-control, of which impulse control is a major component, a theory which has been supported empirically (see Pratt & Cullins 2000 for a meta-analysis). Preschoolers with limited inhibitory control may fail to stop and think before acting, resulting in aggression. Working memory may be tied to physical aggression in various ways including through its association with inhibitory control, emotional control, and goal monitoring during decision making. For example, though it relates distinctly to externalizing issues in preschoolers (Schoemaker et al., 2013), working memory is strongly correlated with inhibitory control (Bodnar et al., 2007). Also, better working memory has been associated with unemotional appraisals of stimuli and more effective suppression of the internal experience and outward expression of negative emotions (Schmeichel, Volokhov & Demaree, 2008). Furthermore, those with working memory impairments may struggle to keep goal-relevant information (e.g., maintain our friendship) in mind while selecting an appropriate behavioural response and therefore, may resort to physical aggression (Barrett, Tugade, & Engle 2004).

With regards to our third hypothesis that links between self-regulation and relational aggression would vary based on the self-regulation measure in question, we did find support for

this assertion, but our findings were not consistent with our specific predictions. For example, counter to both our expectation and findings in middle childhood (e.g., Granvald & Marciszko, 2015), poorer inhibitory control was also predictive of relational aggression. Our finding was consistent with several studies on preschoolers showing that poorer inhibitory control was associated with increased frequency of both physical and relational aggression (O'Toole et al., 2016; Poland et al., 2016), though these failed to control for the overlap between physical and relational aggression. The present study adds to this literature in that we controlled for physical aggression and can therefore conclude that among preschoolers, poorer inhibitory control is uniquely linked to higher relational aggression, not just aggression more generally. Perhaps relational aggression among preschoolers may be more reactive than in middle childhood and therefore, may be similar to other externalizing issues, such as physical aggression, in its association with deficits in inhibitory control; this explanation is further supported by our finding that the model with inhibitory control accounted for the largest amount of variance in relational aggression (15%), as well as physical aggression (43%).

In addition, counter to our predictions that poorer attentional and emotional control would be linked to relational aggression, with the exception of inhibitory control, we did not find evidence of self-regulatory challenges as a risk factor for relational aggression in preschoolers. Our findings also did not support our prediction that better metacognitive control would be associated with relational aggression in preschoolers. Among older children findings have been mixed. However, overall, evidence suggests that poor regulation is more often associated with physical aggression than with relational aggression (Card et al., 2008). Those studies that have included controls for physical aggression highlight that *better* self-regulation is a risk for relational aggression in older children. For example, better overall executive function (McQuade

& Breaux, Miller & Mathias, 2017) and better working memory (Granvald & Marciszko, 2015) have been associated with higher relational aggression. Since more sophisticated self-regulatory skills develop with age (Hughes, 2011), it may be that we failed to find this same linear association in preschoolers because the link gets stronger later. Alternatively, there may be subgroups of relationally aggressive preschoolers, some of which show strong self-regulation and some of which show poor self-regulation. This explanation aligned with our interaction results.

We did not find support for our fourth hypothesis that negative emotionality may be linked to relational aggression most strongly under conditions of poor self-regulation, as has been previously been shown with physical aggression (Suurland et al., 2016). Instead, our findings were consistent with evidence from adolescence suggesting the opposite (Dane & Marini, 2014): negative emotionality was linked with relational aggression only at *high* self-control, specifically at high emotional control and at high attentional control. We had only predicted to find this interaction between negative emotionality and self-regulation for metacognitive control. An interactive effect between negative emotionality and working memory in the prediction of relational aggression may emerge later since working memory is developing at the average age of our participants, which was just less than three years old (Garon, Bryson, & Smith, 2008). For preschoolers who were above average on self-regulation abilities, higher negative emotionality was associated with higher relational aggression, suggesting that better emotional or attentional control may facilitate relational aggression use in preschoolers who are prone to experiencing negative emotions. It may be that preschoolers who can regulate their heightened emotional reactivity through comfort seeking from adults (or other self-soothing means) or through directing their attention at less distressing stimuli may be skillful enough or

have enough self-control and problem-solving options available to them to allow them to choose relational aggression over more overt forms of aggression especially under circumstances where overt aggression may have negative consequences, such as daycare classroom (Coplan, Bullock, Archbell, & Bosacki, 2015). However, given that we did not find that higher negative emotionality was associated with physical aggression at low self-control, we discuss several other possible explanations for our multiplicative findings for relational aggression.

Our measure of emotion regulation was soothability, a temperament trait that represents a child's ability to recover from distress in response to techniques used by the child or a caregiver (Rothbart, 1981). This early co-regulation is believed to lay a foundation for a child's ability to emotionally self-regulate through its impact on the emotional control areas in the midfrontal region of the brain (Posner & Rothbart, 2000). There are multiple possible explanations for the interaction between negative emotionality and soothability in the prediction of relational aggression. For example, perhaps children who are prone to negative emotionality and are also easily comforted by others, have a strong affinity for and/or are highly invested in relationships with others; these characteristics (sociability, valuing relationships) have been found to be associated with soothability (Rowe & Plomin, 1977) and relational aggression (Russell, Hart & Olsen, 2003). Given their pronounced reactivity, preschoolers who are readily soothed in the presence of others may use relational aggression as a means of controlling and manipulating their relationships with peers in order to achieve and maintain the relationship closeness or peer group status they desire. Relational aggression may be an effective means to achieve affiliation in preschool given that it is more tolerated by peers than overt forms of aggression (Salmivalli, Kaukiainen, Lagerspetz, 2000) and has even been associated with friendship intimacy (Murray-Close, Ostrov, & Crick, 2007), network centrality (Xie, Swift, Cairns, & Cairns, 2002), and

social status (Cillessen & Mayheux, 2004; Vaillancourt, & Hymel, 2006). Alternatively, compared with less soothable infants, those who are emotionally reactive but easily soothed by caregivers elicit more attention and sensitivity from their caregivers (Ghera, Hane, Malesa, & Fox, 2006), possibly because their responsiveness to their caregivers' efforts creates a sense of maternal self-efficacy (Leerkes & Crockenberg, 2002); this may boost the child's cognitive and social capacities (Lemelin, Tarabulsky, & Provost, 2006). Early relational aggression has been shown to be associated with developmental advancements (Carpenter & Nangle, 2006). In summary, perhaps preschoolers who are high on negative emotionality and soothability elicit a parenting style that optimizes their cognitive development giving them the capacities to be relationally aggressive so young.

Given the known role of attentional control in the regulation of emotion (Derryberry & Rothbart, 1988), our finding that higher negative emotionality was a risk for relational aggression in preschool only at higher attentional control was surprising and in conflict with findings from older children demonstrating a link with poor attentional control and relational aggression (Arsenault & Foster, 2012; Atherton et al., 2017; Goldstein, 2011). However, sustained attention is associated with planful behaviour and relational aggression can be committed in a calculated, planful manner in preschool (Ostrov & Crick, 2007). Hence, preschoolers who have the attentional control to participate in relational aggression may pursue aggression if they are higher on negative emotionality compared with those who are lower on negative emotionality.

Interpretation of our findings should be done in light of several limitations. First, in order to be able to bring together variables of interest from the temperament and neurocognitive literature, for parsimony, we only controlled for sex in analyses rather than testing sex

moderation. It may be that better attentional and emotional control are only linked to lower physical aggression for boys, but not girls as our correlational analysis revealed. It may have been that an effect for boys was suppressed by considering the sample as whole rather than separated by sex. Second, although they are distinct constructs in preschool (Duku & Vaillancourt, 2014), aspects of self-regulation are interconnected and overlapping (Raffaelli, Crockett, & Shen, 2005). An analysis with all of the variables together may elucidate which unique aspects matter most in the prediction of aggression. Third, because participation in high-quality daycare (as was the case with the present sample) impacts emotional skills, self-regulation, and social behaviour, our results may not be generalizable to all populations (see Huston, Bobbitt, & Bentley, 2015 for a review; Weiland, & Yoshikawa, 2013). Fourth, our findings were within-reporter meaning shared method variance may have impacted them. However, teachers are in a unique position to observe low frequency peer-directed behaviour like preschool relational aggression, which may not be as well captured by short-term behavioural observation methods. Similarly, perhaps because teachers have the opportunity to observe more children than parents would, their reports on emotionality and various aspects of self-regulation may more accurately differentiate children who deviate from average. As well, teacher and parent reports on several aspects of self-regulation are not invariant (Duku & Vaillancourt, 2014). It may be that teachers are reporting on the aspects of self-regulation most relevant to the preschool context, such as those relevant to peer-directed behaviour. Fifth, self-regulation is rapidly changing during the preschool and middle childhood years and therefore what associations are true at one age may not hold as children develop. Finally, our results may not generalize to lower socioeconomic populations given that our participants, while diverse, were not, on average, from low socioeconomic households. This is an important consideration because

lower SES has been linked to lower relational aggression and higher physical aggression, emotional reactivity, and executive function deficits (Jokela & Keltikangas-Järvinen, 2011; McNeilly-Choque et al., 1996; Raver et al., 2013).

The present study had numerous strengths which make it a contribution to the literature. First, in the present study we married two bodies of literature which are often siloed – those examining the temperament and the neurocognitive aspects of self-regulation. Second, we examined the linear and multiplicative effects of negative emotionality with inhibitory, emotional, attentional, and metacognitive control in the prediction of both preschool physical and relational aggression, accounting for the overlap between the two forms of aggression. With regards to relational aggression in early childhood, no studies have been aimed at exploring its association with temperament-based aspects of self-regulation and few studies have been aimed at exploring its association with negative emotionality or executive functions, let alone while simultaneously accounting for physical aggression.

In conclusion, our results do not support the frustration-aggression theory of aggression with regards to physical aggression. Instead our findings are consistent with theories stipulating that limited self-control is predictive of physical aggression. With regards to relational aggression, our findings partially support the frustration-aggression hypothesis in that those high on negative emotionality are more prone to relational aggression use, but only at high levels of self-regulation, showing a similar pattern to that found in adolescence. Therefore, our results support a deficit model of physical aggression. In contrast, early relational aggression appears to be ‘a mixed bag’ in that it may be a symptom of poor inhibitory control, as well as a combination of negative emotionality with developmental advancements, such as above average emotional or attentional control. Overall, relational aggression seems to be associated with an imbalance of

skills, such as individual vulnerabilities or lags in one area paired with advances in another. An important implication of these findings is that, on one hand, interventions to reduce or prevent persistent use of physical aggression should target inhibitory and metacognitive control in early childhood, especially in light of the fact that the strength of the link between self-regulation deficits and physical aggression grows with age (Utendale & Hastings, 2011). On the other hand, children who are predominantly high in relational aggression may benefit less from approaches targeting self-regulation processes (with the exception of inhibitory control) than from other interventions (e.g., those focused on reducing the experience of negative emotions) since a tendency toward negative emotional experiences in the presence of good attentional or emotional regulation may increase preschool relational aggression risk.

Table 1

Summary of intercorrelations, means, and standard deviations for emotionality, self-regulation, and aggression variables for boys and girls separately

Measure	1	2	3	4	5	6	7	<i>M</i>	<i>SD</i>
1. Physical aggression	-	.14	.25*	-.36**	-.25*	-.69**	-.52**	1.16	1.77
2. Relational aggression	.37**	-	.05	-.06	-.07	-.20	-.01	3.96	1.72
3. Negative emotionality	.28**	.27**	-	-.39**	-.72**	-.28**	-.32**	13.73	5.35
4. Attention span	-.06	-.11	-.29**	-	.43**	.56**	.74**	15.49	4.57
5. Soothability	-.14	-.20	-.58**	.38**	-	.29**	.32**	16.18	4.46
6. Inhibitory control	-.53**	-.41**	-.42**	.43**	.39**	-	.77**	23.89	7.98
7. Working memory	-.31**	-.08	-.27**	.67**	.34**	.68**	-	22.85	7.16
<i>M</i>	.47	4.57	13.03	16.66	16.63	26.09	25.03		
<i>SD</i>	1.06	2.63	5.34	3.70	3.69	6.88	5.56		

Note. Intercorrelations for boys ($n = 96$) are presented above the diagonal, and intercorrelations for girls ($n = 100$) are presented below the diagonal. Means and standard deviations for boys are presented in the vertical columns, and means and standard deviations for girls are presented in the horizontal rows.

* $p < 0.05$. ** $p < 0.01$.

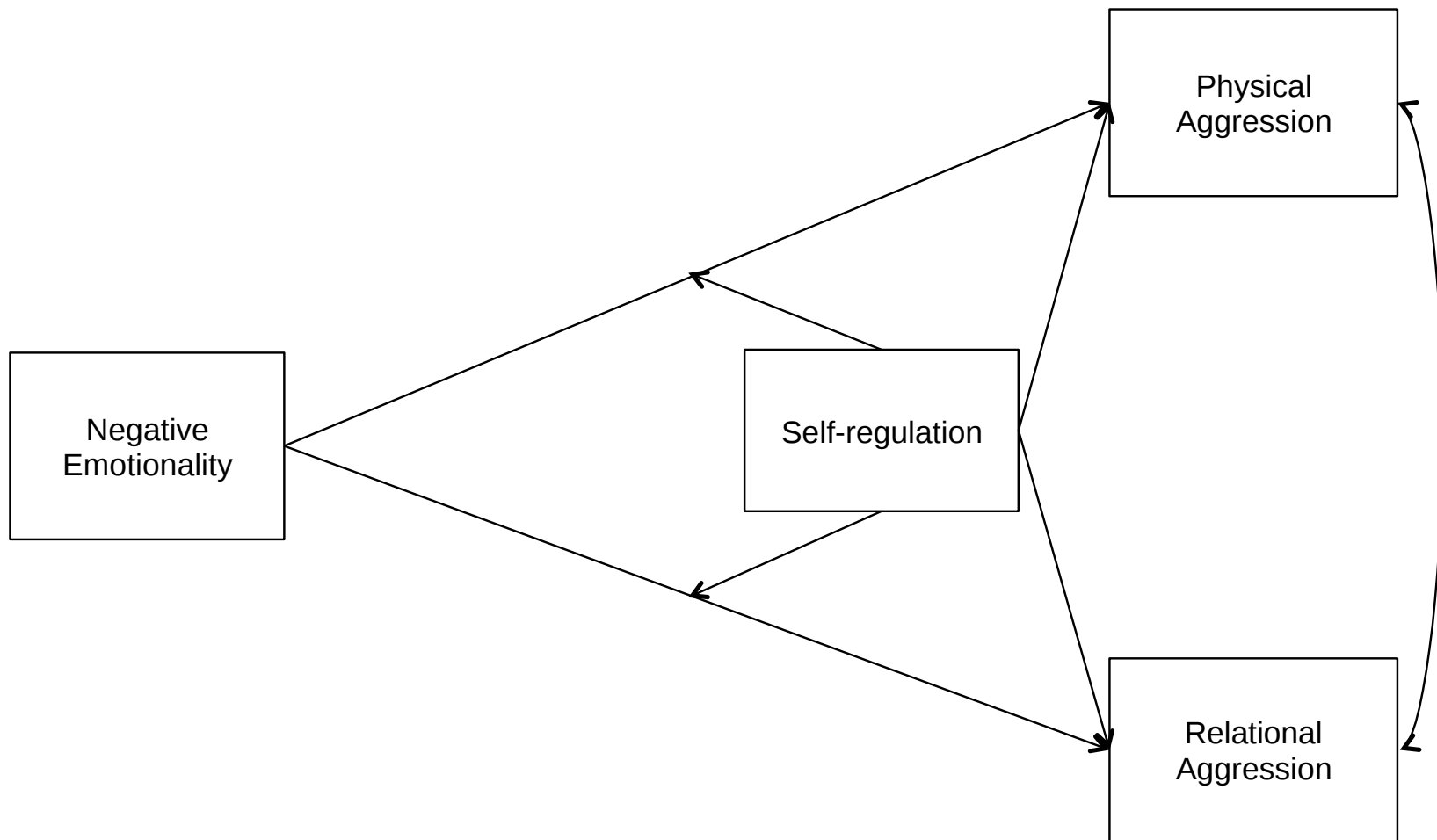


Figure 1. Generic model of self-regulation moderating the relation between negative emotionality and aggression in preschool. Covariances between and among predictors and covariates (sex, age, and socioeconomic status) were tested in the model, though not depicted.

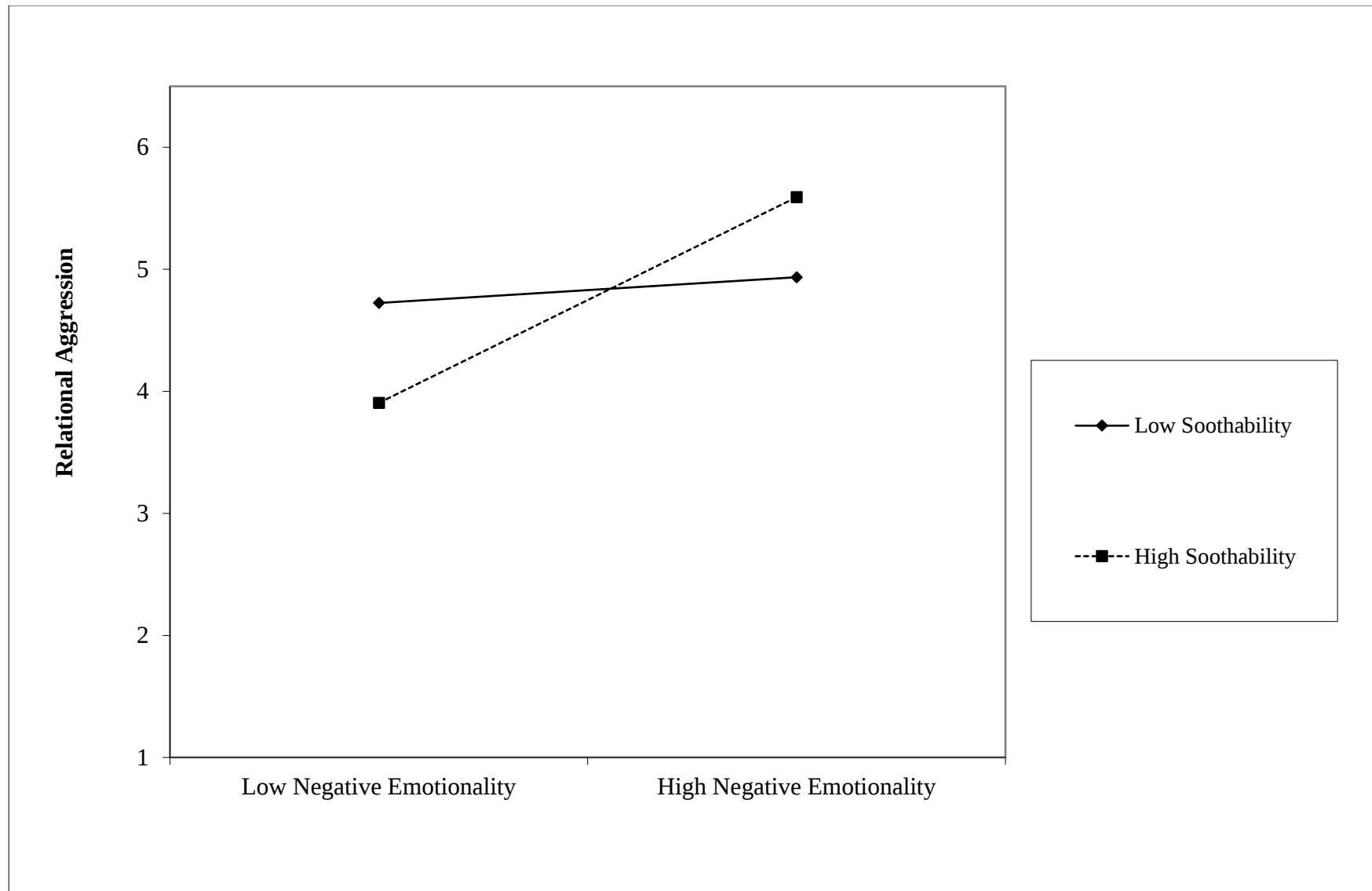


Figure 2. The relation between negative emotionality and relational aggression at high (+ 1 SD) and low (– 1 SD) levels of soothability.

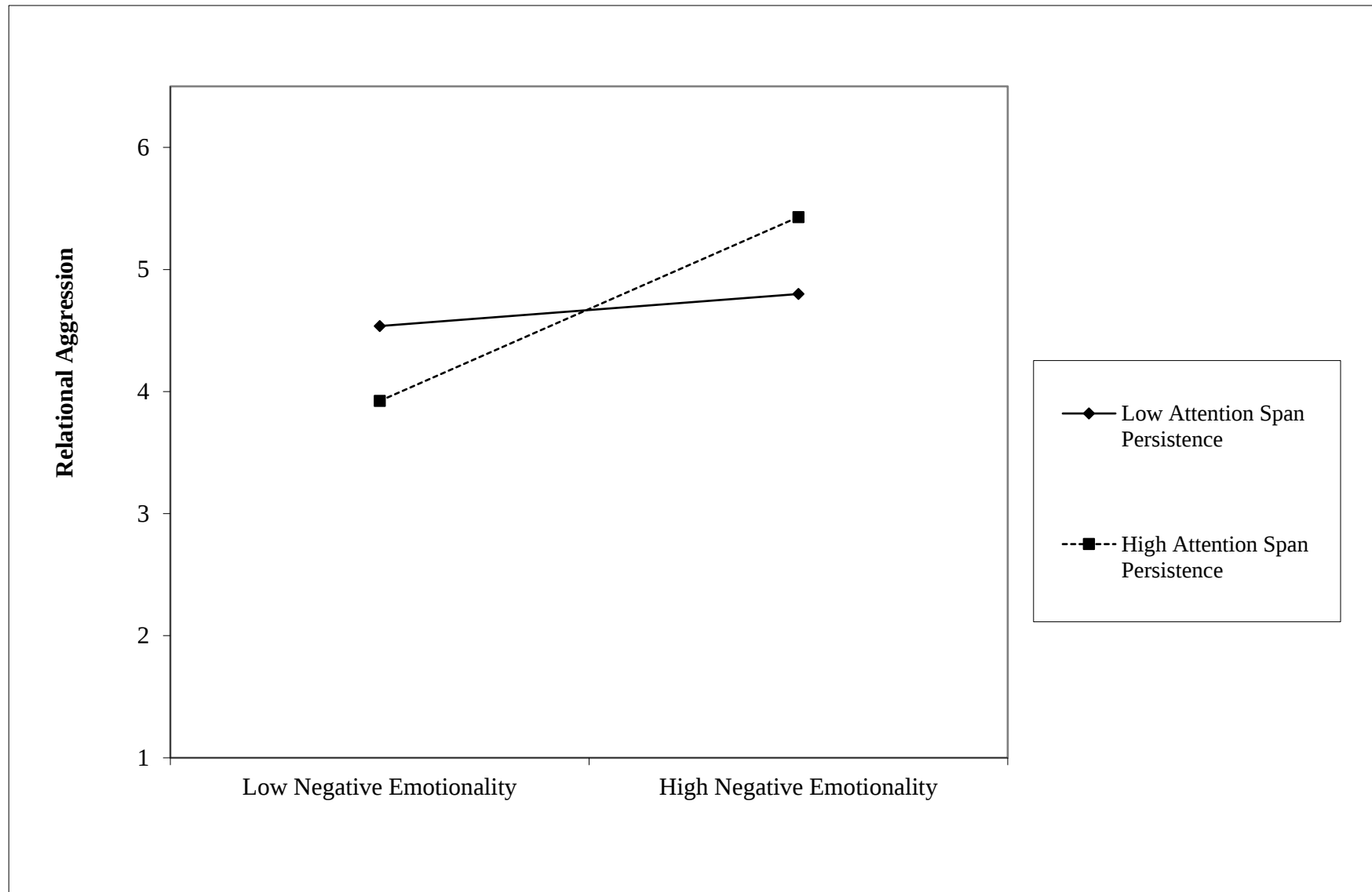


Figure 3. The relation between negative emotionality and relational aggression at high (+ 1 SD) and low (– 1 SD) levels of attention span persistence.

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General Discussion

Summary of Study Findings

Study 1

The main goal of study 1 was to determine if sex, age, prosocial behaviour, internalizing symptoms, and impulsivity could differentiate between aggression styles (i.e., non-aggressive, physically aggressive, relationally aggressive, and combined physically and relationally aggressive) among preschool-aged children, as is the case in middle childhood and adolescence (Card et al., 2008). When simultaneously accounting for all of the predictors, both sex and impulsivity differed significantly across aggression styles. Specifically, being a boy was associated with an increased likelihood of being in the physical aggression group relative to either the non-aggression or relational aggression group. This finding supports the notion that exclusive physical aggression is gender non-normative for girls (Crick, 1997) even at an age when it is more common (Côté et al., 2006). Also, higher impulsivity was established as a significant risk for classification in either the physical or combined aggression groups relative to the non-aggression or relational aggression groups, above and beyond the effects of internalizing issues or prosocial skills. This was similar to a previous comparison of these three predictors, in which early impulsivity was found to be the strongest predictor of engagement in antisocial behaviour later in childhood (Tremblay et al., 1994). Furthermore, impulsivity was not uniquely linked to relational aggression unless preschoolers also used physical aggression, but impulsivity was the notable feature that differentiated these combined users from the relational aggression group. Results support the findings of others who have emphasized the unique risks for maladjustment of combined aggression users and who have behaved researchers to continue to study this group (e.g., Crick, 1997; Crick et al., 2006b; Underwood et al., 2011).

Study 2

The main goal of study 2 was to examine the concurrent and longitudinal links between expressive and receptive language and physical and relational aggression during early childhood while simultaneously accounting for working memory. We did find concurrent links between expressive language and aggression (positive for relational and negative for physical) beyond the effects of working memory, suggesting that expressive vocabulary may play a short-term role in peer interactions. Our findings that working memory and language were strongly linked, and that when working memory was accounted for, there were no longitudinal links between language and either form of aggression, indicate that working memory may be an overlooked third-variable cause of the associations between language and aggression found in past research (e.g., Bonica et al., 2003; Dionne, 2005). Our finding that better working memory was concurrently associated with lower physical aggression and longitudinally predictive of higher relational aggression is consistent with previous research examining this association for physical aggression (e.g., Séguin, et al., 1995, 2004), but ours is the first known study to examine this link for relational aggression in this age group controlling for physical aggression.

Study 3

The main goal of study 3 was to determine which would matter in the prediction of physical and relational aggression among preschoolers: a) negative emotionality, consistent with the frustration-aggression hypothesis of aggression; b) domains of self-regulation (inhibitory, emotional, attentional, and metacognitive control), consistent with theories such as the Gottfredson and Hirschi's General Theory of Crime (Gottfredson & Hirschi, 1990), which stipulate that a lack of self-control is the cause of aggression; or c) an interaction between negative emotionality and self-regulation, consistent with mounting evidence that higher

emotionality combined with lower self-regulation is a risk for preschool physical aggression (e.g., Suurland et al., 2016) and that higher emotionality combined with *higher* self-regulation may pose a risk for adolescent relational aggression (Dane & Marini, 2014).

Regarding physical aggression, we found support for b), that limited self-regulation (specifically inhibitory and metacognitive control [i.e., working memory]) was a risk for physical aggression. Regarding relational aggression, we found support for both b), a negative linear effect of inhibitory control (similar to findings from physical aggression), and c), a multiplicative effect, in that higher negative emotionality was associated with higher relational aggression when preschoolers were above average on either emotional (i.e., soothability) or attentional control. Study 3 adds to the literature in many ways as it was the first of its kind in many regards, including the first to examine temperament-based aspects of self-regulation with regard to relational aggression, the first to examine either of the executive functions, inhibitory control or working memory, and relational aggression in preschool controlling for physical aggression, and the first to examine the multiplicative effects of negative emotionality and self-regulation on relational aggression in preschoolers controlling for physical aggression. In this study, relational aggression emerged as having a complex association with self-regulation in that it was linked to deficits in some aspects (i.e., inhibitory control) and competencies in others (i.e., emotional and attention control each in interaction with negative emotionality).

Integration of Study Findings and Implications

Guided by Björkqvist et al.'s developmental hypothesis of aggression (Björkqvist, 1994; Björkqvist et al., 1992ab; Lagerspetz et al., 1988) and the empirical support for this hypothesis found in early childhood (e.g., Côté et al., 2007; Vaillancourt et al., 2007) this dissertation was aimed at exploring which competencies or lags in development would be linked to relational

aggression during its early childhood origins. The developmental theory of aggression is somewhat unique in that most theories of aggression pose aggression as resulting from deficits (consistent with the predominant developmental psychopathology perspective of physical aggression; Cicchetti, & Rogosch, 1996; Heilbron & Prinstein, 2008; Sroufe & Rutter, 1984), but the developmental theory accounts for physical aggression as well as relational aggression, which is often associated with sophisticated skills and outcomes (consistent with evolutionary theory of relational aggression as adaptive; Vaillancourt, 2005; 2013).

Taken together, the studies in this dissertation show partial support for the developmental theory of aggression and support a skill-deficit model for physical aggression (alone or combined with relational aggression), while providing evidence for both a deficit and competency model for relational aggression. Specifically, in Study 1, for boys only, being older was associated with an increased likelihood of being relationally aggressive versus non-aggressive and a decreased likelihood of being physically aggressive versus relationally aggressive, lending support for the idea that relational aggression replaces physical aggression with increasing age, at least for preschool boys. This is further supported by the finding from Study 3, using a younger sample of preschoolers, that physical and relational aggression were not significantly correlated for boys. It may be that younger boys are rarely relational aggression users, but do use physical aggression. However, since increasing age was not found to be a risk for relational versus physical aggression use for girls in Study 1, it is possible that some preschool girls are relationally aggressive without exhibiting prior physical aggression. This interpretation is consistent with the robust sex differences that emerged in all three studies showing that physical aggression is far more likely among boys than girls even in preschool. However, more longitudinal research is needed using very young preschool samples to test our proposed interpretation of these results,

specifically, that there may be sex differences in the early developmental course of physical and relational aggression.

In Study 2, in testing the longitudinal associations between the forms of aggression drawing from the same participant pool as Study 1, we found evidence for the stability of physical aggression across one year in early childhood. As well, we found physical aggression predicted relational aggression use one year later, evidence in support of the developmental hypothesis of aggression. Taken together, these findings allude to the possibility that rather than replacing physical aggression, relational aggression may be added to physical aggression for some children over time. We found evidence of such combined users of aggression in Study 1 (also year 1 of Study 2), with approximately 5% of preschoolers exhibiting this aggression style (or roughly 14% of all aggressive children). Given the previously stated longitudinal results, the prevalence of this group likely increased by year 2. There were no sex differences found in the proportion of boys and girls exhibiting a combined aggression style. However, findings from Study 1 emphasized that impulsivity is a substantial risk for the combined use of physical and relational aggression in preschoolers. Although they represent a small percentage, the implications of this are that this pattern of aggression use may be an early warning sign. Additional longitudinal study of this group needs to determine if early combined users of both forms of aggression sustain this pattern of aggression use into middle childhood and whether or not they are the same children that previous research has shown face serious maladjustment later on (e.g., Crick, 1997; Crick et al., 2006b; Underwood et al., 2011).

Despite existing evidence that physical aggression is commonplace, even adaptive behaviour during early childhood, support for a skill-deficit model of physical aggression emerged from all three studies. Specifically, poorer concurrent impulse control (measured as

impulsivity in Study 1 and inhibitory control in Study 3), expressive vocabulary (Study 2, Time 1), and working memory (Study 2, Time 2 and Study 3) were associated with higher physical aggression. This has important implications for our current view of physical aggression in early childhood. Although physical aggression may be age-appropriate during preschool, higher expression of physical aggression is clearly linked to lower competencies as compared to age-mates— even among very young children. These lagging skills (particularly impulse control and working memory since they were robust across studies) could be an important focus for early interventions to reduce physical aggression.

Regarding relational aggression, findings from all three studies showed support for both a competency and a deficit model, even after controlling for the overlap with physical aggression. Specifically, on one hand, in support of a competency model of relational aggression, higher concurrent prosocial behaviour (Study 1), expressive vocabulary (Study 2, Time 2), emotional and attentional control (each in interaction with negative emotionality, Study 3), and previous working memory (Study 2, cross-lag effect) were associated with higher preschool relational aggression. On the other hand, in support of a deficit model of relational aggression, higher concurrent internalizing symptoms (Study 1) and negative emotionality (among those with above-average emotional or attentional control, Study 3), as well as poorer concurrent inhibitory control (Study 3) were associated with higher relational aggression. The finding that relational aggression was associated with limited skills in some areas is inconsistent with evolutionary theory and the developmental theory of aggression that paint relational aggression as adaptive and skillful (Björkqvist, 1994; Björkqvist et al., 1992ab; Lagerspetz et al., 1988; Vaillancourt, 2005; 2013). However, associations with skill deficits could be reflective of early relational aggression being executed imperfectly (and overtly) as it is a newly emerging and unpracticed

behaviour. Determining if these associations persist with increasing age is a recommended focus of future work. The finding that relational aggression was tied to emotional reactivity (e.g., internalizing symptoms, negative emotionality) was consistent with the frustration-aggression theory of aggression (Dollard et al., 1939) and empirical evidence of emotional reactivity preceding relational aggression (Ostrov et al., 2013). Efforts to reduce relational aggression should be targeted at reducing early emotional reactivity and future intervention research should be focused on assessing the effectiveness of such intervention efforts.

The combined findings of the articles in this dissertation have additional implications for research and practice. Given that several predictors worked in opposition in that they were risk factors for one form of aggression and protective factors for the other, researchers are urged to always consider the overlap between the two forms to avoid artificially detecting effects (e.g., Study 1 between impulsivity and boys' relational aggression) or missing true effects (e.g., Study 1 between prosocial and boys' relational aggression). For practitioners and educators working to prevent or intervene in early aggression, considering the form of aggression is recommended. For example, while efforts to improve language or working memory skills may reduce physical aggression, they will not reduce relational aggression.

However, through the studies in this dissertation, we did identify one risk factor common to both physical and relational aggression that should be considered in designing intervention efforts - poorer concurrent inhibitory control (Study 3). Notably, impulsivity, which may be similar to inhibitory control, was not associated with relational aggression after accounting for physical aggression in Study 1. There are three possible reasons for this. First, impulsivity and inhibitory control may differ in some important ways that are relevant to relational aggression. Second, there may be sex differences in the association between inhibitory control and relational

aggression. We consider this explanation since they were correlated for girls, but not boys in Study 3. In the multivariate multiple regression analyses we controlled for sex, but did not test sex as a moderator of the link between inhibitory control and relational aggression. This is recommended for future research. A third possible explanation for the discrepancy between the findings in these two studies is that there may be developmental differences in the association between impulse control and relational aggression. The participants in Study 3, in which an effect was found, were slightly younger on average than those in Study 1, in which no effect was found. Relational aggression among younger children may be more reactive and direct (Ostrov & Keating, 2004). Therefore, better inhibitory control may be protective against such overt relational aggression, but not relevant for relational aggression as it becomes more circuitous with increasing age. Future research should explore age differences in the association between inhibitory control and relational aggression to determine if this link is consistent across ages and therefore may be an area worth focusing intervention efforts on.

Strengths and Limitations

Several limitations of the studies in this dissertation should be considered in interpretation of our findings. First, with the exception of Study 2, the findings are cross-sectional meaning the direction of effects and causality cannot be ascertained for certain. Second, with the exception of Study 2, findings are within reporter and may therefore be inflated by shared method variance. Third, all participants were selected from quality-controlled, licensed daycare facilities. Participation in such an early childhood intervention may impact cognition, including language and memory (Nores & Barnett, 2010), emotional skills, self-regulation, and social behaviour (see Huston, Bobbitt, & Bentley, 2015 for a review; Weiland, & Yoshikawa, 2013). Consequently, our findings may not generalize to all populations. Finally, many of the

constructs addressed in these three studies (e.g., executive function, language) are undergoing substantial developmental changes during early childhood and therefore links with aggression may change over time. Longitudinal designs are best to capture such evolving associations.

The studies in the present dissertation had several strengths that made them an important contribution to the current body of literature. First, in each study, the overlap between physical and relational aggression was considered ensuring that findings were unique to the specific form. Researchers fail to do this far too often, but it is important given their significant overlap and seemingly opposing link to a number of the predictors (e.g., language, prosocial behaviour). Second, studies addressed relational aggression during preschool, an understudied developmental period. Third, we accounted for sex, age, and socioeconomic status in all analyses since these have been shown to be linked with several of the predictors as well as relate uniquely to physical and relational aggression.

Conclusion

In summary, the studies in this dissertation examined individual differences in developing skills as they relate to early childhood physical and relational aggression. The findings of Study 1 highlighted the importance of impulsivity as a risk for engagement in physical aggression (alone or combined with relational aggression). From Study 2 we learned that better working memory predicted more relational aggression over time above and beyond any concurrent links between language and aggression. Finally, the findings of Study 3 illustrated that poorer inhibitory control was a risk for engagement in higher physical and relational aggression, poorer working memory was linked to higher physical aggression, and that when above average on emotional or attentional control, preschoolers who were higher on negative emotionality were also higher on relational aggression. The findings in this dissertation support a skill-deficit model of preschool

physical aggression and both a deficit and competency model for preschool relational aggression, furthering our understanding of which lagging skills could be targeted through interventions aimed at reducing early childhood aggression when it first emerges.

References for the Introduction and General Discussion

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