

Longitudinal Associations between Externalizing Problems and Depression in Children and  
Adolescents

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### **Declaration of Academic Achievement**

Christine Blain-Arcaro, the author of the manuscript “Does Worry Moderate the Relation between Aggression and Depression in Adolescent Girls?” is the primary author of this article. As primary author, contributions included conceptualizing the manuscript from the theoretical formulations from the research proposal, conducting the literature review, analyzing the data, and preparing the manuscript for submission. The data used for this manuscript came from the UBC Teen Study. The primary investigator of the UBC Teen Study is the co-author of this manuscript and thesis supervisor Dr. Tracy Vaillancourt. Dr. Vaillancourt offered input and expertise during each phase of the research formulation and manuscript preparation. As per guidelines for training and publication, the co-author offered feedback and approval of the final manuscript for submission. This manuscript has been published in the *Journal of Adolescence*. Please consult Appendix A for the Main Effects Tables that were not included in the publication.

Christine Blain-Arcaro is the primary author of the manuscript “Longitudinal Associations between Depression and Aggression in Children and Adolescents”. Christine Blain-Arcaro conceptualized the manuscript from the theoretical formulations from the research proposal, conducted the literature review, analyzed the data, and prepared the manuscript for submission. The data used for this manuscript came from the McMaster Teen Study. The primary investigator of the McMaster Teen Study is the co-author of this manuscript and thesis supervisor Dr. Vaillancourt. The second author and thesis supervisor Dr. Vaillancourt offered input and expertise during each phase of the research formulation and manuscript preparation. As per guidelines for training and publication, the co-author offered input and approval of the final manuscript for submission. The manuscript is currently under review.

Finally, Christine Blain-Arcaro is the primary author of the manuscript “Longitudinal Associations between Externalizing Disorders and Depression in Children and Adolescents”. Christine Blain-Arcaro conceptualized the manuscript from the theoretical and methodological formulations from the research proposal, conducted the literature review, analyzed the data, and prepared the manuscript for submission. The data used for this manuscript came from the McMaster Teen Study. The primary investigator of the McMaster Teen Study is the co-author of this manuscript and thesis supervisor Dr. Vaillancourt who offered input and expertise during each phase of the research formulation and manuscript preparation.

## Abstract

Although researchers have often focused on the victims of aggression, the detrimental effects of engaging in aggression and/or displaying symptoms of externalizing disorders have been clearly identified in children and adolescents. Longstanding consequences of externalizing problems include internalizing difficulties such as depression. There is an increasing interest in identifying the direction of effect and understand whether externalizing problems precede internalizing problems, vice-versa, or whether they share a bi-directional relation. However, the study of the temporal sequence between aggression, externalizing disorders, and internalizing disorders in children and adolescents has yielded inconsistent findings.

The sequential relation between externalizing and internalizing difficulties in children and adolescents was examined in this dissertation consisting of three studies. In Study 1, the moderating role of worry in the relation between aggression and depression was examined. The sample consisted of girls nominated as either relationally or physically aggressive by their peers. Results indicated that worry exacerbated the risk of reporting elevated depressive symptoms concurrently and one year later for physically aggressive girls. In Study 2, three competing hypotheses on the longitudinal relation between aggression and depression were compared. Findings from this study supported the hypothesis that symptoms of depression are preceded by aggressive behaviour. Additionally, it was found that engaging in physical aggression predicted depressive symptoms for girls but not for boys. The results of the first two studies suggest that for girls, engaging in non-normative forms of aggression is associated with greater mental health problems. In Study 3, the temporal relation between symptoms of externalizing disorders, namely oppositional defiant disorder and conduct disorder, and symptoms of depression was examined. Results provided support that the progressive relation between symptoms of externalizing and internalizing disorders was bi-directional.

In summary, although it seems that engaging in externalizing behaviour, such as aggression, predicts symptoms of depression, findings from the third study suggest that the sequential relation between symptoms of externalizing problems, which may or may not include aggressive behaviour, and symptoms of depression seem to share a reciprocal relation.

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**Dedication**

*To my loved ones*

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## **Chapter 1 – Introduction**

The temporal relation between externalizing difficulties, such as aggressive behaviour, and internalizing difficulties, such as symptoms of depression, has recently been of interest to researchers. However, findings in this area have yielded inconsistent results with some suggesting that externalizing difficulties predict internalizing difficulties (Kiesner, 2002; Ladd & Troop-Gordon, 2003; Moilanen, Shaw, & Maxwell, 2010; Obradovic, Burt, & Masten, 2010; Vaillancourt, Brittain, McDougall, & Duku, 2013; van Lier & Koot, 2010; van Lier, Vitaro, Barker, Brendgen, Tremblay, & Boivin, 2012), some finding evidence for the inverse relation (Bornstein, Hahn, & Haynes, 2010; Mesman, Bongers, & Koot, 2001), and finally, some finding evidence that the relation may be reciprocal in nature (Angold, Costello, & Erkanli, 1999; Beyers & Loeber, 2003; Caron & Rutter, 1991; Measelle, Stice, & Hogansen, 2006; Wolff & Ollendick, 2006). In the present dissertation the aim was to examine the longitudinal relation between externalizing and internalizing problems in children and adolescents in an effort to clarify the directionality of effect.

Externalizing behaviour, including aggression, in children and adolescents has been linked to a host of long-lasting negative consequences, including internalizing difficulties (Angold et al., 1999; Capaldi, 1991, 1992; Capaldi & Stoolmiller, 1999; Coie & Dodge, 1998; Cleverley, Szatmari, Vaillancourt, Boyle, & Lipman, 2012; Costello, Angold, & Keeler, 1999; Crick, Ostrov, & Werner, 2006; Murray-Close, Ostrov, & Crick, 2007; Xie, Drabick, & Chen, 2011), with this co-occurrence leading to greater impairment, poorer adjustment, and more frequent future psychological diagnoses than when dealing with either depression or aggression alone (Keiley, Lofthouse, Bates, Dodge, & Pettit, 2003). In addition, certain findings suggest that externalizing behaviour in children and adolescents might even predict depression (Boylan, Georgiades, & Szatmari, 2010; Boylan, Vaillancourt, Boyle, & Szatmari, 2007; Boylan, Vaillancourt, & Szatmari, 2012). Understanding the developmental trajectory between these two commonly occurring problems in children and adolescents has the potential to help clinicians accurately identify the difficulty they are experiencing and treat it accordingly.

### **Aggression**

Aggression, an outward directed behaviour with the intent to cause harm to another individual, can take many different forms (Anderson & Bushman, 2002). Physical aggression, which involves outwardly directed behaviour with the intent to cause harm, includes acts such as

hitting or kicking (e.g., Nagin & Tremblay, 1999). Relational aggression, also termed indirect or social aggression, is a behaviour wherein there is intent to damage interpersonal relationships using indirect and direct means, such as verbal and non-verbal social exclusion, gossip, and friendship manipulation (e.g., Crick, 1997; Crick & Grotpeter, 1995; Galen & Underwood, 1997; Underwood, 2003). Prevalence rates of relational aggression in Canada have been found to range between 10% and 20%, making up the vast majority of peer abuse (Craig et al., 2009; McMorris, Hemphill, Toumbourou, Catalano, & Patton, 2007; Vaillancourt et al., 2010). Lower incidences of physical aggression have been found with prevalence rates estimated at 3.7% for boys aged 5 to 11 years old and range from 2.3% for 5 year-old girls and 0.5% for 11 year-old girls (Lee, Baillargeon, Vermunt, Xu, & Tremblay, 2007).

The type of aggression used by children and adolescents has been found to change over the course of development. Physical aggression has been found to emerge as early as during the toddler years (see review by Tremblay, 2000), and the use of physical aggression is more common in younger children, while the use of relational forms of aggression is more common in older children (e.g., Bjorkqvist, Lagerspetz, & Kaukainen, 1992). Longitudinal studies have demonstrated a decrease in the use of physical aggression over the years and the emergence of more sophisticated forms such as relational aggression (e.g., Côté, Vaillancourt, Barker, Nagin, & Tremblay, 2007; Vaillancourt, Brendgen, Boivin, & Tremblay, 2003). Further, although physical aggression decreases with age, relational forms of aggression increase (e.g., Côté et al., 2007). Sex differences have also been identified in the use of aggression with boys being more likely than girls to be aggressive overall, and to engage in physical forms of aggression. However, negligible sex differences have been found for the use of relational aggression (see Archer & Coyne, 2005; Card, Stucky, Sawalani, & Little, 2008; Moffitt & Caspi, 2001).

### **Externalizing Disorders**

Externalizing disorders, or disruptive disorders, are characterized by their outwardly directed behaviour, often involve rule-breaking and aggressive behaviour, and include disorders such as oppositional defiant disorder (ODD) and conduct disorder (CD; Kovacs & Devlin, 1998; Krueger & Markon, 2006; Youngstrom, Findling, & Calabrese, 2003). ODD is a disorder characterized as a persistent pattern of angry/irritable mood, argumentative/defiant behaviour, and vindictiveness that impairs a child's social functioning for at least 6 months (APA, 2013). ODD occurs in approximately 3.3% of the population (Canino, Polanczyk, Bauermeister, Rohde,

& Frick, 2010) and is more common in boys than girls prior to adolescence, however, sex differences are not consistently found in adolescence (Boylan et al., 2007).

Children with ODD often do not accurately view themselves as angry, oppositional, or defiant, and rather attribute their behaviour to unrealistic demands imposed by their environment (APA, 2013). Although symptoms of the disorder can appear in only one setting (i.e., mild ODD; APA, 2013), such as the home, children meeting diagnostic criteria typically show significant impairment across setting and in particular, in their social relations (Frick & Nigg, 2012). In fact, these children frequently experience conflict with parents, teachers, and peers, resulting in emotional, social, and academic difficulties (Frick & Nigg, 2012)

One of the most commonly co-occurring disorder with ODD is CD (Nock, Hwang, Sampson, & Kessler, 2010), which is characterized primarily by “a repetitive and persistent pattern of behaviour in which the basic rights of others or major age-appropriate societal norms or rules are violated” (APA, 2013, Conduct Disorder, para. 1). Four non-orthogonal categories including aggression to people and animals, non-aggressive conduct that causes destruction of property, deceitfulness or theft, and serious violation of rules, of which the presence of at least three criterion from any of the categories constitute CD (APA, 2013). Longitudinal studies suggest that ODD often precedes the development of CD (Burke, Hipwell, & Loeber, 2010; Pardini, Frick, & Moffitt, 2010).

The prevalence of CD is estimated at 4% (Costello, Egger, & Angold, 2005), with increasing rates from childhood to adolescence, and occurs most frequently in boys than girls (Maughan, Rowe, Messer, Goodman, & Meltzer, 2004; Nock, Kazdin, Hiripi, & Kessler 2006). Although symptoms of CD may emerge as early as in preschool, CD is most common in middle-childhood to adolescence (Keenan et al., 2011; Moffitt et al., 2008). Three specifiers of CD exist— childhood-onset, adolescent-onset, and unspecified onset (APA, 2013). Childhood onset of CD is related to higher risks including difficulties in peer relationships, and increased risk of criminal behaviour, than those with adolescent onset (Kim-Cohen et al., 2003; Moffitt & Caspi, 2001; Nock et al., 2006).

### **Internalizing Disorders**

Internalizing difficulties, including depression and anxiety, often begin to appear during childhood and adolescence (Broeren & Muris, 2009; Muris, Merckelbach, Gadet, & Moulaert, 2000). Longitudinal studies have demonstrated that children and adolescents struggling with high

levels of depressive symptoms often continue showing an increase in symptoms from late childhood to early adolescence (Fombonne, Wostear, Cooper, Harrington, & Rutter, 2001; Twenge & Nolen-Hoeksema, 2002), and even into adulthood (Dunn & Goodyear, 2006; Thapar, Collinshaw, Potter, & Thapar, 2010). Furthermore, early symptoms of depression have been found to develop into more serious issues, such as major depressive disorder (Pine, Cohen, Cohen, & Brook, 1999).

Sex differences with regards to depression have been identified. Although prevalence rates of symptoms of depression are similar for boys and girls during childhood (Cole et al., 2002; Hankin et al., 1998), sex differences become apparent between the ages of 11 and 15, during which an increase in symptoms of depression in girls occurs (Dekker et al., 2007), which continues throughout early adulthood (Holsen, Jraft, & Vitterso, 2000). In fact, depression is the most prevalent mental health difficulty for adolescent girls, with prevalence rates of reported clinically significant symptoms of depression at 20% (Kessler, Avenevoli, & Merikangas, 2001; Lewinsohn, Pettit, Joiner, & Seeley, 2003). It has also been found that being a girl is predictive of increasing levels of depressive symptoms over time (Garber, Keiley, & Martin, 2002; Lewinsohn et al., 2003; Wade, Cairney, & Pevalin, 2002), and of longer depressive episodes (Birmaher et al., 2004). However, sex differences in the duration of depressive symptoms have been inconsistent (see Birmaher, Arbelaez, & Brent, 2002), suggesting that further research taking sex into account is warranted. The increasingly negative outcome for children and adolescents, particularly young girls, affected by depression calls researchers to turn their focus to longitudinal models of research.

Although anxiety disorders are common in children and adolescents, prevalence rates for generalized anxiety disorder in adolescence are low, ranging from 1% to 3% in adolescents aged 13 to 18 (Merikangas et al., 2010). However, worry has been found to be very prevalent in children, with one study finding that 49% of children aged 8 to 13 years old reported chronic worry and 23% met diagnostic criteria for an anxiety disorder (Muris et al., 2000). In fact, worry is considered a cognitive component of anxiety and core feature of generalized anxiety disorder (MacLeod & Matthews, 1991; APA, 2013), which has been associated with detrimental behavioural and mental health outcomes, and found to be a significant precursor to more serious mental illness such as anxiety disorders (Rickels & Rynn, 2001). Due to the high prevalence of

worry in children and adolescents, as well as identified association to later anxiety disorders, it is important to understand the potential prodromal effect of worry.

Anxiety has been shown to have high rates of comorbidity with depression (Kovacs & Devlin, 1998; Krueger & Markon, 2006; Youngstrom et al., 2003) with certain studies indicating that as many as 91% of patients with an anxiety disorder also met diagnostic criteria for major depressive disorder, and that 85% of patients with major depressive disorder also met criteria for an anxiety disorder (Wetzler & Katz, 1989). In fact, researchers have suggested that comorbid presentation of anxiety and depression is the rule rather than the exception (Rapaport, 2001). Further, researchers have been unsuccessful in their attempts to identify groups of depressed patients that did not also present with anxiety (e.g., MacLeod & Byrne, 1996), putting into question whether depression and anxiety represent distinct disorders. The classification of anxiety and depression into a single category of distress disorders has even been proposed due to the strong relation between anxiety and depression and because the findings that symptoms of both disorders are usually found to represent a single factor (Achenbach, 1991; Moffitt et al., 2007; Sterba, Prinstein, & Cox, 2007). For instance, worry is a symptom that is central to the diagnosis of generalized anxiety disorder but is also highly present in depression (APA, 2013; Starcevic, 1995). Although not all symptoms of anxiety are comorbid with symptoms of depression, there is strong evidence pointing to the possibility that anxiety is in fact subsumed under depression due to the strong links between symptoms of both disorders. Further, due to the low prevalence of generalized anxiety disorder in children and adolescents and high prevalence of worry and depression, it may be more useful for researchers to turn their attention to worry and depression in this population.

### **The Association between Aggression, Externalizing Disorders, and Depression**

Researchers have often focused on the negative outcomes of victims of aggression, even though children and adolescents who engage in aggressive behaviour have also been found to experience notable difficulties including internalizing symptoms such as depression and suicide ideation and attempts (e.g., Angold et al., 1999; Capaldi, 1991, 1992; Capaldi & Stoolmiller, 1999; Coie & Dodge, 1998; Costello et al., 1999; Cleverley et al., 2012; Crick et al., 2006; Hawley, Little, & Rodkin, 2007; Ladd, 2005; Murray-Close et al., 2007; Xie et al., 2011). In fact, children and adolescents with depression often report dysfunctions in their regulation of aggressive expression (Jackson, Kuppens, Sheeber, & Allen, 2011; Kashani, Dahlmeier, Borduin,

Soltys, & Reid, 1995) and thus, it has been suggested that aggression may actually be an expression of depression in children and adolescents (Boylan et al., 2010; Boylan et al., 2007; Boylan et al., 2012; Burke et al., 2010; Cleverly et al., 2012; Copeland, Shanahan, Costello, & Angold, 2009; Garland & Garland, 2001; Lee et al., 2008; Stringaris & Goodman, 2009).

The consequences of engaging in relational aggression have been shown to be greater than engaging in physical aggression. Relational aggression has been found to be a unique predictor of depressive symptoms, low self-esteem, loneliness, and social difficulty (Card et al., 2008; Crick, 1997; Crick & Grotpeter, 1995; Crick et al., 2006; Murray-Close et al., 2007; Prinstein, Boergers, & Vernberg, 2001), even after accounting for the variance associated with overt aggression (Crick et al., 2006; Murray-Close et al., 2007). Stronger effects of engaging in relational aggression have been found for girls than for boys or non-aggressive peers, with these girls reporting greater levels of loneliness and peer isolation (Crick & Grotpeter, 1995).

Albeit the marked differences between the presentation of externalizing and internalizing disorders, they have been found to frequently co-occur. Symptoms of ODD have not only been found to co-occur with those of depression, but it has also been suggested that they might even predict symptoms of depression (Boylan et al., 2010; Boylan et al., 2007; Boylan et al., 2012; Burke et al., 2010; Copeland et al., 2009; Costello, Mustillo, Erkanli, Keeler, & Angold, 2003; Stringaris & Goodman, 2009). A similar relation between CD and depression has also been found (Kim-Cohen et al., Lahey, Loeber, Burke, Rathouz, & McBurnett, 2002; Maughen et al., 2004). In fact, both ODD and CD have been linked to high rates of suicidal ideation and attempts, even after controlling for comorbid disorders (Bridge, Goldstein, & Brent, 2006; Nock et al., 2010). Despite certain studies suggesting that CD precedes internalizing difficulties such as depression (Loth, Drabick, Leibenluft, & Hulvershorn, 2014; Nock et al., 2006), further researcher using longitudinal models are still warranted (Nock et al., 2006).

### **Temporal Sequence**

Many researchers have reported that aggressive behaviour is predictive of depressive symptoms. Nevertheless, research on the directional nature of aggression and depression has yielded conflicting findings (e.g., Beyers & Loeber, 2003; Capaldi, 1992; Carlson & Cantwell, 1980; Wolff & Ollendick, 2006). Similarly, the directionality of effect between externalizing and internalizing disorders also remains unclear (Bornstein et al., 2010; Kiesner, 2002; Ladd &

Troop-Gordon, 2003; Mesman et al., 2001; Moilanen et al., 2010; Obradovic et al., 2010; Vaillancourt, Brittain, McDougall, & Duku, 2013; van Lier & Koot, 2010; van Lier et al., 2012).

Researchers have recently made use of “cascade” models which allow researchers to predict symptoms and behaviour across different domains over time, while controlling for the stability of constructs at multiple time points (Masten & Cicchetti, 2010). Using cascade models, researchers have largely found evidence that externalizing difficulties precede internalizing difficulties in children and adolescents (e.g. Kiesner, 2002; Ladd & Troop-Gordon, 2003; Moilanen et al., 2010; Obradovic et al., 2010; Vaillancourt et al., 2013; van Lier & Koot, 2010; van Lier et al., 2012). For instance, cascade models have been used to identify failures in key developmental areas, such as identifying behavioural problems in family relations prior to school that then progress to behavioural problems at school age, leading to academic and social problems, which in turn, lead to the emergence of symptoms of depression (Patterson & Stoolmiller, 1991). However, evidence for the reverse pathway has also been found using cascade models wherein internalizing difficulties precede externalizing difficulties (Bornstein et al., 2010; Mesman et al., 2001). These conflicting findings call researchers to make use of longitudinal models in efforts to clarify whether the direction of effect between these difficulties in children and adolescents is in fact unidirectional or bi-directional.

### **Theoretical Conceptualizations**

In attempts to provide an explanation for the prospective relationship between aggression, externalizing, and internalizing difficulties in children and adolescents, three models have been proposed— the *failure model*, the *acting out model*, and the *shared risk model*.

The *failure model* (Capaldi, 1991, 1992; Capaldi & Stoolmiller, 1999) proposes that children and adolescents who experience difficulty regulating their externalizing behaviour, such as aggression, place themselves at an increased risk of experiencing repeated interpersonal failure which may contribute to increased anxiety and lower self-worth (Burks, Dodge, & Price, 1995; Coie, Terry, Lenox, Lochman, & Hyman, 1995; Piquero, Farrington, Nagin, & Moffitt, 2010). In turn, these difficulties leave these children and adolescents vulnerable to depression (Reinherz, Giaconia, Pakiz, Silverman, Farst, & Lofkowitz, 1993). Thus, the model suggests that the likelihood of experiencing repeated failure and rejection within relationships with peers, family, and teachers, due to their aggressive behaviour, places these children and adolescents at risk for depressive symptoms (Patterson & Capaldi, 1990). Evidence for this model has been provided

through longitudinal studies pointing to the development of depressive symptoms following pre-existing behavioural problems (Cleverly et al., 2012; Wolff & Ollendick, 2006).

Alternatively, the *acting out model* (Carlson & Cantwell, 1980; Ritakallio, Koivisto, von der Pahlen, Pelkonen, Marttunen, & Kaltiala-Heino, 2008) has been proposed following evidence suggesting that depression predicts aggressive behaviour. According to this model, depressive symptoms (e.g., irritability) are expressed behaviourally through aggression (Akse, Hale, Engels, Raaijmakers, & Meeus, 2007; Wolff & Ollendick, 2006), which in turn may result in high levels of social isolation and increase the likelihood to develop relationships with peers who model and reinforce deviant behaviour (Oland & Shaw, 2005). Similarly to the *failure model*, longitudinal studies have lent support for the *acting out model* by demonstrating the presence of depressive symptoms prior to aggressive behaviour (Capaldi & Stoolmiller, 1999; Curran & Bollen, 2001; Kofler et al., 2011; Nock et al., 2006), as well as prior to changes in aggressive behaviour (Beyers & Loeber, 2003). However, these studies frequently considered severe delinquent behaviour and so different associations might exist between less severe aggressive behaviour, oppositional behaviour, and depressive symptoms (Rapport, LaFond, & Sivo, 2009).

Finally, it has also been suggested that the relation between externalizing and internalizing difficulties might be reciprocal in nature due to other non-specific factors might lead to the development of both externalizing and internalizing symptoms (e.g., Caron & Rutter, 1991; Wolff & Ollendick, 2006). Certain factors that have been identified in the development of these separate difficulties include social disadvantage, adverse life events, conflict between parents, and parental mental illness (e.g., Angold et al., 1999; Caron & Rutter, 1991; Fergusson, Lynskey, & Horwood, 1996; Wolff & Ollendick, 2006). Similarly to the *failure* and *acting out models*, longitudinal studies have also lent support to the *shared-risk model* suggesting that although externalizing behaviour preceded internalizing symptoms, the reverse relation could also be supported. However, when the shared factors are taken into consideration, the prospective association between the syndromes is blunted (Caron & Rutter, 1991; Fergusson et al., 1996). Additional support for bi-directional association of these syndromes has been found above and beyond the presence of common risk factors (Beyers & Loeber, 2003; Measelle, Stice, & Hogansen, 2006; Wiesner, 2003).

Recently, Van der Giessen and colleagues (2013) provided criticism of certain studies suggesting evidence of a *failure model* (Capaldi & Stoolmiller, 1999; Kosterman, Hawkins,

Mason, Herrenkohl, Lengua, & McCauley, 2010), *acting-out model* (Carlson & Cantwell, 1980; Ritakallio et al., 2008), *shared-risk model* (Caron & Rutter, 1991; Fergusson et al., 1996) or bi-directional associations (Beyers & Loeber, 2003; Measelle et al., 2006), or no cross-lagged associations (Ingoldsby, Kohl, McMahon, & Lengua, 2006; Overbeek, Biesecker, Stattin, Meeus, & Engels, 2006) between depressive symptoms and externalizing behaviour. Their criticism stems from the use of models that, rather than making use of fully recursive models in which all variables are interconnected across time, they failed to include cross-lagged, or continued, associations between the constructs across time. For instance, including cross-lagged paths from externalizing to depressive symptoms (*failure model* paths), without accounting for the cross-lagged paths from depressive to externalizing symptoms (*acting out model* paths), prevents predictive associations in one or the other direction. Further, prospective studies making use of fully recursive models have often resulted in inconsistent findings (e.g. Bornstein et al., 2010), with certain studies using fully recursive models continuing to provide evidence for the *failure model* (Curran & Bollen, 2001; Moilanen et al., 2010; Van Lier & Koot, 2010; Wiesner, 2003). Nonetheless, using a fully recursive model, Wiesner (2003) found evidence for both the *failure model* and the *acting out model* for adolescent girls. These findings suggest that the use of recursive models allows researchers to determine with greater accuracy the directionality of effect. Further, the inclusion of larger time frames might provide evidence of different relations across childhood and adolescent development.

### **Overviews of the Current Studies**

The present dissertation consists of three studies on the progressive associations between aggression, externalizing difficulties, and symptoms of depression. In the first study, the aim was to identify whether symptoms of worry might play a role in the subsequent development of depressive symptoms in aggressive girls. In the second study, the aim was to identify the sequential relation between aggressive behaviour and symptoms of depression in children and adolescents. Finally, in the third study, the aim was to identify the temporal sequence between symptoms of externalizing and internalizing difficulties in children and adolescents.

#### **Study 1: Depression and Aggression in Girls: The Moderating Role of Worry**

The first study consisted of moderation analyses with worry as a possible moderator in the relation between aggression, physical and relational, and depression. The study included a sample of 226 girls aged 13 at Time 1 and 14 at Time 2.

A sample of peer-nominated aggressive girls was chosen because of their particular vulnerability (Angold et al., 1999; Cole et al., 2002; Hankin et al., 1998; Lewinsohn et al., 2003). First, a moderation analysis where worry moderated the relation between physical and relational aggression and depressive symptoms at Time 1 was conducted. Second, a moderation analysis where worry moderated the relation between physical and relational aggression and depressive symptoms at Time 2 was conducted. In order to control for any potential influences, age was entered as a control variable. Physical aggression was also entered as a control variable for the relational aggression analysis and vice-versa for the physical aggression analysis. For our second moderation analyses, depression at Time 1 was also entered as a control variable. Although this study was the first to examine worry as a moderator between aggression and depressive symptoms, based on research on anxiety and aggression it was hypothesized that worry might exacerbate the risk of developing depressive symptoms for aggressive girls. Specifically, it was expected that there would be a stronger effect for relationally aggressive girls than physically aggressive girls. Results of this study suggest that physically aggressive girls with high and moderate worry were at increased risk of experiencing depressive symptoms concurrently and one year later. Conversely, relationally aggressive girls who reported worries were not found at increased risk of current or subsequent depressive symptoms.

### **Study 2: Longitudinal Associations between Depression and Aggression in Children and Adolescents**

In the second study, structural equation modeling was used to identify the sequential relation between aggression and depressive symptoms in children and adolescents. Three models were compared in this study: (1) the *failure model*, in which aggression predicted depression, (2) the *acting out model*, in which depression predicted aggression, and (3) a *reciprocal model*, in which both aggression and depression shared a reciprocal relation over time, in order to determine the directionality between these constructs. Additionally, both physical and relational forms of aggression were considered in the models. Participants included 643 students aged 10 at Time 1 followed annually for 7 years. Results of this study provided evidence for the *failure model*, wherein engaging in physical and relational aggression predicted depressive symptoms. Similarly to Study 1, it was found that girls who engaged in physical aggression predicted depressive symptoms, whereas this relation was not found for boys.

### **Study 3: Longitudinal Associations between Externalizing Disorders and Depression in Children and Adolescents**

Study 3 builds on findings from the second study by using structural equation modeling to examine longitudinal relations between externalizing, ODD and CD, and depressive symptoms in children and adolescents. This study was conducted in a sample of 494 children aged 10 at Time 1 followed across 7 years. Unlike Study 2, findings from this study suggest that externalizing and internalizing symptoms share a reciprocal relation. Although ODD predicted depressive symptoms across all time points, depressive symptoms were also found to predict symptoms of ODD and CD across time.

## Chapter 2 – Study 1

Does Worry Moderate the Relation between Aggression and Depression in Adolescent Girls?

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## Does worry moderate the relation between aggression and depression in adolescent girls?★

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## ABSTRACT

Aggressive girls, more so than aggressive boys, are at an increased risk for depression. Despite disconcerting outcomes, few researchers have examined factors that may attenuate or exacerbate the relation between aggression and depression. Competing hypotheses for explaining the role of worry in the relation between aggressive behaviour and depressive symptoms, commonly co-occurring problems in girls, have been proposed. In the present study, we examined worry as a possible moderator in the relation between girls nominated as aggressive by their peers and self-reported depressive symptoms in a sample of 226 girls aged 13 ( $M = 12.92$ ,  $SD = 1.28$ ) at Time 1. We found that worry exacerbated the risk of depressive symptoms concurrently and one year later for physically aggressive girls, but not relationally aggressive girls. These results suggest that worry plays an important role in the prediction of depression for aggressive girls, which varies by the form aggression takes.

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Childhood and adolescence are periods during which mental health symptoms begin to emerge (Muris, Merckelback, Mayer, & Prins, 2000). Young girls seem to be particularly at risk for the development of mental health difficulties (Angold, Costello, & Erkanli, 1999; Lewinsohn, Pettit, Joiner, & Seeley, 2003). Unfortunately, the prognosis for children and adolescents struggling with high levels of internalizing difficulties such as depression and anxiety is poor, with many continuing to show an increase in symptoms from late childhood to early adolescence, which remains stable over time (e.g. Fombonne, Wostear, Cooper, Harrington, & Rutter, 2001). During adolescence, girls, more so than boys, experience higher rates of co-occurring disorders, with comorbidity rates surpassing single disorder rates, and showing continued increased comorbidity with age (Angold et al., 1999; Kessler et al., 2005). These findings point to the importance of better understanding the development of mental health difficulties in girls.

Despite researchers often focusing on victims of aggression, the plight of aggressive youth is also problematic (e.g., Hawley, Little, & Rodkin, 2007). In fact, internalizing problems and externalizing problems have been found to co-occur in youth more often than by chance (Copeland, Shanahan, Costello, & Angold, 2009), with co-occurrence being related to greater impairment, poorer adjustment, and more frequent future psychological diagnoses than when dealing with either depression or

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aggression alone (Keiley, Lofthouse, Bates, Dodge, & Pettit, 2003). Externalizing problems, such as aggressive behaviour, are also common among adolescent girls (Broidy et al., 2003), and have been shown to not only co-occur with depression but also predict depression (Boylan, Vaillancourt, & Szatmari, 2012). The co-occurrence between aggression and depression has been related to greater impairment, poorer adjustment, and more frequent future psychological diagnoses than when dealing with either depression or aggression alone (Keiley et al., 2003). The host of negative outcomes associated with engaging in aggressive behaviour, and those associated with depression, warrant further investigation in order to better understand whether certain factors may underlie the aggression and depression relation.

### Aggression in youth

Aggression takes many different forms. Physical aggression is defined as an overt behaviour such as hitting or kicking that is directed against self or others with the intent to cause harm (e.g., Nagin & Tremblay, 1999); whereas relational aggression (also termed indirect or social aggression) is defined as behaviour wherein there is intent to damage interpersonal relationships using indirect and direct means (e.g., Crick, 1997; Crick & Grotpeter, 1995). Relational aggression includes behaviour such as verbal and non-verbal social exclusion, gossiping, and friendship manipulation. Relational aggression makes up the vast majority of peer abuse incidences with prevalence rates ranging between 10% and 20% (Craig et al., 2009; Vaillancourt et al., 2010), while prevalence rates of physical aggression are estimated at 3.7% for boys aged 5–11 years old and range from 2.3% for 5 year-old girls and 0.5% for 11 year-old girls (Lee, Baillargeon, Vermunt, Xu, & Tremblay, 2007).

Sex differences have been identified in the use of aggression. Although boys are more likely than girls to be aggressive overall, and are more likely to engage in physical forms of aggression than girls, negligible sex differences have been found for the use of relational forms of aggression (see Card, Stucky, Sawalani, & Little, 2008). Since it has been shown that girls engage in different types of aggression, both physical and relational forms of aggression were considered in this study.

### Aggression and anxiety

Although anxiety disorders have been shown to have the highest lifetime prevalence, with rates estimated at 28.8% (Kessler et al., 2005), generalized anxiety disorder has a late median age of onset, estimated at 19–31 years of age (Kessler et al., 2005), and a low prevalence rate in adolescence, estimated at only 2.2% in those aged 13–18 years old (Merikangas et al., 2010). Worry, defined as a cognitive process in response to thoughts related to realistic and/or unrealistic events (Muris et al., 2000; Silverman, La Greca, & Wasserstein, 1995), functions to avoid possible threats or outcomes, which can be protective (Borkovec, Ray, & Stober, 1998). However, excessive worry is maladaptive and is even considered a cognitive component of anxiety (APA, 2013). Worry is the core feature of generalized anxiety disorder (APA, 2013; MacLeod & Matthews, 1991) and is also highly present in depression (Starcevic, 1995). In fact, unlike generalized anxiety disorder, worry is common in childhood and adolescence with one study finding that 49% of children aged 8–13 years old reported having fears and worries that met subclinical threshold of anxiety disorders, and 23% reported fears and worries so intense as to qualify for a diagnosis of an anxiety disorder (Muris et al., 2000). Adolescent worry has been associated with detrimental behavioural and mental health outcomes, and has been found to be a significant precursor to more serious mental illness such as generalized anxiety disorder (Rickels & Rynn, 2001). Further, the high rate of comorbidity between anxiety and depression is well-established (Krueger & Markon, 2006), with their co-occurrence linked to poorer prognosis and response to treatment (Copeland et al., 2009). Therefore, we were interested in examining the role of worry since it is more common in adolescence than generalized anxiety disorder, is well-established as a predictor of anxiety, and has been linked to depression.

The association between anxiety and aggression has been supported (Crick, Ostrov, & Werner, 2006). Compared to non-anxious youth, aggressive youth with co-occurring anxiety displayed larger increases in subsequent aggression, suggesting a possible additive risk (Ialongo, Edelsohn, Werthamer-Larsson, Crocket, & Kellam, 1995). It has also been suggested that anxiety might actually serve as a motivator for youth to engage in aggressive behaviour. For instance, anxious and/or aggressive youth might hold negative social-cognitive biases that would lead them to interpret certain social situations as threatening. Researchers have demonstrated that anxious youth tend to engage in cognitive errors in social situations such as attending to negative aspects of a peer interaction (Weems, Berman, Silverman, & Saavedra, 2001) and that youth who engage in physical and/or relational forms of aggression exhibit these cognitive biases (Crick, 1997).

Interestingly, the inverse relation has also been suggested where anxiety may serve as a suppressor and may decrease the likelihood of aggression. The attenuation hypothesis proposes that the inhibition and fear of negative evaluation by peers consistent with anxiety would prevent aggressive behaviour (Gray, 1987; Quay, 1988). For example, when examining the effect of psychiatric comorbidity on aggression, Connor, Chartier, Preen, and Kaplan (2010) found that comorbid anxiety was the only condition not associated with aggression. Anxiety has also been shown to inhibit reward-seeking behaviour and attenuate future delinquency in boys with conduct problems (Kerr, Tremblay, Pagani, & Vitaro, 1997). Further, worry has also been shown to increase threat avoidance (Maner et al., 2007) and therefore might attenuate engaging in aggressive behaviour. These findings suggest that worry may play a protective role for aggressive behaviour.

## Relational aggression and internalizing disorders

Engaging in relational aggression has been shown to have greater risks than engaging in physical aggression. For example, increases in relationally aggressive behaviour over the course of a year was associated with increases in, as well as being a unique predictor of, internalizing symptoms in youth even after controlling for the variance associated with overt aggression (Crick et al., 2006; Murray-Close, Ostrov, & Crick, 2007). Youth engaging in relational aggression seem to have a greater risk for depressive symptoms, low self-esteem, loneliness, and social difficulties (Crick, 1997; Crick & Grotpeter, 1995; Crick et al., 2006; Murray-Close et al., 2007), and this effect seems stronger in girls than in non-relationally aggressive boys (Crick & Grotpeter, 1995). Further, gender non-normative use of aggression, such as girls engaging in physical aggression, has been found to increase the risk of depression (Crick, 1997) suggesting that the mechanism between aggression and subsequent mental health difficulties might be different for boys and girls.

Relational aggression and anxiety also share a unique relation. It has been proposed that relational aggression serves a particular use for anxious youth, such as transferring negative attention away from themselves and onto other peers (Loudin, Loukas, & Robinson, 2003). Anxious youth are often concerned and distressed with other's evaluation and often assume negative evaluation (Kashdan & Herbert, 2001; La Greca, 2001). Therefore, anxious youth who may assume hostile intentions by their peers may retaliate using covert forms of aggressive behaviour in order to maximize anonymity and minimize disapproval by peers and further negative evaluation (Xie, Cairns, & Cairns, 2002).

## The current study

Our aim for the current study was to explore the moderating role worry might play in the relation between depression and aggression. Although it has been suggested that anxiety may serve as a protective factor (e.g., Connor et al., 2010; Gray, 1987; Quay, 1988), we hypothesized that worry might exacerbate the risk of depression for aggressive girls. This hypothesis is based on evidence suggesting that anxious youth might be motivated to use aggression because of negative biases in their interpretation of peer interactions (Kashdan & Herbert, 2001; La Greca, 2001), and that anxious youth often experience social withdrawal and have poorly developed social skills (Hymel, Bowker, & Woody, 1993; Messer & Beidel, 1994). Further, youth who experience difficulty with regulating their aggressive behaviour are at increased risk of experiencing repeated interpersonal failure which may contribute to increased worry and lower self-worth (Burks, Dodge, & Price, 1995), and in turn may leave youth vulnerable to depression (Reinherz et al., 1993). Since engaging in relational aggression has been found to yield higher risk and is more prevalent in girls than physical aggression (Crick et al., 2006; Lee et al., 2007; Murray-Close et al., 2007), we expected to find an exacerbating effect of worry on depression for relationally, but not physically, aggressive girls.

Finally, longitudinal studies on the trajectory of mental health difficulties in adolescence have often focused on adolescent boys, calling more attention to the developmental trajectory of girls, who are found to often experience more symptoms, as well as higher prevalence rates, of depression and worry than boys (Angold, Costello, & Worthman, 1998; Measelle, Stice, & Hogansen, 2006; Muris et al., 2000; Silverman et al., 1995). In an effort to obtain an accurate reflection of the girls considered as aggressive by their peers, nominations were obtained from both girls and boys. The use of peer nominations holds the advantage of reducing the potential of self-report bias by taking into account the perspective of many individuals, and thus have been found to be a psychometrically valid method when used with middle-childhood and adolescent participants (e.g., Hymel, Vaillancourt, McDougall, & Renshaw, 2002).

## Method

### Participants

Data were collected at two time points (1 year apart) using peer- and self-reports. Participants were recruited from five elementary schools and one secondary school located in a small western Canadian city for a longitudinal study. The participants included 226 girls in grades 6 to 9 at Time 1 ( $M_{\text{age}} = 12.92$   $SD = 1.28$ ) and 211 girls in grades 7 to 10 at Time 2 ( $M_{\text{age}} = 14.00$ ,  $SD = 1.28$ ).

### Procedure

Parental consent was obtained yearly for those individuals who had agreed to participate in the study (consent rate was 98% at Time 1 and 96% at Time 2). Confidentiality regarding their individual responses was assured to the participants. At the end of the school year at Time 1 and Time 2 (one year later), participants were invited to complete a package including all self-report and peer assessment measures during a single group-testing session lasting 50 min.

### Measures

#### Aggression

The Revised Class Play Procedure (Masten, Morison, & Pellegrini, 1985) was used to collect peer reports of aggressive behaviour, including physical and relational aggression. The measure asks students to nominate an unlimited number of

their peers who they believe fit the descriptions presented with higher scores reflecting greater perception of the described characteristic. The physical aggression subscale was made up of three items (“Who threatens other people to get their way?”, “Who starts fights and arguments with others?”, and “Who hits others?”), which were internally consistent ( $\alpha = .90$ ), and the relational aggression subscale is comprised of four items (“Who spreads mean rumours about someone to get others to stop liking the person?”, “Who will make someone feel bad or look bad by making a face, or turning away, or rolling their eyes?”, “Who tells others to stop liking a person to get even with them?”, and “Who tries to control or dominate a person by keeping them out of the group?”), which were internally consistent ( $\alpha = .89$ ). Scores were standardized by class (grades 6–7), and grade (grades 8–10) in order to account for variations in group size. Specifically, the proportion of times each child was nominated as aggressive by her peers was computed to create a composite aggression score for each participant.

### *Depression*

Children’s depression symptoms were assessed using the Children’s Depression Inventory (CDI; Kovacs, 1992). The psychometric properties of the CDI have been well established by the author of the scale and many researchers with the scale demonstrating good internal consistency, test–retest reliability, concurrent validity, and standard error of measurement (e.g., Barreto, 1994; Hodges, 1990; Kovacs, 1985). The CDI yielded internally consistent scores at Time 1 ( $\alpha = .90$ ) and Time 2 ( $\alpha = .88$ ). At the request of the school board, item 9 was removed due to concerns with regards to asking youth about suicidal ideation.

### *Worry*

Children’s worries were assessed using two selected subscales (Myself and Verbal Communication) of the Things I Worry About Scale (Millar & Gallagher, 1996). The Myself subscale included 14 items such as “I worry about the way I look” and “I worry about what others think of me” and the Verbal Communication subscale included 12 items such as “I worry about talking in front of a group of people” and “I worry about meeting new people”. Each item was rated on a 5-point Likert-type scale with anchors from 1 (never worry) to 5 (always worry), with higher scores indicating higher levels of worry. The psychometric properties of the scale have been well established (e.g., Esters, Tracey, & Millar, 2007; Millar & Gallagher, 1996). The scale yielded an internally consistent score ( $\alpha = .92$ ).

### *Data analyses*

We first examined the relation among all our study variables. We then conducted a series of hierarchical multiple regression analyses to examine whether worry moderated the relation between physical or relational aggression and depression. The moderating effect of worry was examined cross-sectionally and longitudinally. For each analysis, we first controlled for age (Step 1), we then entered main effects of worry, physical, and relational aggression (Step 2) in an effort to control for one type of aggression when examining the other since developmental differences in the onset of depression and in the use of aggression in girls have been identified (see Angold et al., 1998; Card et al., 2008). Lastly, we entered the interaction between physical aggression and worry, and relational aggression and worry (Step 3) to examine the independent effects of the interactions. For our longitudinal analyses, we re-examined the regression analyses controlling for previous levels of depression at T1 in Step 2. According to procedures outlined by Aiken and West (1991), all predictors were centred prior to creating the interaction terms. Significant interactions were interpreted and graphed using the techniques recommended by Aiken and West (1991) to predict depression at low ( $-1$  SD), moderate (mean), and high ( $+1$  SD) levels of worry.

### *Missing data*

Because we were interested in examining the longitudinal relation between aggression, worry, and depression, we examined if the missing data (range = 0.3–34.2%) were missing at random or systematically. Little’s Missing Completely at Random test (Little, 1988) indicating that these data were missing completely at random  $\chi^2 = 15.06$ ,  $df = 17$ ,  $p = .59$ . The listwise deletion method was applied to handle missing data for the descriptive and moderation analyses.

## **Results**

### *Descriptive analyses*

Means and standard deviations are presented in Table 1. Bivariate correlations are presented in Table 2. Bivariate correlations revealed that at Time 1, physical aggression and relational aggression were positive and statistically significantly related, but not significantly related to Time 1 worry. Depression at Time 1 was positively and significantly related to Time 1 physical aggression and worry. Time 2 depression was also positively and significantly correlated with Time 1 worry, but was not correlated with Time 1 physical or relational aggression. The stability coefficient between Time 1 and Time 2 depression was moderately high.

**Table 1**  
Means and SD.

	<i>M</i>	<i>SD</i>	Min	Max
Physical aggression T1	-0.16	0.71	-0.85	5.44
Relational aggression T1	0.11	1.00	-0.77	7.63
Worry T1	71.82	19.73	26	125
Depression T1	9.32	8.21	0	46
Depression T2	8.63	8.02	0	52

*Does worry moderate the relation between physical aggression and depression?*

Analyses revealed significant physical aggression  $\times$  worry interactions for both current symptoms of depression ( $\beta = 0.26$ ,  $t(203) = 2.15$ ,  $p < .05$ ) and subsequent symptoms of depression, with ( $\beta = 0.22$ ,  $t(186) = 1.98$ ,  $p < .05$ ) and without ( $\beta = 0.43$ ,  $t(186) = 3.22$ ,  $p < .01$ ) depression at Time 1 as a control variable. For current (Time 1) symptoms of depression, physical aggression predicted higher levels of depression in girls experiencing high,  $b = 6.43$ ,  $t(203) = 3.36$ ,  $p < .001$ , and moderate,  $b = 3.63$ ,  $t(203) = 3.15$ ,  $p < .01$ , but not low,  $b = 0.82$ ,  $t(203) = 0.57$ , *ns*, levels of worry (see Fig. 1). For subsequent (Time 2) symptoms of depression, physical aggression predicted higher levels of depression in girls experiencing high,  $b = 8.27$ ,  $t(186) = 3.88$ ,  $p < .001$ , and moderate,  $b = 3.89$ ,  $t(186) = 3.10$ ,  $p < .01$ , but not low,  $b = -0.49$ ,  $t(186) = -0.31$ , *ns*, levels of worry (see Fig. 2). These findings suggest that worry exacerbated the risk of depression in physically aggressive girls. However, when depression at T1 was entered as a control variable, no statistically significant difference between the slopes was observed at high,  $b = 3.21$ ,  $t(186) = 1.81$ , *ns*, moderate,  $b = 0.96$ ,  $t(186) = 0.37$ , *ns*, or low,  $b = -1.29$ ,  $t(186) = -1.05$ , *ns*, levels of worry, even though the interaction between physical aggression and worry was statistically significant.

*Does worry moderate the relation between relational aggression and depression?*

Analyses did not reveal a statistically significant relational aggression  $\times$  worry interaction for current symptoms of depression ( $\beta = -0.11$ ,  $t(203) = -0.89$ , *ns*) or subsequent symptoms of depression ( $\beta = -0.20$ ,  $t(186) = -1.46$ , *ns*; control for depression T1,  $\beta = -1.12$ ,  $t(186) = -1.09$ , *ns*), indicating that the relation between relational aggression and depression was not moderated by worry.

**Discussion**

Our aim for the current study was to examine the role worry might play in the relation between aggression and depression in girls. We were interested in whether worry, a known precursor to anxiety that is common among children and adolescents (Muris et al., 2000; Rickels & Rynn, 2001), moderated the relation between aggression and depression. This study adds to the current literature by being the first, to our knowledge, to suggest that worry plays a role in the relation between aggression and subsequent depression.

The results of our study are consistent with research demonstrating that depression and anxiety share a strong relation (Krueger & Markon, 2006), and that worry and depression also share a strong relation (Starcevic, 1995). We found that worry was significantly and positively related to depression one year later.

Our findings for girls nominated as relationally aggressive did not support our initial hypothesis and contrast previous findings suggesting that engaging in relational aggression confers greater risk than engaging in physical aggression (Card et al., 2008; Crick, 1997; Crick & Grotpeter, 1995; Crick et al., 2006; Murray-Close et al., 2007). Specifically, we found no cross-sectional or longitudinal interaction effect between worry and relational aggression in predicting depression. Although some findings suggest that engaging in aggressive behaviour is problematic, some researchers have found that engaging in aggression can be related to higher social status, which can be a buffer against mental health difficulties (Vaillancourt, Hymel, & McDougall, 2003). Therefore, it is possible that our sample of relationally aggressive girls benefit from possibly increased social status, which in turn might be protective. However, further research examining this relation would be warranted.

The interaction between worry and depression was associated with physical aggression concurrently and longitudinally. Specifically, higher physical aggression nominations by peers and higher self-reported worries jointly predicted higher self-

**Table 2**  
Bivariate correlations.

	1	2	3	4	5
1. Physical aggression T1	1				
2. Relational aggression T1	0.76**	1			
3. Worry T1	-0.11	-0.13	1		
4. Depression T1	0.22*	0.12	0.45**	1	
5. Depression T2	0.14	0.07	0.34**	0.68**	1

Note. \*\* =  $p < .001$ , \* =  $p < .01$ .

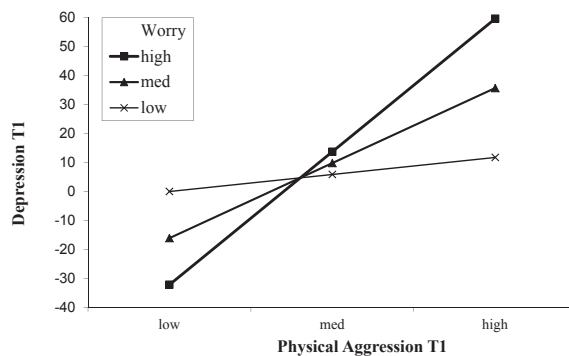


Fig. 1. Interaction of physical aggression and worry on Time 1 depression.

reported depressive symptoms concurrently and one year later. Adding to the evidence that gender non-normative use of aggression (e.g., physical aggression in girls) confers an elevated risk of depression (Crick, 1997); our findings suggest that worry might exacerbate the risk of depression for physically aggressive girls. It is possible that these physically aggressive girls have weaker abilities to regulate their emotionally based reactions (Kochanska, Murray, & Harlan, 2000), which in turn places them at greater risk to experience higher depressive symptoms than their non-aggressive peers, consistent with findings that girls experience higher levels of depression than boys (Garrison et al., 1997; Lewinsohn et al., 2003; Wade, Cairney, & Pevalin, 2002). Recently, Vaillancourt et al. (2014) extended findings on adverse outcomes associated with girls' engagement in non-normative forms of aggression. In fact, the authors demonstrated that physical aggression in girls was the strongest predictor of borderline personality features 2 years later. Despite findings that girls are less frequently physically aggressive than boys (Card et al., 2008), our findings add to those suggesting that engaging in physical aggression may be particularly detrimental for girls with longstanding negative consequences spanning various mental health difficulties (Crick, 1997; Vaillancourt et al., 2014).

We were able to demonstrate the association between worry and physical aggression longitudinally. When depression at T1 was not controlled for we were able to demonstrate a stronger association between physical aggression and worry, as well as demonstrate that high and moderate levels of worry exacerbate the relation. The inclusion of previous depressive symptoms is strongly advised in an effort to rigorously test the relation between the constructs. However, short lapses of time between assessments have been shown to mask important findings, especially in highly correlated constructs (Masten & Cicchetti, 2010). Due to the short time frame between assessment waves in the current study, it is possible that effects were less pronounced when controlling for depression at T1 because of the high stability of depression. In fact, it has been suggested that longer assessment intervals be considered because if not, high between time correlations may result in "... cumulative direction of effects [that] may be lost in the directionally indeterminate covariance within an assessment wave" (Masten & Cicchetti, 2010, p. 493).

Taken together, our findings indicate that worry may play a role in the relation between physical aggression and depression in adolescent girls. Although future research on the topic would be needed to further clarify the underlying mechanism, it appears that the presence of worries places already vulnerable physically aggressive girls at increased risk of subsequent depressive symptoms. For instance, through the use of longitudinal models, it has been found that lower anxiety in youth was predicted by peer acceptance, social connectedness, and friendships (Crick & Grotpeter, 1995; Hymel et al., 1993). Interestingly, a relation between symptoms of anxiety and social relationships has been shown wherein socially competent youth reported lower anxiety (e.g. Strauss, Frame, & Forehand, 1987), whereas excessive adolescent worry has

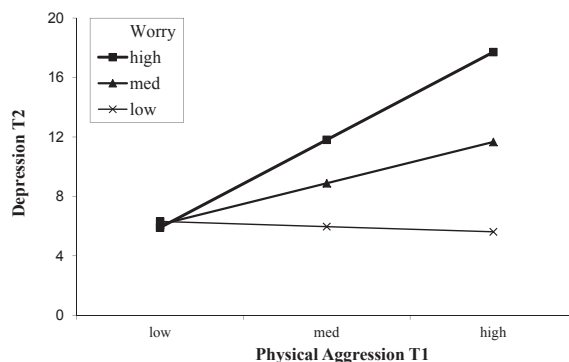


Fig. 2. Interaction of physical aggression and worry on Time 2 depression.

been shown to impair social skills (Silverman et al., 1995). Furthermore, understanding the relation between externalizing and internalizing problems, two seemingly opposite difficulties, has been an important area of investigation. It has been proposed that children and adolescents with difficulty regulating their aggressive behaviour are at risk of experiencing repeated difficulties in their interpersonal relationships, which may contribute to increased anxiety and lower self-worth (Burks et al., 1995; Coie, Terry, Lenox, Lochman, & Hyman, 1995). Due to these repeated failures, these children and adolescents are then susceptible to subsequent depression (Reinherz et al., 1993), a theory that has been coined the *failure hypothesis* (Capaldi, 1991, 1992; Capaldi & Stoolmiller, 1999). Our findings seem to be in line with this hypothesis, wherein engaging in physical aggression, coupled with excessive worry, may be impairing these adolescent girls social relations and in turn placing them at risk of depression.

### Limitations

Certain limitations to this study warrant consideration. The data on worry and depression were self-reported and therefore the association between these two measures of internalizing problems may have been inflated due to shared-method variance. Further, our measure of worry only tapped into worries related to the self and verbal communication. Findings suggest that social anxiety related to aggression, particularly relational aggression, due to the fear of negative evaluation by peers (Loudin et al., 2003; Xie et al., 2002), indicating that a different pattern may have emerged with the use of a social anxiety measure. However, generalized anxiety disorder is rare in older children and adolescents whereas worries are more common and are a predictor of anxiety, thus making it a more accurate measure for our sample (Merikangas et al., 2010; Silverman et al., 1995). Further, our measure of worry did not assess worry as related to the perpetuation or reception of aggression, nor did it include rumination. Rumination has been shown to exacerbate mood related to depression and anxiety, and is more common in women than men (e.g., Nolen-Hoeksema, Larson, & Grayson, 1999). In fact, in experimentation studies, higher rumination has been linked to greater aggression (e.g., Bushman, 2002).

Although the use of peer-reports of aggression adds strength to our findings by removing self-reporting bias since peers are accurate observers of their peers' behaviour (see Hymel et al., 2002; Masten et al., 1985), we were not able to identify whether these nominated youth were reactive or instrumental in their use of aggression. There is growing evidence suggesting that reactive, rather than proactive, aggression is associated with both depression and anxiety in youth (e.g., Card & Little, 2006). Therefore, the use of different measures of worry, anxiety, and aggression would be warranted in future studies in order to replicate and extend the current findings. Further, our findings seems to be in line with the *failure hypothesis* (Capaldi, 1991, 1992; Capaldi & Stoolmiller, 1999), however, future research including measures assessing quality of peer relations would be warranted in an effort to provide further evidence of the relation between aggression and depression. Finally, although the use of a longitudinal design implies directionality, causal conclusions cannot be drawn from our study.

### Conclusion

The current study extends prior research by being the first to establish a link between worry and the aggression-depression link. This study expands our knowledge base by demonstrating that worry moderates the association between physical aggression and depression in adolescent girls. Current findings support the need to continue focusing intervention efforts on the promotion of healthy peer relationships in an effort to protect vulnerable youth from experiencing subsequent difficulties. Early identification that is aimed at coping with aggression and worry may attenuate the risk of depression for girls.

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**Chapter 3 – Study 2**

Longitudinal Associations between Depression and Aggression in Children and Adolescents

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## Abstract

The longitudinal links between relational aggression, physical aggression, and depression were examined across 7 years in a sample of 643 children aged 10 at Time 1. Three models were compared— (1) the *failure model*, in which aggression predicted depression, (2) the *acting out model*, in which depression predicted aggression, and (3) a *reciprocal model*, in which both aggression and depression shared a reciprocal relation over time. Cross-lagged path analyses using structural equation modeling supported the *failure model* (i.e., engaging in relational and physical aggression predicts subsequent depressive symptoms). Sex differences were also noted wherein engaging in physical aggression predicted depressive symptoms for girls but not for boys. These findings add to the literature suggesting that externalizing problems lead to internalizing problems, and that gender non-normative aggression confers higher risks.

*Keywords:* depression, aggression, failure model, acting out model, reciprocal model

### **Longitudinal Associations between Depression and Aggression in Children and Adolescents**

Despite their different presentations, externalizing problems, such as aggression, and internalizing problems, such as depression, have been found to co-occur more often than by chance (Krueger, Caspi, & Moffitt, 2000). Depression and behavioural problems are two of the most common mental health difficulties in youth (Wolff & Ollendick, 2006), with youth presenting with both problems concurrently experiencing poorer response to treatment and suffering worse overall outcomes than those struggling with either problem alone (Capaldi & Stoolmiller, 1999; Copeland, Shanahan, Costello, & Angold, 2009). The detrimental outcomes for these youth call researchers to further examine the link between externalizing and internalizing problems.

The co-occurrence of depression and aggression has been established, however, it is still unclear whether the relation between these constructs is unidirectional or bidirectional. Research in this area has yielded inconsistent findings with some suggesting that aggression is a risk factor for depression (*failure model*; Capaldi, 1991, 1992; Capaldi & Stoolmiller, 1999). Others have demonstrated that aggression seems to be an outcome of depression (*acting out model*; Carlson & Cantwell, 1980), or that aggression shares a reciprocal relation with depression (e.g., Beyers & Loeber, 2003; Caron & Rutter, 1991; Measelle, Stice, & Hogansen, 2006; Wolff & Ollendick, 2006). In the present study, we were interested in examining the temporal sequence between aggressive behaviour and symptoms of depression in order to better understand whether (1) aggressive behaviour leads to depression, (2) aggressive behaviour is an outcome of depression, or (3) both share a reciprocal relation.

#### **Conceptualization of Aggression**

There exist many forms of aggression including physical aggression, defined as an overt physical behaviour such as hitting or kicking, directed against self or others to cause harm (e.g., Nagin & Tremblay, 1999); and relational aggression (also termed indirect or social aggression), defined as behaviour wherein there is intent to damage interpersonal relationships using indirect and direct means such as verbal and non-verbal social exclusion, gossip, and friendship manipulation (e.g., Crick, 1997; Crick & Grotpeter, 1995; Galen & Underwood, 1997; Underwood, 2003). The type of aggression used by youth has been found to change over the course of development. Physical aggression, which is more common in younger children and boys, has been found to emerge as early as the toddler years (Tremblay, 2000), while the use of

relational forms of aggression is more common in older children, with negligible sex differences found (Card, Stucky, Sawalani, & Little, 2008). Further, longitudinal studies have shown a decrease in the use of physical aggression and the emergence of more sophisticated forms of aggression such as relational aggression (e.g., Côté, Vaillancourt, Barker, Nagin, & Tremblay, 2007; Vaillancourt, Brendgen, Boivin, & Tremblay, 2003).

### **Aggression and Depression**

Longitudinal research has demonstrated that aggressive behaviour in children and adolescents is associated with a wide range of difficulties, including depression (Capaldi, 1991, 1992; Capaldi & Stoolmiller, 1999; Cleverley, Szatmari, Vaillancourt, Boyle, & Lipman, 2012; Crick, Ostrov, & Werner, 2006) and that the negative outcomes differ by the type of aggression. Specifically, the negative outcomes of engaging in relational aggression seem to be worse than engaging in physical aggression and include a greater risk for depressive symptoms, low self-esteem, loneliness, and social difficulties (Crick, 1997; Crick & Grotpeter, 1995; Crick et al., 2006). Further, relationally aggressive girls have been found to experience greater levels of impairment, such as higher levels of loneliness and reports of peer isolation, than non-relationally aggressive youth (Crick & Grotpeter, 1995). After controlling for the variance associated with overt aggression, increases in relational aggression over the course of a year was associated with increases in, as well as being a unique predictor of, internalizing symptoms in youth (Crick et al., 2006). These studies highlight the need for researchers to better understand the co-occurrence of aggression and depression in youth, while taking into account different types of aggression and the moderating role of sex.

### **Temporal Sequence of Aggression and Depression**

The co-occurrence between aggression and depression has been well established; however, the direction of association is unclear. Indeed, although many studies report that aggressive behaviour is predictive of depressive symptoms, research on the directional nature of aggression and depression has yielded conflicting findings (e.g., Beyers & Loeber, 2003; Capaldi, 1992; Carlson & Cantwell, 1980; Wolff & Ollendick, 2006). Thus, three models have been proposed on the directionality of effect— the *failure model*, the *acting out model*, and the *shared risk model*.

One mechanism proposed to explain why engaging in aggression could subsequently lead to depression is the *failure model* (Capaldi, 1991, 1992; Capaldi & Stoolmiller, 1999). This

model grew out of research originally examining the co-occurrence of conduct problems and depressive symptoms in boys (Capaldi, 1991, 1992). It was proposed that others would respond to aggressive behaviour in a negative manner and in turn place individuals at increased risk of rejection (Capaldi, 1991, 1992). This model is consistent with findings that children and adolescents who experience difficulty with regulating their aggressive behaviour are at increased risk of experiencing repeated interpersonal failure which may contribute to increased anxiety and lower self-worth (Burks, Dodge, & Price, 1995; Coie, Terry, Lenox, Lochman, & Hyman, 1995), and in turn may leave youth vulnerable to depression (Reinherz et al., 1993). That is, this model assumes that aggressive behaviour may increase the likelihood of experiencing repeated failure and rejection within relationships with peers, family, and teachers, which in turn places the youth at risk for depressive symptoms. Thus, engaging in aggressive behaviour elicits a “failure” from the youth’s social environment, which may be a mediating factor that overtime is internalized and leads to depressive symptoms (Patterson & Capaldi, 1990).

The *failure model* is supported by several studies linking aggression and peer rejection (e.g., Dodge, Coie, Pettit, & Price, 1990). Youth high on peer rejection have been shown to be at risk for the development of depressive symptoms (e.g., Little & Garber, 1995). Thus, these negative social experiences impact healthy development in youth (Kellam & Rebok, 1992), placing them at risk for the development of depression (Patterson & Stollmiller, 1991). In fact, the *failure model* is in line with the interpersonal theory of depression (Coyne, 1976), wherein depression may contribute to the development of problematic relationships, which may in turn also worsen an individual’s feelings of depression. According to this model of depression, problematic peer relationships can be seen as risk factors for the increase in symptoms of depression (Rudolph, Flynn, & Abaied, 2008).

The *failure model* emerged from research examining the link between externalizing behaviour, which may or may not include aggression, and depression in boys (Capaldi, 1991, 1991; Patterson & Capaldi, 1990). For example, Nock and colleagues (2006) found that conduct disorder, including symptoms of aggression, in youth preceded depression in 72% of cases, and that youth with conduct disorder, were more likely to develop depression. However, these data were obtained retrospectively in an adult population. Research examining the outcome of aggressive boys and girls has also provided evidence supporting this model. For instance, Spieker and colleagues (2012) found that, among girls, engaging in relational aggression at an earlier age

(Grade 3) was predictive of later relational aggression, as well as a unique predictor of depressive symptoms. A recent nationally representative study of children between the ages of 10 and 19 found that youth following joint trajectories of high or moderate physical aggression and high or moderate relational aggression reported increased delinquency and depressive symptoms at age 18 or 19 compared to those following a declining trajectory or no aggression (Cleverley et al., 2012). However, in both studies previous depressive symptomology was not controlled for, in turn making it difficult to conclude that aggressive behaviour leads to depression. Using a fully recursive model examining both the predictive paths of aggression to depression as well as depression to aggression, van der Giessen and colleagues (2013) found evidence of the *failure model* in a sample of 497 adolescents, with no differences across sex.

Evidence of the reverse relation, wherein depression precedes externalizing difficulties has also been found, albeit less consistently. The *acting out model* (Carlson & Cantwell, 1980), which posits that depression predicts aggressive behaviour, has also been proposed. According to this model, depressive symptoms are expressed externally, such as aggression behaviour (Akse, Hale, Engels, Raaijmakers, & Meeus, 2007; Wolff & Ollendick, 2006). One explanation of this temporal sequence is that the irritability related to depression may be acted out in interpersonal relationships, leading to an escalation of problem behaviour over time (Wolff & Ollendick, 2006).

Longitudinal studies have provided support for this model by demonstrating the presence of depressive symptoms prior to aggressive behaviour, as well as prior to changes in aggression (Capaldi & Stoolmiller, 1999; Curran & Bollen, 2001). For instance, Kovacs and colleagues (1988) found that 56% of children in their study developed depression prior to conduct disorder. However, this study made use of a small sample size and only included youth meeting criteria for depression. More recently, using a large-scale nationwide accelerated longitudinal sample of youth ages 12 to 17 spanning only 3 years, Kofler and colleagues (2011) found evidence for the *acting out model* wherein early depressive symptoms were predictive of changes in delinquent behaviour, including but not limited to physical aggression, fit the data better than a model where delinquent behaviour were predictive of depressive symptoms. In addition, early depressive symptoms were predictive of later delinquent behaviour particularly for girls. However, findings from these studies are mostly limited to severe delinquent behaviour, such as conduct disorder, and a different relation may exist with less severe oppositional or aggressive behaviour, which

typically precedes more severe delinquent behaviour (Rapport, LaFond, & Sivo, 2009). Additionally, an alternative explanation for this sequence may be that children and adolescents with depressive symptoms seek out deviant peers wherein delinquent behaviour is reinforced, therefore leading to aggressive behaviour (Connell & Dishion, 2006). Further, although it has been suggested that depression emerges prior to conduct problems, as conduct problems worsen over time so may depressive symptoms (Loeber & Keenan, 1994), thereby suggesting perhaps the presence of a bidirectional relation.

A third model, the *shared risk* model, has been proposed wherein both depression and aggression may be progressively related possibly due to common risk factors (e.g., Caron & Rutter, 1991; Fergusson, Lynskey, & Horwood, 1996; Wolff & Ollendick, 2006). Within this model, it is believed that depression and aggression co-occur and develop likely due to “third variable” factors which lead to separate but associated problems (Caron & Rutter, 1991; Wolff & Ollendick, 2006). For instance, the co-occurrence between depression and aggression has been suggested to be a result of parents’ depression, wherein marital discord mediates the relation between the child’s predisposition for depression and an environmental risk factor for problem behaviour, including social disadvantage, adverse life events, marital conflict, and parental mental illness (Caron & Rutter, 1991; Fergusson et al., 1996). In fact, when this common risk is taken into consideration, the association between aggressive behaviour and depressive symptoms is mitigated.

However, the longitudinal association between aggressive behaviour and depressive symptoms may be bi-directional even when controlling for possible shared risk factors. For example, depressed mood has been found to predict delinquent behaviour and vice-versa in a sample of adolescent boys, even when taking into account the possible shared risk of social contextual factors (Beyers & Loeber, 2003). However, the authors found a stronger effect for depression predicting delinquent behaviour. Similarly, Measelle, Stice, and Hogansen (2006) also found a bi-directional association between antisocial symptoms and depressive symptoms using a 5-year longitudinal model of 495 adolescent girls ranging from 12 to 15 years of age at the first time point. The authors found that initial levels of antisocial behaviour predicted an increase in depressive symptoms over time and that initial depressive symptoms predicted continued antisocial behaviour over time.

Studies making use of mixed samples have also supported the bi-directional relation between externalizing problems and depression. Wiesner (2003), using a 4-wave longitudinal model of 15-year-old youth, found evidence of delinquent behaviour predicting higher levels of depressive symptoms from wave 3 to wave 4 for boys only. However, similarly to findings by Measelle and colleagues (2006) the author found a stronger association between problem behaviour and depression for adolescent girls and, unlike in adolescent boys, the relation was bidirectional rather than unidirectional. Taken together, results from these studies suggest that a different temporal sequence might exist for boys and girls, highlighting the need to examine the sequential relation between aggression and depression in both boys and girls.

### **The Current Study**

For the current study, our aim was to expand our knowledge of children's mental health by examining the relation between depression and aggression. Our objective included examining both the stability and the temporal associations of these constructs, namely whether their association was unidirectional or bidirectional. Currently it remains unclear whether depression precedes aggression; aggression precedes depression; or whether they co-occur. Specifically, we were interested in testing the. Due to the discrepancies in previous findings, no directional hypotheses were proposed; however directional hypotheses were proposed concerning sex differences.

Most studies investigating the sequential relation between these constructs and providing support for these models were comprised of predominantly male samples and provided different operational definitions of externalizing behaviour, often using measures of conduct disorder (e.g. Capaldi, 1991, 1991; Kofler et al., 2011; Nock et al., 2006; Patterson & Capaldi, 1990), which may not always include aggression. In fact, prevalence rates of conduct disorder in youth are rather low, estimated at only 4% (Costello, Mustillo, Erkanli, Keeler, & Angold, 2003). Although these rates are comparable to those of physical aggression estimated at 3.7% for boys aged 5 to 11 and range from 0.5% to 2.3% in girls aged 5 to 11 (Lee, Baillargeon, Vermunt, Xu, & Tremblay, 2007), prevalence rates of relational aggression in youth range from 10% to 20% (McMorris, Hemphill, Toumbourou, Catalano, & Patton, 2007). Therefore it is difficult to predict whether previous findings extend to aggressive behaviour. In addition, relational aggression has been shown to occur in both boys and girls (Card et al., 2008). Therefore, we extend previous studies in this area by making use of a sample of boys and girls assessed over a period of 7 years.

In this study, our measure of externalizing difficulties included physical, as well as relational aggression, since this behaviour is considerably more prevalent, especially relational aggression which has been suggested to replace physical aggression with age (see Côté et al., 2007).

In our model, we also explored sex as a moderator since important sex differences have been found for aggression and depression. Although the use of type of aggression has been shown to change over time (see Côté et al., 2007) we were interested in examining whether differences exist among types of aggression, namely physical and relational aggression, and again, whether these relations differ by sex. Further, we expected stronger effects for girls than boys, since it has been suggested that girls who engage in aggression are at risk for depression, and those who engage in non-gender normative aggression, such as physical aggression, might be particularly at risk for later depression (Crick, 1997; Crick & Grotpeter, 1995; Crick et al., 2006).

## Methods

### Participants

Data from the ongoing longitudinal *McMaster Teen Study* were used for this study. Following school board approval, participants were recruited beginning in spring of 2008 (grade 5, age 10; T1) from 51 randomly selected primary public schools from a large southern Ontario school district who were contacted to participate in this study. Data were collected annually from Time 1 (T1) to Time 7 (T7). For a comprehensive description of recruitment procedures see Vaillancourt, Brittain, McDougall, and Duku (2013). Through the recruitment process, 875 participants at T1 took part in the longitudinal study. In order to maximize the use of available data, participants with data at T1 on the depression inventory and at least one more assessment time were used for the study. Of this sample, 643 were included at T1, 548 at T2, 495 at T3, 462 at T4, 447 at T5, 417 at T6, and 402 at T7. The mean age for the child participants was 10.91 ( $SD=0.36$ ) years at T1 and the sample was predominantly White (Caucasian; 70%). Parents reported a median household income to \$70,000-\$80,000 at T1, similar to the median income of \$76,222 of the city from which participants were recruited, and \$70,910 for the province (<http://www.statscan.gc.ca>).

### Procedure

Parents were asked yearly to provide consent for access to their children's Ontario Student Record, as well as their and their children's participation in the study. Children were asked to provide their written assent at each time point. Each year parents were asked to

participate in a telephone interview. At T1 children completed paper/pencil surveys in their classroom. In subsequent years children were offered the option to either complete an online or paper/pencil version of the questionnaire. Across time, there were very few differences noted among those who completed the survey on-line versus using the paper/pencil version and the effect sizes of these few differences were small (Cohen's  $d < .30$ ), with one exception. At T3, participants who completed the paper/pencil format reported higher scores of relational aggression ( $n = 191$ ,  $M = 0.44$ ,  $SD = 0.40$ ) than those who completed the online version ( $n = 287$ ,  $M = 0.32$ ,  $SD = 0.30$ ),  $t(476) = 3.47$ ,  $p < 0.01$ ; Cohen's  $d = .34$ . The McMaster Teen Study has continued to obtain yearly approval from the University of Ottawa research ethics board.

### Measures

*Aggression.* Aggression was measured using the self-report Aggressive Behavior Scale (ABS; Little, Henrich, Jones, & Hawley, 2003). This scale measures physical (e.g., "I am the kind of person who hits, kicks, or punches others.") and relational aggression (e.g., "I am the kind of person who tells my friends to stop liking someone."). Participants were asked to rate, on a 4-point Likert-type scale with anchors from "not at all true" = 0 to "completely true" = 3, how true each of the 24 statements was for them (12 physical aggression and 12 relational aggression statements). Higher mean scores on the ABS are indicative of greater levels of self-reported physical and relational aggression. The ABS yielded high internally consistent alpha coefficients in our sample. The alphas on the physical aggression subscale were between .81 and .87, and .80 to .87 for relational aggression subscale, across the 7 waves.

*Depressive symptoms.* Children's symptoms of depression were measured using the depression clinical subscale of the self-reported Behavior Assessment System for Children-Second Edition (BASC-2; Reynolds & Kamphaus, 2004), a well validated measure of children's mental health (Reynolds & Kamphaus, 2004). The depression clinical subscale assesses common symptoms of depression related to the DSM-IV-TR criterion such as loneliness, sadness, and anhedonia. Of the 12 items at T1-T2, and 13 items at T3-T7, children were asked to respond either "true" = 2 or "false" = 0 to 9 statements such as "Nothing ever goes right for me". For 4 items, children were asked to rate the frequency of statements such as "I feel like my life is getting worse and worse" on a 4-point scale (0 = never, 1 = sometimes, 2 = often, 3 = almost always). Higher mean scores on the BASC-2 depression scale were indicative of higher self-

reported symptoms of depression. The internal consistency for the BASC-2 depression scale was high in our sample with an alpha coefficient of .87 to .91 across the 7 waves.

### **Data Analyses**

*Preliminary analyses.* Prior to conducting all analyses, data were examined in order to test the assumptions of multivariate analyses following recommendations by Tabachnick and Fidell (2007). Descriptive statistics indicated that the variables were normally distributed and within acceptable limits of skewness and kurtosis. Further, we also examined demographic characteristics of our sample and conducted a series of *t*-tests in order to assess whether our sample had comparable sex differences on our constructs as compared to previous findings in this area.

*Statistical modeling.* In order to examine the temporal sequence between depression and aggression we tested several structural equation models in AMOS 20.0.0 (Amos Development Corporation, 2011). Specifically, we tested the *failure*, *acting out*, and *reciprocal* models (see Figure 1) to determine whether depression is an outcome of aggression, vice versa, or whether they share a reciprocal relation. It has been suggested that the inclusion of larger intervals between assessments could be beneficial in more accurately identifying directionality, which may be obscured if high within-time and across-time correlations exist between variables (Masten & Cicchetti, 2010). Therefore, following recommendations by Masten and Cicchetti (2010) of larger intervals between assessments, we first examined the within-time and across-time correlations between our variables at all time points. We did note many large correlations ( $r = .12-.82, p < .05-.001$ ), therefore, we tested a series of models in which time points were excluded (i.e., assessments at T2, T4, and T6 were excluded and we tested T1, T3, T5, and T7).

The *failure model* contained cross-lagged paths from both physical and relational aggression at T1-T7 to depressive symptoms at T3, T5, and T7. In turn, the *acting out model* contained crossed-lagged paths from depressive symptoms at T1-T7 to both physical and relational aggression at T3-T7. Finally, the *reciprocal model* contained cross-lagged paths from depressive symptoms to both physical and relational aggression, as well as cross-lagged paths from both physical and relational to depressive symptoms from T1-T7. In an effort to rigorously test the models we also included autoregressive paths between depression, physical, and relational aggression in order to test for prior levels and the stability of these factors (Masten & Cicchetti, 2010). To control and adjust for the concurrent relations between our three variables

we included within-time correlations. We also controlled for the across time interrelation (cross-lag effect) between physical and relational aggression.

Similarly to procedures outlined by other researchers employing structural equation modeling, we performed our follow-up analyses on the final best fitting model (see Burt & Roisman, 2010; Masten et al., 2005; Moilanen et al., 2010; Obradovic, Burt, & Masten, 2010; Vaillancourt et al., 2013; Vaillancourt et al., 2014). First, we statistically controlled for household income, a known predictor of aggression and depression (e.g., Kessler, Davis, & Kendler, 1997; Lorant, Delière, Eaton, Robert, Philippot, & Ansseau, 2003; Tremblay et al., 2004) in an effort to account for some variance that may affect the interpretability of our model. Second, in order to test our hypothesis of whether sex moderated the relation between aggression and depression, we ran a multigroup analysis on our best fitting model. We first tested a sex specific model in which all parameters were freely estimated across sex. We then tested a second sex invariant model where cross-lagged paths between depressive symptoms and both physical and relational aggression were constrained to equality across sex. If the model fit did not significantly change after imposing the constraints, it was assumed that the model did not vary across sex. If there was a significant change in model fit, it was assumed that the model varied by sex, subsequently we trimmed the model gradually to identify sex differences and for reasons of parsimony (Byrne, 2001).

The comparative fit index (CFI) and the root mean square error of approximation (RMSEA) were used to estimate goodness-of-fit, with CFI values above .95 indicating close fit (Hu & Bentler, 1999) and RMSEA values between .05 and .08 indicating acceptable fit and values below .05 indicating close fit (Browne & Cudeck, 1993). Goodness-of-fit was not solely assessed using the  $\chi^2$  test of significance because it has been shown to be sensitive to large samples (Kline, 2005). In order to compare nested models we used the chi-squared and CFI difference tests. If the  $\Delta\chi^2$  had a  $p < .05$  and  $\Delta CFI > .01$  the models were statistically significantly different (Cheung & Rensvold, 2002). We used the Akaike information criterion (AIC) as a measure of fit to compare non-nested models. The model with the lower AIC value was considered to fit best (Akaike, 1974, 1987). If the models were not statistically significantly different, the most parsimonious model was preferred (Byrne, 2001).

*Missing data.* According to a Little's Missing Completely at Random test (Little, 1988) data were missing completely at random  $\chi^2 = 930.79$ ,  $df = 882$   $p = 0.12$ . On average, 24% of

child-reported depression and aggression scores were missing at each time point (range = 5-38% missing). Of the 420 *t*-test comparisons, only 35 revealed significant associations between the variables. Taken together with the Little's Missing Completely at Random test (Little, 1998) we attributed these differences to chance. Therefore, the listwise deletion method was applied to handle missing data for the descriptive and correlation analyses. The full information maximum likelihood (FIML) was used to handle missing data for the path analyses as it has been demonstrated to provide less biased estimates and maximize the amount of data that can be used as compared to other methods (Acock, 2005).

## Results

### Preliminary statistics

Bivariate correlations are presented in Table 1. Within time, correlations between depression, physical aggression, and relational aggression at T1, T3, T5, and T7 were positive and statistically significant. Physical aggression and relational aggression were also positively correlated and statistically significant. Across time, depression was positively and significantly correlated with physical and relational aggression (except for depression at T1 and at T3 to PA and RA at T7). SES was not correlated to depression, physical, or relational aggression across time.

Means, standard deviations, and sex difference tests for depression, physical, and relational aggression are presented in Table 2. A series of independent-samples *t*-test revealed sex differences in mean depression, with girls reporting higher levels of depressive symptoms than boys across all waves. Sex differences in mean physical aggression were found, with boys reporting more physical aggression use than girls at T1 and T3 but not for T5 or T7. No sex differences were found for relational aggression.

### The depressive-aggressive symptoms link

Each model presented in Figure 1 was estimated. The fit statistics for each model and model comparison tests are presented in Table 3. Our first model, the *failure model*, fit our data well. The standardized estimates are presented in Figure 1. In this model, depression, physical aggression, and relational aggression were stable across time. Physical aggression significantly predicted relational aggression from T1-T3, but not for T3-T5 and T5-T7. Relational aggression significantly predicted physical aggression from T3-T5 and T5-T7, but not for T1-T3. Relational

aggression significantly predicted depression from T5-T7, but not for T1-T3 and T3-T5. Physical aggression did not significantly predict depression.

We compared the fit of the *failure model* to the fit of the *acting out model*. The *acting out model* fit our data well. The lower AIC of the *failure model* suggests that our first model fit our data better than our second model. The standardized estimates are presented in Figure 1. In this model, depression, physical aggression, and relational aggression were stable across time. Physical aggression significantly predicted relational aggression from T1-T3 but not for T3-T5 and T5-T7. Relational aggression significantly predicted physical aggression from T3-T5, but not for T1-T3 and T5-T7. Depression did not significantly predict physical or relational aggression across time.

Finally, we estimated our *reciprocal model* and compared it to our two previous models, the *failure* and *acting out models*. The *reciprocal model* also fit our data well. This model fit better than the *acting out model* according to the  $\chi^2$  difference test, but only marginally according to the CFI difference test. Our third model did not differ in fit from the *failure model*. The standardized estimates are presented in Figure 1. Similarly to the previous models, depression, physical aggression, relational aggression, and were stable across time. Physical aggression significantly predicted relational aggression from T1-T3 but not for T3-T5 and T5-T7. Relational aggression significantly predicted physical aggression from T3-T5 and T5-T7, but not for T1-T5. In this model, relational aggression (but not physical aggression) predicted depression (*failure* path) from T5-T7, but not T1-T3 and T3-T5. Depression did not predict physical aggression or relational aggression (*acting out* paths) across time.

Since our *failure model* was most parsimonious (Byrne, 2001) and did not differ in fit from our *reciprocal model*, and that the only significant path in our *reciprocal model* was a *failure* path, our *failure model* was chosen as the best fitting model.

*Control variable effects.* To control the effect of household income at T1 we tested a new model (Model 4, Table 4) to which we added this new variable to our *failure model* (Model 1). Model 4 (with control) had similar fit to our *failure model* (Model 1), and parameter estimates were very similar to those found in the *failure model* (Model 1). However, the increase in AIC between the *failure model* (Model 1) and the model including the control variable (Model 4) indicate that our *failure model* (Model 1) without the control variable had a better fit and was chosen as our final model.

*Multigroup model*<sup>1</sup>. The fit and sex difference test statistics are presented in Table 3. An unconstrained model (Model 5, Table 3), in which all parameters of the *failure model* (Model 1, Table 3) were allowed to vary across sex, was compared to a constrained model (Model 6, Table 3), in which the cross-lagged paths were constrained equal across sex. The sex specific model fit the data well. The sex invariant model also fit the data well. Allowing for sex differences improved fit to the data, according to the  $\chi^2$  difference test, but only marginally according to the CFI difference test, suggesting evidence of sex differences in the cross-lagged paths. Thus we continued testing the sex specific model (see Figure 2) by constraining a single path at a time.

*Sex specific stability paths*. In the sex-specific model, three significant stability paths emerged. For boys, physical aggression at T1 predicted physical aggression at T3 ( $\Delta b = 0.64$ ,  $\beta = 0.68$ ,  $p < .001$ ), more so than for girls ( $b = 0.48$ ,  $\beta = 0.43$ ,  $p < .001$ ). For girls, relational aggression at T1 and T3 were predictive of relational aggression at T3 and T5, respectively,  $b = 0.39$ ,  $\beta = 0.40$ , and  $b = 0.52$ ,  $\beta = 0.51$ ,  $ps < .001$ ), more so than for boys ( $b = 0.16$ ,  $\beta = 0.18$ ,  $p < .01$ , and  $b = 0.33$ ,  $\beta = 0.38$ ,  $p < .001$ ).

*Sex differences in relation to depressive symptoms*. In the sex-specific model, one significant cross-lagged path emerged. For girls, but not boys, physical aggression at T3 predicted depressive symptoms at T5 ( $b = 2.86$ ,  $\beta = 0.16$ ).

### Discussion

In the present study, we were interested in examining the longitudinal relation between aggression, both physical and relational forms, and depression in children and adolescents over a 7-year time span. We examined three models in order to investigate whether aggression is a risk factor for (*failure model*), an outcome of (*acting out model*), or shares a reciprocal relation (*reciprocal model*) with symptoms of depression in children and adolescents.

Similarly to previous findings, our results indicate a positive and significant association between physical and relational aggression, and between both forms of aggression and depression (Capaldi, 1991, 1992; Capaldi & Stoolmiller, 1999; Cleverley et al., 2012; Crick et al., 2006).

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<sup>1</sup> Although follow-up multigroup analyses are only reported for our best fitting model (the *failure model*) each model was evaluated independently within sex. Findings of these follow-up analyses on the *acting out* and *shared risk* models indicated that sex differences for the aggression paths were the same as the *failure model*. Further, within the *acting out model* no statistically significant sex differences emerged from aggression to depression. Finally, within the *reciprocal model*, the only statistically significant sex path to emerge in the depression-aggression relation was the same path as in the *failure model*, wherein physical aggression at T3 predicted depressive symptoms at T5 for girls and not boys.

Our findings also echoed those indicating that boys engage in physical aggression more so than girls and that they do not differ in terms of relational aggression (e.g., Côté et al., 2007; Vaillancourt et al., 2003).

Our findings are in line with previous studies on the stability of aggression (Côté et al., 2007; Vaillancourt et al., 2003), and depression (Fombonne et al., 2001). Although children and adolescents typically show a decrease in aggressive behaviour with age, some continue to engage in aggressive behaviour across adolescence (Martino, Ellickson, Klein, McCaffrey, & Edelen, 2008). Longitudinally, we found that for boys, engaging in physical aggression at T1 predicted engaging in physical aggression at T3, more so than for girls. However, for girls, we found that engaging in relational aggression at T1 and T3 predicted engaging in relational aggression at T3 and T5 respectively, more so than boys. These findings suggest that aggression is in fact a stable construct across childhood and adolescence and are in line with previous findings on sex differences in the use of aggression (Card et al., 2008).

### **Aggression-Depression Relation**

It has been demonstrated that depression is more common in girls than boys beyond puberty (Angold, Costello, & Erlanki, 1999). Across all time points, we found that girls reported more depressive symptoms than boys (Kessler et al., 2001; Lewinsohn et al., 2003). Further, engaging in relational, rather than physical, aggression has been associated with greater risk of negative outcomes (Crick, 1997; Crick & Grotpeter, 1995; Crick et al., 2006). Accordingly, we found a stronger association between relational aggression and depressive symptoms across most time points.

Consistent with previous longitudinal studies (Cleverley et al., 2012; Spieker et al., 2012; Wolff & Ollendick, 2006), we found that engaging in physical aggression at T1 was predictive of depressive symptoms at T3 for boys and that relational aggression at T5 was predictive of depressive symptoms at T7 for both boys and girls. In turn, we found no evidence for the reverse pathway wherein symptoms of depression lead to aggressive behaviour. These findings are consistent with those indicating that engaging in aggressive behaviour is predictive of depressive symptoms and that relational aggression is perhaps more so predictive of this relation than physical aggression since it was found regardless of sex (Crick, 1997; Crick & Bigby, 1998; Crick & Grotpeter, 1995; Crick et al., 2006; Spieker et al., 2012).

Engaging in aggressive behaviour increases the likelihood of difficulties and failures (Burks et al., 1995; Coie et al., 1995), which in turn places individuals at risk (Reinherz et al., 1993). Our findings tie into those indicating, through the use of cascade models spanning multiple time points, that externalizing difficulties, such as aggression, precede internalizing difficulties, such as depression, in children and adolescents (e.g. Kiesner, 2002; Ladd & Troop-Gordon, 2003; Moilanen et al., 2010; Obradovic et al., 2010; Vaillancourt et al., 2013, 2014; van Lier & Koot, 2010; van Lier et al., 2012). Therefore, our findings suggest that aggression may place youth at risk for the development of depressive symptoms, similarly to the *failure model*. It is possible that these aggressive adolescents experience failure in their relationships, which in turn increases the likelihood of developing depressive symptoms (Capaldi, 1991; 1992; Capaldi & Stoolmiller, 1999; Coyne, 1976; Joiner & Coyne, 1999). Further, externalizing behaviour, such as aggression, in children and adolescents may be a marker, or prodromal symptom of psychopathology, namely depression (Cleverley et al., 2012; Copeland et al., 2009; Sourander et al., 2000). However, future research would have to be conducted in an effort to corroborate these findings. Finally, research supporting the *failure model* has largely focused on more serious externalizing difficulties such as conduct disorder (e.g. Capaldi, 1991, 1991; Kofler et al., 2011; Nock et al., 2006; Patterson & Capaldi, 1990). Thus, the results from our study demonstrate the importance of aggression, a far more commonly occurring behaviour in children and adolescents, in the prediction of depressive symptoms.

An important limitation of past research in this area has been the neglect of sex differences. When we accounted for sex as a possible moderator in the aggression depression relation, important differences were found. We identified that for girls, but not for boys, engaging in physical aggression at T3 predicted depressive symptoms at T5. These findings add to the literature on gender non-normative use of aggression, such as physical aggression in girls, which places these girls at a higher risk of negative outcomes, such as depression (Crick, 1997). Although girls are less frequently physically aggressive than boys (Card et al., 2008), our findings add to those suggesting that engaging in physical aggression may be particularly detrimental for girls (Crick, 1997; Loeber & Keenan, 1994; Vaillancourt et al., 2014). As one example, it was recently found that for girls, engaging in physical aggression was the strongest predictor of borderline personality features two years later (Vaillancourt et al., 2014). Taken

together, it appears that engaging in non-normative aggression may be linked to poorer mental health outcomes.

### **Limitations and future directions**

Certain limitations to this study warrant consideration. First, the data on aggression and depressive symptoms were self-reported and therefore may be subject to a variety of biases (e.g., self-serving biases). Further, the association between these two measures may have been inflated due to shared-method variance. Another limitation related to measurement is our use of the depression subscale of the BASC-2. Although the BASC-2 is a reliable, valid, and well-standardized tool, its development was designed primarily for use as a diagnostic, as opposed to research, tool (Reynolds & Kamphaus, 2004). Nevertheless, the BASC-2 has been found to correlate with other well-established measures such as the Youth Self-Report (YSR; Achenbach & Edelbrock, 1987) and has been widely used in non-clinical research (e.g. Bell, McCallum, & Doucette, 2004; Blackman, Ostrander, & Herman, 2005; Vaillancourt et al., 2013, 2014). Second, although we were attempting to identify the directionality of the relation between aggression and depressive symptoms, other unexamined factors may account for the relation, such as genetic vulnerability. There is a large body of evidence that suggests that high levels of stress and conflict, low levels of warmth and support, and parental psychopathology contribute significantly to the development of depression in youth (Sheeber, Hops, & Davis, 2001). Further, genetic studies on depression suggest a genetic effect ranging from 15% to 80% (Happonen et al., 2002; Rice, 2009). In relation to these limitations, despite our longitudinal design implying directionality, causal inferences cannot be drawn from our study. Therefore, future studies on the longitudinal link between aggression and depression should take into account possible risk factors including genetic vulnerability.

Finally, although our findings provide further evidence for the *failure model* (Capaldi, 1991, 1992; Capaldi & Stoolmiller, 1999), the mechanism underlying the relation between aggression and subsequent depressive symptoms remains unclear. Future research should consider peer relations as a possible mediator in the subsequent development of depressive symptoms for these children and adolescents.

### **Conclusion and clinical implications**

Our study provides evidence that engaging in aggressive behaviour might place children and adolescents at risk of developing depressive symptoms. That is, in line with the *failure model* (Capaldi, 1991, 1992; Capaldi & Stoolmiller, 1999), depressive symptoms were predicted by aggressive behaviour in our sample of children and adolescents across certain time points. Further, we found evidence that engaging in relational aggression predicted depressive symptoms in children and that for girls, engaging in physical aggression predicted depressive symptoms.

Understanding the longitudinal relations between aggression and depression is important since these difficulties can persist throughout adolescence and into adulthood (Kessler et al., 2001; Kessler et al., 2005). This understanding can help clinicians better focus their early intervention strategies. For instance, it would be beneficial for clinicians to inquire about interpersonal relations and aim intervention at developing social skills in aggressive youth as a measure of buffering the possible development of depressive symptoms. Although youth may present with externalizing difficulties, such as aggressive behaviour, our findings indicate that a particular attention to these youth is warranted in order to curtail the progression of mental health difficulties such as depression.

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Table 1.

*Bivariate correlations*

	SES1	Dep1	PA1	RA1	Dep3	PA3	RA3	Dep5	PA5	RA5	Dep7	PA7	RA7
Time1													
SES	1												
Dep	-.07	1											
PA	-.52	.18**	1										
RA	-.32	.34**	.63**	1									
Time3													
Dep	-.38	.41**	.17**	.18**	1								
PA	-.28	.18**	.62**	.41**	.27**	1							
RA	-.33	.19**	.37**	.45**	.29**	.44**	1						
Time5													
Dep	.43	.36**	.07	.14**	.42**	.17**	.17**	1					
PA	.53	.19**	.37**	.25**	.16**	.56**	.34**	.36**	1				
RA	.10	.16**	.15**	.33**	.19**	.28**	.54**	.32**	.51**	1			
Time7													
Dep	-.21	.27**	.01	.01	.36**	.13*	.16**	.54**	.21**	.30**	1		
PA	.28	.07	.34**	.15**	.08	.49**	.30**	.21**	.58**	.39**	.28**	1	
RA	.02	.06	.10	.16**	.09	.20**	.44**	.18**	.34**	.70**	.37**	.54**	1

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

Dep, Depression; PA, Physical aggression; RA, Relational aggression.

Table 2

*Means, standard deviations, and sex difference tests*

	Boys		Girls		Test	Total		Range	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>F</i>	<i>M</i>	<i>SD</i>	Min	Max
Time 1									
Dep	4.32	5.08	6.54	6.71	18.80**	6.06	6.56	0	28.00
PA	0.42	0.51	0.22	0.31	21.71**	0.35	0.44	0	2.56
RA	0.44	0.40	0.41	0.36	1.86	0.42	0.37	0	2.17
Time 3									
Dep	2.74	3.64	4.45	5.46	14.29**	3.67	4.82	0	26.00
PA	0.47	0.47	0.27	0.36	9.97*	0.37	0.42	0	2.33
RA	0.34	0.33	0.37	0.35	1.33	0.37	0.35	0	2.33
Time 5									
Dep	2.77	3.85	5.53	6.54	40.33**	4.46	5.73	0	27.00
PA	0.43	0.40	0.32	0.38	2.64	0.37	0.40	0	2.33
RA	0.27	0.29	0.36	0.37	3.71	0.33	0.34	0	2.25
Time 7									
Dep	3.30	4.32	6.46	6.64	18.52**	5.06	5.62	0	27.00
PA	0.35	0.35	0.24	0.35	0.28	0.29	0.36	0	2.11
RA	0.27	0.38	0.36	0.43	1.35	0.33	0.40	0	2.17

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

Dep, Depression; PA, Physical aggression; RA, Relational aggression.

Table 3.

*Model fit and comparison statistics*

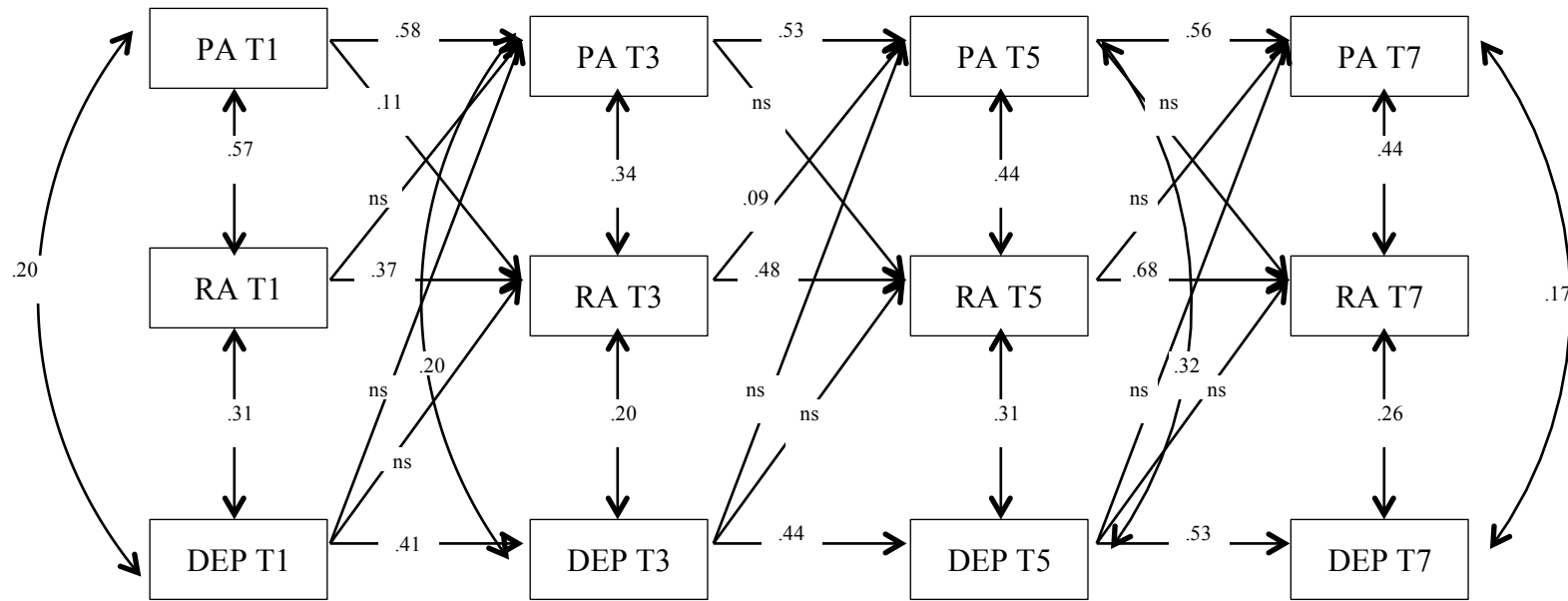
Model	Fit statistics					Difference tests			
	$\chi^2$	<i>df</i>	CFI	RMSEA (90% CI)	AIC	vs.	$\Delta\chi^2$	$\Delta df$	$\Delta CFI$
1. Failure	147.03**	33	0.946	0.071 (0.060-0.083)	261.03	3 vs. 1	3.35	6	0.001
2. Acting out	163.51**	33	0.938	0.076 (0.065-0.088)	277.51	3 vs. 2	19.83**	6	0.007
3. Reciprocal	143.68**	27	0.945	0.080 (0.067-0.093)	269.679				
Control									
4. Failure with household income	140.82**	36	0.949	0.073 (0.061-0.086)	286.06				
Sex differences									
5. Failure sex specific	170.83**	76	0.955	0.040 (0.035-0.053)	378.83	6 vs. 5	30.20**	16	0.007
6. Failure sex invariant	201.03**	92	0.948	0.043 (0.035-0.051)	377.03				

*Note.* \* =  $p < .05$ , \*\* =  $p < .01$ .

CFI, comparative fit index; RMSEA, root mean square error of approximation; AIC, Akaike information criterion.



Figure 1b. The acting out model





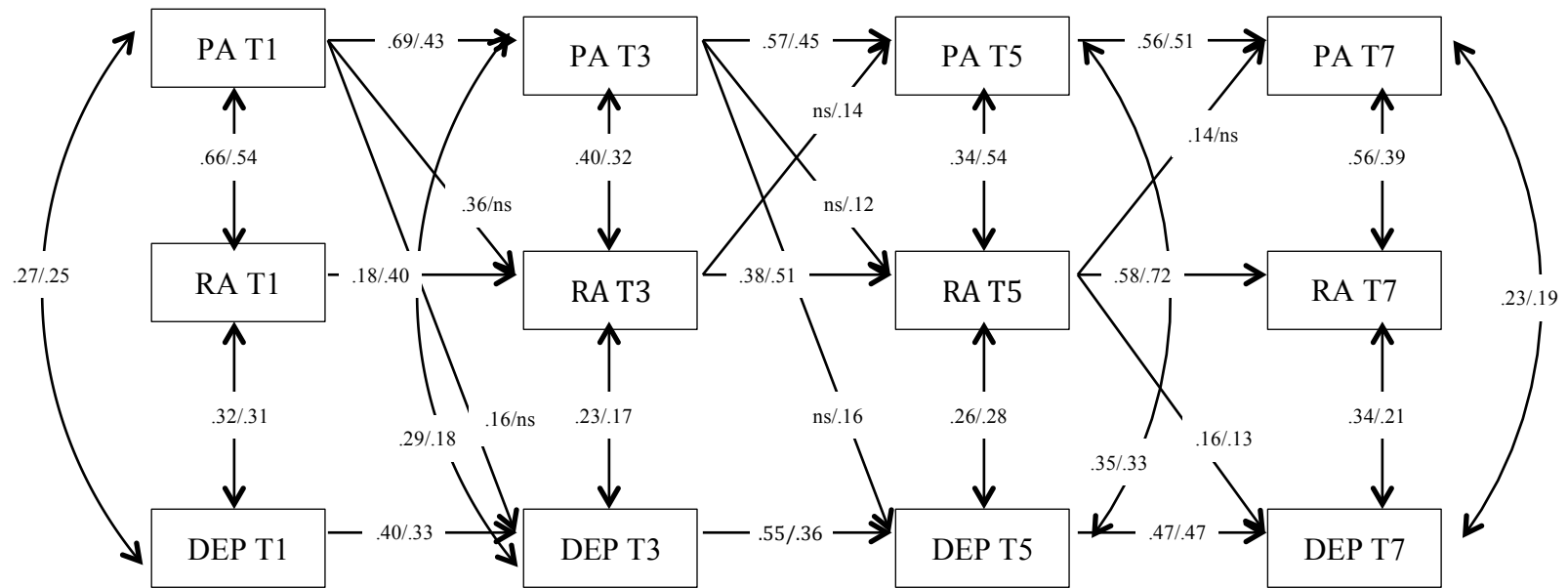


Figure 2. Final model (trimmed failure model)

Note. Boys/girls, statistically significant standardized path coefficients and within time correlations ( $p < .05$ ), controlling for the cross-sectional relation between the variables, the potential effects of the interrelations between physical aggression, relational aggression, and depressive symptoms across time, as well as prior physical aggression, relational aggression, and depressive symptoms. PA, Physical aggression; RA, Relational aggression; DEP, Depression.

### Chapter 4 – Study 3

## Longitudinal Associations between Externalizing Problems and Symptoms of Depression in Children and Adolescents

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### Abstract

The longitudinal links between symptoms of externalizing difficulties – oppositional defiant disorder (ODD) and conduct disorder (CD) – and symptoms of depression were examined across 7 years in a sample of 494 children aged 10 ( $M=10.91$ ,  $SD=0.36$ ) at Time 1. Cross-lagged path analyses using structural equation modeling was used. Although symptoms of ODD predicted depressive symptoms across all time points and CD at Time 1 negatively predicted depressive symptoms at Time 3, evidence of the inverse relation was also found for both ODD and CD. Sex differences were also noted. We found that for girls, but not for boys, symptoms of depression at Time 1 predicted symptoms of ODD at Time 3 as well as the inverse relation from Time 5 to Time 7. We also found that for boys, but not for girls, symptoms of depression at Time 5 predicted those of CD at Time 7. These findings add to the mixed literature on the directionality of externalizing and internalizing difficulties in children and adolescents by suggesting the presence of a reciprocal relation.

*Keywords:* oppositional defiant disorder, conduct disorder, depression

### **Longitudinal Associations between Externalizing Problems and Symptoms of Depression in Children and Adolescents**

Many children and adolescents experience significant mental health difficulties. A recent study of over 10,000 US youth between the ages of 13 to 18 revealed that nearly half of the sample (49.5%) met diagnostic criteria for at least one mental health disorder, with depression as the most commonly occurring with approximately 16% of girls and 8% of boys meeting diagnostic criteria for this disorder (Merikangas et al., 2010). Similarly, an estimated 1.04 million (23.4%) Canadian children and adolescents aged 9 to 19 have been found to be living with at least one mental health disorder with mood and anxiety disorders as the most prevalent (12.1%; Mental Health Commission of Canada [MHCC], 2013). The high prevalence of mental health difficulties affecting children and adolescents is of particular concern because mental health difficulties can negatively affect a number of areas including physical health, school achievement, social and family relationships, and cognitive functioning (e.g., Fröjd et al., 2008; Kupersmidt, Coie, & Dodge, 1996; Scott et al., 2011). Children and adolescents with depression often have one or two co-occurring mental health disorders (Ryan et al., 1987) and if left untreated, these difficulties can persist throughout high school and into adulthood (Kessler, Avenevoli, & Merikangas, 2001; Kessler, Berglund, Demler, Jin, Merikangas, & Walters, 2005). Results from these epidemiological studies highlight the importance of understanding the development and progression of mental health difficulties throughout childhood and adolescence.

The central feature of internalizing disorders, such as depression, anxiety, and somatization disorders, includes internal states of distress (Kovacs & Devlin, 1998; Youngstrom, Findling, & Calabrese, 2003). Contrary to internalizing disorders, symptoms of externalizing disorders, or disruptive disorders, are observed as outwardly directed behaviour and often involve rule-breaking and aggressive behaviour and include disorders such as oppositional defiant disorder (ODD) and conduct disorder (CD; Kovacs & Devlin, 1998; Youngstrom et al., 2003).

Although the presentation of internalizing and externalizing problems are quite different, high rates of comorbidity have been found (Angold, Costello, & Erkanli, 1999). High comorbidity at the symptom level has been found with 51% of children and youth who scored high on the externalizing scale of the Child Behaviour Check List (CBCL; Achenbach, 1991) also scoring high on the internalizing scale, and 52% who scored high on the internalizing scale also scoring high on the externalizing scale (Achenbach, 1991). In fact, comorbidity has been

linked to greater detrimental consequences than when faced with either disorder alone (Keiley, Lofthouse, Bates, Dodge, & Pettit, 2003). Externalizing disorders such as ODD and CD (Kovacs & Devlin, 1998; Youngstrom et al., 2003) have often been found to co-occur with, and have been suggested to even predict, depressive symptoms (Boylan, Georgiades, & Szatmari, 2010; Boylan, Vaillancourt, Boyle, & Szatmari, 2007; Boylan, Vaillancourt, & Szatmari, 2012; Burke, Hipwell, & Loeber, 2010; Cleverly, Szatmari, Vaillancourt, Boyle, & Lipman, 2012; Copeland, Shanahan, Costello, & Angold, 2009; Stringaris & Goodman, 2009). In an effort to help identify whether early intervention may reduce the development or progression of depression, it is important to better understand the relation between externalizing difficulties and its role in the development of internalizing difficulties such as depression (Rao & Chen, 2009).

The use of "cascade" models has allowed researchers to study longitudinal effects across domains while accounting for the stability of constructs (Masten & Cicchetti, 2010). In other words, these models provide estimates of behaviour across time by allowing researchers to predict behaviour in one area, while also controlling for the stability of these variables at each time point (Masten & Cicchetti, 2010). This approach has provided longitudinal evidence suggesting that externalizing disorders may predict internalizing disorders such as depression (Kiesner, 2002; Ladd & Troop-Gordon, 2003; Moilanen, Shaw, & Maxwell, 2010; Obradovic, Burt, & Masten, 2010; Vaillancourt, Brittain, McDougall, & Duku, 2013; van Lier & Koot, 2010; van Lier, Vitaro, Barker, Brendgen, Tremblay, & Boivin, 2012). However, although more limited, the reverse relation has also been identified (Bornstein, Hahn, & Haynes, 2010; Mesman, Bongers, & Koot, 2001), which calls researchers to provide more evidence about the temporal link between externalizing and internalizing disorders.

In the current study, we used path analyses to identify the sequential relation between symptoms of externalizing disorders, namely ODD and CD, and symptoms of internalizing disorders, namely depression, using a longitudinal sample of Canadian children and adolescents. Findings from this study can help increase our understanding of the stability and predictive pathway of externalizing and internalizing difficulties in children and adolescents. These findings can also provide further evidence of the directionality of effect between symptoms of externalizing difficulties (ODD and CD) and depression, which has the potential to help clinicians intervene appropriately at early signs of mental health difficulties.

### **Oppositional Defiant Disorder**

ODD is a disorder that is described by a pattern of negativistic, hostile, and deviant behaviour that impairs a child's social functioning for at least 6 months (APA, 2013). Children with ODD are found to be moody, irritable, and have problems with affect regulation (Hinshaw, 1987). ODD has been found to frequently co-occur with, and has even been suggested to predict, symptoms of depression (Boylan et al., 2010; Boylan et al., 2007; Boylan et al., 2012; Burke et al., 2010; Cleverly et al., 2012; Copeland et al., 2009; Lee et al., 2008; Stringaris & Goodman, 2009). Longitudinal epidemiologic studies have demonstrated that for children diagnosed with ODD, depression was the most consistent diagnosis into adolescence and adulthood (Nock, Kazdin, Hiripi, & Kessler, 2007). Boylan and colleagues (2010) found that boys high on oppositional symptoms at ages 6 to 7 demonstrated increased depressive symptoms at ages 8 and 11. However, these results were not found for girls, suggesting that perhaps girls high on oppositional symptoms do not follow the same trajectory that boys follow. In a more recent study, Boylan and colleagues (2012) found that all children with depressive symptoms had an early onset and elevated levels of oppositional symptoms, and further, that 40% of those with significant trajectories of oppositional behaviour had concurrent trajectories of depressed mood. The authors suggest that there is a high co-occurrence of depressed mood and oppositional behaviour in youth and that the behaviour may be a precursor of depression. Thus, oppositional behaviour may be a feature of depression, a relation we were interested in further examining.

### **Conduct Disorder**

ODD has been found to frequently co-occur with, and even predict symptoms of CD (Pardini, Frick, & Moffitt, 2010), a disorder that is marked with repetitive and persistent behaviour that violate the right of others as well as societal norms or rules (APA, 2013). Compared to children and adolescents presenting with a single difficulty, those with comorbid symptoms appear to be at an increased risk. Similarly to those with ODD, the concurrent association between CD and other mental disorders, including depression, has been clearly identified (Kim-Cohen et al., 2003; Lahey, Loeber, Burke, Rathouz, & McBurnett, 2002). It has also been found that children and adolescents with CD also have high rates of suicidal ideation, attempts, and completion (Bridge, Goldstein, & Brent, 2006). Although it has been suggested that CD, similarly to ODD, precedes mood disorders, such as depression (Loth, Drabick, Leibenluft, & Hulvershorn, 2014; Nock et al., 2006), it is still unclear whether the onset of other difficulties,

such as depression, precedes or follows the onset of CD (Nock et al., 2006). Accordingly, further research is needed to understand the longitudinal associations between ODD, CD, and internalizing difficulties.

### **Trajectories of Mental Health Difficulties**

Longitudinal studies examining the sequential relation between internalizing and externalizing disorders, have largely yielded evidence that externalizing disorders predict internalizing disorders such as depression (Kiesner, 2002; Ladd & Troop-Gordon, 2003; Moilanen, Shaw, & Maxwell, 2010; Obradovic, Burt, & Masten, 2010; Vaillancourt, Brittain, McDougall, & Duku, 2013; van Lier & Koot, 2010; van Lier, Vitaro, Barker, Brendgen, Tremblay, & Boivin, 2012). However, although more limited, the reverse relation, from internalizing problems to externalizing problems, has also been identified (Bornstein, Hahn, & Haynes, 2010; Mesman, Bongers, & Koot, 2001), which calls researchers to provide more evidence about the temporal link between externalizing and internalizing disorders. For instance, Moilanen and colleagues (2010) found that the presence of externalizing problems in youth entering school and those transitioning from middle school to high school (ages 6 to 11) were predictive of high levels of internalizing problems at ages 8 to 12.

Limited research on the reverse pathway, from internalizing problems to externalizing problems, has been shown. Following children from pre-school to pre-adolescence, Mesman and colleagues (2001) found that early pre-school externalizing problems predicted later internalizing problems. However, the authors also found evidence for the reverse pathway wherein internalizing problems predicted later externalizing problems. A more recent study found that children with internalizing problems at age 4 demonstrated more internalizing problems at ages 10 and externalizing behaviour at age 14 (Bornstein et al., 2010), suggesting that internalizing symptoms may predict externalizing symptoms. However, this study had a small sample size (117 children) and so replication using a larger sample would be warranted.

Bi-directional associations between externalizing and internalizing problems have also been found with important sex differences emerging (Klostermann, Connell, & Stormshak, 2014; Wiesner, 2003). For instance, delinquent behaviour and depressive symptoms were reciprocal for girls, but that depressive symptoms were predictive of delinquent for boys across one wave of assessment (Wiesner, 2003). However, the study only spanned 2 years and was conducted in a sample of 15-year-olds. Thus, a different relation might emerge over a longer assessment period

covering childhood into adolescence. Using a 4-wave longitudinal model of 11-year-old youth at a first time-point, Klostermann and colleagues (2014) found that antisocial and deviant behaviour predicted depressive symptoms in boys but found the opposite relation in girls.

Findings from these studies suggesting that externalizing problems predict internalizing problems provide evidence that repeatedly engaging in externalizing behaviour may be a marker, or prodromal symptom, of psychopathology, namely depression. For instance, the *failure hypothesis*, or *failure model* (Capaldi, 1991, 1992; Capaldi & Stoolmiller, 1999), has been proposed wherein engaging in externalizing behaviour may increase the likelihood of experiencing repeated failure and rejection within social relations, which increase the likelihood of subsequent depression. Alternatively, the studies suggesting that internalizing problems predict externalizing problems may be providing evidence that youth mask their depressive symptoms by acting out and engaging in externalizing behaviour (Carlson & Cantwell, 1980), also known as the *acting out model*. However, the relation between externalizing and internalizing difficulties may also be reciprocal in nature (e.g., Beyers & Loeber, 2003; Measelle, Stice, & Hogansen, 2006; Wiesner, 2003), wherein the development of both difficulties occurs bi-directionally above and beyond factors that have been shown to contribute to the development of both syndromes.

The studies reviewed herein point to the complexity in identifying the trajectory of mental health difficulties. Further, these studies vary in their definitions of externalizing problems, varying between aggressive behaviour, symptoms of CD, delinquency, or deviance, and may combine them to form an overall construct (e.g. Capaldi, 1991, 1992; Klostermann et al., 2014; Wiesner, 2003; Vaillancourt et al., 2013), which maybe be contributing to the differences in results. In order to shed light on the inconsistent findings we were interested in exploring the longitudinal relation between symptoms of externalizing difficulties, namely the unique contribution of CD and ODD, and of symptoms of internalizing difficulties, namely depression, in children and adolescents.

### **The current study**

In the present study, we made use of path analyses to explore the co-occurrence and stability of ODD, CD, and depression symptoms, as well as the temporal and predictive pathways of ODD, CD, and depression symptoms. Further, ODD and CD are often examined as a single construct of externalizing behaviour yet we were interested in observing them as separate predictors of depression in order to better understand their possible unique contribution.

The direction of effect between externalizing and internalizing difficulties has recently been of interest to many researchers yet results are inconsistent. The paucity of research aimed at understanding the temporal sequence of mental health problems and contradictions in findings warrant the need for studies on this topic. Furthering our understanding of the sequence between externalizing and internalizing difficulties in youth over time can help clinicians better focus early intervention strategies that aim at stunting the progression of mental health difficulties. Although the longitudinal relation remains unclear, it was expected that symptoms of depression would be preceded by symptoms of ODD and CD, thereby providing additional support for the hypothesis that externalizing symptoms may be a prodromal expression of depressive symptoms.

Many of the studies investigating the longitudinal relation between these constructs were comprised of predominantly male samples or found inconsistent results in mixed samples (e.g., Capaldi, 1991, 1992; Klostermann et al., 2014; Nock et al., 2007; Patterson & Capaldi, 1990; Wiesner, 2003). However, since certain sex differences have been identified within the constructs we were also interested in examining sex as a moderator. For instance, depression has been found to be more prevalent in adolescent girls, with girls continuing to show an increase in symptoms over time, and is the most common mental health difficulty for adolescent girls and women (e.g., Kessler et al., 2001; Lewinsohn, Pettit, Joiner, & Seeley, 2003; Wade, Cairney, & Prevalin, 2002). However, sex differences in ODD are not as clear. ODD appears to be more prevalent in boys than girls, but these differences have not been consistently found in samples of adolescents (Boylan et al., 2007). Contrastingly, CD tends to be more prevalent in boys than girls and so we expected our results to highlight these sex differences (Maughan et al., 2004; Nock et al., 2006).

Finally, as suggested by previous researchers examining externalizing and internalizing difficulties over time (e.g., Vaillancourt et al., 2013; van Lier et al., 2012), we controlled for household income, which has been shown to be a robust predictor of both externalizing and internalizing problems (e.g. Duncan, Morris, & Rodrigues, 2011; Tremblay et al., 2004).

## **Method**

### **Participants**

Data from the *McMaster Teen Study*, an ongoing longitudinal study, from multiple informants including parent-, and self-reports, were used for this study. Following school board approval, participants were recruited beginning in spring of 2008 (grade 5, mean age 10.91 ( $SD=0.36$ ) at Time 1) from 51 randomly selected primary public schools from a large southern

Ontario school district who were contacted to participate. Data were then collected annually from Time 1 (T1) to Time 7 (T7). For a comprehensive description of recruitment procedures see Vaillancourt et al. (2013). Through the recruitment process, 875 participants at T1 took part in the longitudinal study. In order to maximize the use of available data, participants with data at T1 on the depression inventory and/or on the parent reported inventory and at least once more assessment time were used for the study. Of this sample, 494 were included at T1, 469 at T2, 430 at T3, 403 at T4, 404 at T5, 384 at T6, and 401 at T7. The sample was predominantly White (Caucasian; 70%). Parents reported a median household income of \$70,000-\$80,000 at T1, similar to the median income of \$76,222 of the city from which participants were recruited, and \$70,910 for the province (<http://www.statscan.gc.ca>).

*Missing data.* Exploration of missing data was completed using SPSS Missing Values Analysis. The results of the Little's Missing Completely at Random test (Little, 1988),  $\chi^2 = 1994.79$ ,  $df = 1662$ ,  $p < .001$ , indicated that data were not missing completely at random. On average, 19% (range = 0.6-27% missing) of children self-reported data and 17% (range = 0.4-26% missing) of parent-reported data were missing at each time point. In order to further explore the pattern of missing data, we conducted a series of *t*-tests to explore mean-level differences between missing and present cases on our study variables. According to the results of these analyses, the missing values of ODD and CD at T2, T3, and T5 could be predicted by depression scores at T1. Specifically, participants missing ODD and CD data at T2 ( $n = 54$ ;  $M = 7.98$ ) had higher levels of depressive symptoms at T1 than participants who had ODD and CD data at T2 ( $n = 437$ ;  $M = 5.60$ ),  $t(64.5) = -2.4$ ,  $p < .05$ . Participants missing ODD and CD data at T3 ( $n = 80$ ;  $M = 7.59$ ) had higher levels of depressive symptoms at T1 than participants who had ODD and CD data at T3 ( $n = 411$ ;  $M = 5.53$ ),  $t(96.7) = -2.1$ ,  $p < .05$ . Finally, participants missing ODD and CD data at T5 ( $n = 104$ ;  $M = 7.48$ ) had higher levels of depressive symptoms at T1 than participants who had ODD and CD data at T5 ( $n = 387$ ;  $M = 5.43$ ),  $t(138.4) = -2.5$ ,  $p < .05$ . Consequently, in order to handle missing data for the descriptive and correlation analyses, we employed the Multiple Imputation (MI) technique in SPSS. Although there is no gold standard approach in dealing with missing data, MI, introduced by Rubin (1987), has been considered a state of the art technique and the best approach for quantitative research when data are missing (Cox et al., 2014; Schafer & Graham, 2002; Treiman, 2009). MI provides unbiased standard estimates through a three step-process that creates *m* separate imputed data sets (generally 5-10), estimates the model

(e.g., regression) separately for each imputed dataset, and finally, allows pooling of the parameter estimates and standard errors using the imputed datasets (Rubin, 1987). The full information maximum likelihood (FIML) was used to handle missing data for the path analyses as it has been suggested to reduce the amount of biased estimates and maximize the amount of data that can be used (Acock, 2005).

*Reporters.* An important measurement issue in the study of children's mental health is the reliance on single-informant measures. Unfortunately, there does not exist a gold standard of assessment and so it is important to gather information from multiple informants, such as the child and their parent (De Los Reyes, Youngstrom, Pabon, Youngstrom, Feeny, & Findling, 2011). Although disagreement between reporters has been found (for review see De Los Reyes & Kazdin, 2005), the use of a multi-informant approach in assessing children's mental health is important in reducing measurement error (Achenbach, McConaughy, & Howell, 1987). It has been found that children's reports of internalizing symptoms are more in line with clinical diagnoses and that parent reports of their children's externalizing behaviour are more in line with clinical diagnoses (e.g., Barkley, Fisher, Smallish, & Fletcher, 2002; Rubio-Stipec, Fitzmaurice, Murphy, & Walker, 2003). Further, youth with ODD and CD often have poor insight and awareness into their externalizing behaviour (e.g., Barkley, Fisher, Edelbrock, & Smallish, 1990; Hinshaw, 1994), which may result in less accurate reports. In turn, parents often show a poor awareness of their children's depressive symptoms (Logan & King, 2002; Rubio-Stipec et al., 2003). Therefore, for this study we made use of self-reports of depression and parent-reports of ODD and CD.

### **Procedure**

Parents are asked yearly to provide consent for their and their children's participation in the study. Children were asked to provide their written assent at each time point. Each year parents are asked to participate in a telephone interview and children are offered the option to either complete an online or paper/pencil version of the questionnaire (see Vaillancourt et al., 2013). Both methods yielded similar scores across time, with only one difference noted at T2. The effect size of this difference was small (Cohen's  $d = 0.29$ ). The *McMaster Teen Study* has continued to obtain yearly approval from the University of Ottawa research ethics board.

## Measures

*Depression.* Children's depression symptoms were measured using subscales of the self-reported Behavior Assessment System for Children-Second Edition (BASC-II; Reynolds & Kamphaus, 2004), a well-validated measures of children's mental health (Reynolds & Kamphaus, 2004). The depression clinical subscale assesses common symptoms of depression such as loneliness, sadness, and anhedonia as outlined by the DSM-IV-TR criterion. Of the 12 items at T1-T2, and 13 items at T3-T7, children are asked to respond either "true" = 2 or "false" = 0 to 9 statements such as "Nothing ever goes right for me". For 4 items, children are asked to rate the frequency of statements such as "I feel like my life is getting worse and worse" on a 4-point scale (0 = never, 1 = sometimes, 2 = often, 3 = almost always). Higher scores on the BASC-II depression clinical subscale are indicative of greater levels of self-reported depressive symptoms. The internal consistency for the BASC-2 depression scale was high in our sample with an alpha coefficient of .88 to .91 across the 7 waves.

*ODD and CD.* Parent reports of symptoms of ODD and CD were measured using questions from the Brief Child and Family Phone Interview Version 3 (BCFPI-3; Cunningham, Pettingill, & Boyle, 2000). Trained research assistants conducted the phone interviews. ODD was measured using the Cooperation with Others subscale from the BCFPI-3 (Cunningham et al., 2000). The 6-item subscale includes questions such as "Does your child argue a lot with adults?" and "Does your child become easily annoyed by others?" Parents were asked to rate the frequency of their child's behaviour based on a 3-point scale (0 = never, 1 = sometimes, and 2 = often). CD was assessed using the Conduct subscale from the BCFPI-3 (Cunningham et al., 2000), which has been found to provide a good approximation of CD (Boyle et al., 2009). Six items measure conduct behaviour (e.g., "Does your child physically attack people?"). Parents were asked to report on the frequency of their child's behaviour based on a 3-point scale (0 = never, 1 = sometimes, and 2 = often). Higher scores on the BCFPI-3 Cooperation with Others and Conduct subscales are indicative of greater levels of parent-reported ODD and CD symptoms. The internal consistency for the Cooperation with Others subscale was good with an alpha coefficient of .83 to .88 as well as for the Conduct subscale with an alpha coefficient of .51 to .59, across the 7 waves.

## Data Analyses

In order to address our study objective, cascade models were examined using structural equation modeling in AMOS 20.0.0 (Amos Development Corporation, 2011). Following recommendations by Masten and Cicchetti (2010) of larger intervals between assessments in order to account for high within-time and across-time correlations, we first examined the within-time and across-time correlations between variables at all time points. We did note many high correlations ( $r = .11-.76, p < .05$ ), therefore, we tested a series of models in which T2, T4, and T6 were excluded, thus we tested T1, T3, T5, and T7. In our first Model, we estimated covariance terms between all cross-sectional variables (i.e., T1 ODD symptoms with CD symptoms). In Model 2, we added stability paths between the repeated measures in addition to our covariance terms (i.e., T1-T3 CD symptoms). In our third Model, we included cross-lagged paths between differing variables at consecutive time points to our covariance terms and stability paths (i.e. T1 ODD to T3 CD). In accordance with procedures outlined by other researchers employing structural equation modeling, we then performed a series of follow-up analyses (see Burt & Roisman, 2010; Masten et al., 2005; Moilanen et al., 2010; Obradovic, Burt, & Masten, 2010; Vaillancourt et al., 2013; Vaillancourt et al., 2014). First, as previously suggested by Vaillancourt et al. (2013) and van Lier et al. (2012), we examined the potential effect for household income as a control variable on our best fitting model since this has been shown to be a robust predictor of externalizing problems, which could possibly affect the interpretability of the models (e.g. Moilanen et al., 2010; Tremblay et al., 2004). Second, we examined potential sex differences in the links between ODD and CD in the prediction of depressive symptoms. We first tested a sex specific model in which all parameters were freely estimated across sex, and compared it to a second, sex invariant model where all cross-lagged paths between ODD, CD, and depressive symptoms were constrained to equality across sex.

To assess the fit of our model, we used the comparative fit index (CFI) and the root mean square error of approximation (RMSEA), with CFI values above .95 indicating close fit (Hu & Bentler, 1999) and RMSEA values between .05 and .08 indicating acceptable fit and values below .06 indicating close fit (Browne & Cudeck, 1993). Goodness-of-fit was not solely assessed using the  $\chi^2$  test of significance because it has been shown to be sensitive to large samples but is still reported (Kline, 2005). In order to compare nested models we used the chi-squared and CFI difference tests. If the  $\Delta\chi^2$  had a  $p < .05$  and  $\Delta CFI > .01$  the models were statistically significantly

different (Cheung & Rensvold, 2002). We used the Akaike information criterion (AIC) as a measure of fit to compare non-nested models. The model with the lower AIC value was considered to fit best (Akaike, 1974, 1987).

## Results

### Descriptive statistics

Bivariate correlations are presented in Table 1. Within time, correlations between ODD symptoms, CD symptoms, and depressive symptoms were positive and statistically significant at all time points. Across time, ODD symptoms and depressive symptoms were positively and significantly correlated. Across time, CD symptoms and depressive symptoms were positively and significantly correlated (except for CD at T1 and depression at T3, T5, and T7, and CD at T3 and T5 and depression at T7). SES at T1 was negatively and significantly correlated to symptoms of depression, ODD, and CD across all time points except for CD at T3.

Means, standard deviations, and sex difference tests for ODD symptoms, CD symptoms, and depressive symptoms are presented in Table 2. An independent-samples *t*-test revealed sex differences in mean depression, with girls reporting higher levels of depressive symptoms than boys across all waves. No sex differences in mean ODD and CD symptoms were found.

### Path models

The fit statistics for each model and model comparison tests are presented in Table 3. Our first model included covariance terms between cross-sectional variables and resulted in poor model fit (CFI = 0.240, RMSEA = 0.222). Model 2 included the addition of stability paths between repeated measures, which resulted in adequate fit and improved fit over Model 1 (CFI = 0.898, RMSEA = 0.089),  $\Delta\chi^2(9) = 1142.85, p < .01, \Delta\text{CFI} = 0.66$ . In Model 3 we added cross-lagged paths between the different variables at consecutive time points, which resulted in good fit according to the CFI and adequate fit according to the RMSEA, and improved fit over Model 2 (CFI = 0.933, RMSEA = 0.093),  $\Delta\chi^2(18) = 78.82, p < .01, \Delta\text{CFI} = 0.04$ , and thus was retained as our final model. All statistically significant paths and correlations are illustrated in Figure 1. We did not display or report non-significant paths, however they were retained in the model.

### Cross-sectional and stability paths of predictors in the final model

ODD symptoms were concurrently positively related to CD symptoms at each time point ( $r = .42, .29, .20, .24, ps < .001$ ). Depression symptoms at T1 were concurrently positively related to ODD and CD symptoms at T1 ( $r = .31, .23, ps < .001$ ), depression symptoms at T5 were

concurrently positively related to ODD symptoms at T5 ( $r = .28, p < .001$ ). ODD symptoms ( $b = 0.66, 0.64, \text{ and } 0.78, \beta = 0.65, 0.69, \text{ and } 0.72, ps < .001$ ), CD symptoms ( $b = 0.47, 0.29, \text{ and } 0.31, \beta = 0.51, 0.40, \text{ and } 0.23, ps < .001$ ), and depression symptoms ( $b = 0.28, 0.49, \text{ and } 0.48, \beta = 0.38, 0.41, \text{ and } 0.49, ps < .001$ ) were stable across time.

### **Cross-lagged paths between predictors in the final model**

Significant cross-lagged paths were found between ODD symptoms at T1, T3, and T5 and CD symptoms at T3, T5, and T7 ( $b = 0.02, 0.02, \text{ and } 0.04, \beta = 0.11, 0.14, \text{ and } 0.21, ps < .05$ ). ODD symptoms at T1, T3, and T5 predicted depression symptoms at T3, T5, and T7 ( $b = 0.31, 0.29, \text{ and } 0.23, \beta = 0.19, 0.15, \text{ and } 0.11, ps < .05$ ). Inversely, depression symptoms at T1 and T3 predicted ODD symptoms at T3 and T5 ( $b = 0.04 \text{ and } 0.06, \beta = 0.09 \text{ and } 0.11, ps < .05$ ). CD symptoms at T1 predicted depression symptoms at T3 ( $b = -0.91, \beta = -0.13, p < .05$ ). Depression symptoms at T3 also predicted CD symptoms at T5 ( $b = 0.01, \beta = 0.11, p < .05$ ).

### **Control variables**

To control for the effect of household income at T1 we tested a new model (Model 4, Table 3) to which we added this new variable to Model 3. Adding the control variable resulted in very similar fit and parameter estimates to those found in Model 3. However, the increase in AIC between the Model 3 and Model 4 with the inclusion of control variables indicated that Model 3 without the control variable had a better fit. Thus, we chose to continue testing Model 3, our model without the control variable.

### **Multigroup models examining sex differences**

The fit and sex difference test statistics are presented in Table 3. Using Model 3 as a baseline model, an unconstrained model (Model 5, Table 3), in which all parameters of Model 3 were allowed to vary across sex, was compared to a constrained model (Model 6, Table 3), in which all parameters were constrained equally across sex. The sex specific model fit the data well. The sex invariant model also fit the data well. Allowing for sex differences improved fit to the data, according to the  $\chi^2$  difference test and the CFI difference test, suggesting evidence of sex differences in the paths. Thus we continued testing the sex specific model (see Figure 2) by constraining a single path at a time to identify which paths were moderated by sex.

### Sex differences in relation to externalizing symptoms

In the sex-specific model, 2 significant cross-lagged paths emerged. For girls, ODD symptoms at T3 predicted CD symptoms at T5 ( $b = 0.04$ ,  $\beta = 0.23$ ,  $p < .001$ ), but not for boys ( $b = 0.00$ ,  $\beta = 0.02$ ,  $p < .05$ ). Inversely, ODD symptoms at T5 predicted CD symptoms at T7 for boys ( $b = 0.08$ ,  $\beta = 0.27$ ,  $p < .001$ ), but not for girls ( $b = 0.02$ ,  $\beta = 0.11$ ,  $p < .05$ ).

### Sex differences in relation to depression symptoms

In the sex-specific model, 3 significant cross-lagged paths emerged. For girls, depression symptoms at T1 predicted ODD symptoms at T3 ( $b = 0.06$ ,  $\beta = 0.14$ ,  $p < .01$ ), but not for boys ( $b = -0.03$ ,  $\beta = -0.05$ ,  $p < .05$ ). For boys, depression symptoms at T3 predicted CD symptoms at T5 ( $b = 0.03$ ,  $\beta = 0.30$ ,  $p < .001$ ), but not for girls ( $b = 0.00$ ,  $\beta = 0.00$ ,  $p < .05$ ).

## Discussion

Although the results of certain studies suggest that externalizing disorders predict internalizing disorders (Kiesner, 2002; Ladd & Troop-Gordon, 2003; Loth, et al., 2014; Moilanen et al., 2010; Obradovic et al., 2010; Vaillancourt et al., 2013; van Lier & Koot, 2010; van Lier et al., 2012), others have found evidence of the opposite pattern (Bornstein et al., 2010; Mesman et al., 2001). In the present study, we were interested in examining the progressive sequence between symptoms of externalizing (ODD and CD) and internalizing (depression) difficulties through the use of path analyses.

Consistent with previous studies, we found that symptoms of ODD and CD were concurrently related (Angold et al., 1999; Pardini et al., 2010), and that externalizing and internalizing symptoms were also related at each time point (e.g. Nock et al., 2006; Nock et al., 2007). Also in keeping with previous studies examining sex differences in externalizing and internalizing difficulties, we found that girls reported higher levels of depressive symptoms than boys (Kessler et al., 2001; Lewinsohn et al., 2003) across all time points. Although findings on sex differences in symptoms of ODD have been inconsistent (Boylan et al., 2007), we found no evidence of sex differences. Further, contrastingly to previous findings, we found no sex differences in symptoms of CD (Maughan et al., 2004; Nock et al., 2006). It is possible that we did not find these sex differences because our participants were currently enrolled in school and from average income earning families thus lowering the risk of prevalence of externalizing symptoms (Loeber & Keenen, 1994). Indeed, CD has been found to be most prevalent in individuals with low education and urban residence (Lambert, Wahler, Andrade, & Bickman,

2001; Loeber & Keenen, 1994). Therefore, perhaps a different pattern of results would emerge in a sample of lower socio-economic and educational attainment individuals.

Our findings are in line with previous studies on the stability of externalizing symptoms (e.g., Côté et al., 2007; Vaillancourt et al., 2003), and depression (e.g., Fombonne et al., 2001; Harrington et al., 1991; Tram & Cole, 2006; Twenge & Nolen-Hoeksema, 2002). We also found sex differences in the stability of CD. Specifically, symptoms of CD at T3 predicted CD symptoms at T5 for girls but not for boys.

In sum, as previously observed in cross-sectional studies, we found that externalizing and internalizing difficulties were positively correlated, and that girls reported more symptoms of depression than boys. However, unlike previous findings, we did not find evidence of sex differences in CD. As previously observed in longitudinal studies examining the stability of these constructs, we found that externalizing and internalizing difficulties were relatively stable across time.

### **Cross-Lagged findings**

Similarly to longitudinal studies on the comorbidity of ODD and CD (Angold et al., 1999; Kim-Cohen et al., 2003; Lahey, et al., 2002), we found that symptoms of ODD predicted symptoms of CD across all times points. These findings are consistent with those suggesting that CD is often preceded by symptoms of ODD (Maughan et al., 2004; Nock et al., 2006; Pardini et al., 2010). Interesting sex differences in the prediction of externalizing difficulties emerged. At T3, symptoms of ODD predicted symptoms of CD at T5 for girls but not for boys. Inversely, we found that symptoms of ODD at T5 predicted symptoms of CD at T7 for boys but not for girls. These sex differences suggest that perhaps vulnerability in the stability of externalizing symptoms varies by age.

Across all time points we found that symptoms of ODD predicted depressive symptoms. Our findings are in line with those highlighting the co-occurrence and prediction of ODD and depression (Boylan et al., 2010; Boylan et al., 2007; Boylan et al., 2012; Nock et al., 2007), suggesting that oppositional behaviour may in fact be a prodromal symptom of depression. In fact, certain dimensions of ODD have been found to be unique predictors of mood disorders, such as irritability. For instance, Stringaris and Goodman (2009) found that the irritable dimension of ODD was the only significant predictor of depression. These findings have also been corroborated wherein adolescent irritability was predictive of mood disorders 20 years later,

after controlling for previous behavioural and emotional difficulties (Rowe et al., 2010).

Therefore, it is possible that the irritability dimension of ODD is accounting for this relation.

We also found that symptoms of CD at T1 were negatively predictive of symptoms of depression at T3, but not across any other time point. These findings are consistent with those suggesting that childhood-onset CD is more predictive of depressive symptoms than adolescent-onset CD (Kim-Cohen et al., 2003; Moffit & Caspi, 2001; Nock et al., 2006). Thus, these results could be indicative of adolescent-onset of symptoms of CD, which may be more strongly related to subsequent symptoms of CD rather than depression. Further, our findings are similar to those suggesting that ODD is a stronger predictor of depressive symptoms than CD (Rowe, Costello, Angold, Copeland, & Maughan, 2010). No sex differences in the relation between symptoms of CD and of depression emerged or between symptoms of ODD and depression. These findings seem to suggest that, in line with the *failure model* (Capaldi, 1991, 1992; Capaldi & Stoolmiller, 1999), externalizing symptoms predict internalizing symptoms.

Alternatively, we also found evidence for the inverse relation wherein depression symptoms at T3 predicted symptoms of CD at T5, and that depression symptoms at T1 and T3 predicted symptoms of ODD at T3 and T5. Sex differences emerged in these relations wherein depression symptoms at T1 predicted ODD symptoms at T3 for girls but not for boys. No sex differences emerged for the prediction of ODD at T5. Depression symptoms at T3 predicted symptoms of ODD and CD at T5 for boys but not for girls. These findings suggest that at a younger age, girls with depressive symptoms may be more vulnerable than boys or older girls to engage in subsequent oppositional behaviour. In fact these findings echo those of Beyers and Loeber (2003) suggesting that perhaps there is evidence of an acting-out model for boys but not for girls. Thus, boys with depressive symptoms may be more vulnerable than girls in engaging in future conduct problems.

In conclusion, our findings suggest that the relation between externalizing and internalizing difficulties might in fact be bi-directional, wherein externalizing symptoms predict internalizing symptoms and vice-versa. Although many longitudinal studies suggest that externalizing difficulties precede internalizing difficulties (Kiesner, 2002; Ladd & Troop-Gordon, 2003; Moilanen et al., 2010; Obradovic et al., 2010; Vaillancourt et al., 2013; van Lier & Koot, 2010; van Lier et al., 2012), these results have been inconsistent (Bornstein et al., 2010; Mesman et al., 2001). Unlike the *failure model* (Capaldi, 1991, 1992; Capaldi & Stoolmiller, 1999) or the

*acting out model* (Carlson & Cantwell, 1980), our findings suggest a bi-directional association between these syndromes. It is possible that the development of depression and externalizing difficulties is reciprocal in nature but due to common risk factors, also known as the *shared risk model* (Caron & Rutter, 1991; Wolff & Ollendick, 2006). Within this model, it is believed that the co-occurrence of depression and externalizing difficulties is caused by other non-specific factors, such as social disadvantage, adverse life events, marital conflict, and parental mental illness, which leads to separate but associated problems (Capaldi, 1991; Caron & Rutter, 1991; Fergusson, Lynskey, & Horwood, 1996; Loeber, & Stouthamer-Loeber, 1998; Wolff & Ollendick, 2006). Contrasting previous studies suggesting sex differences in this relation (Boylan et al., 2010; Boylan et al., 2012; Wiesner, 2003), our findings suggest that a circular process between symptoms of ODD and depression maybe be present in both boys and girls.

### **Limitations**

There are certain limitations within our study that warrant discussion. Although we were attempting to identify the directionality of the relation between externalizing and depressive symptoms, other unexamined factors may account for the relation. For example, genetic vulnerability has been found to account from 15% up to 80% of depressive symptoms (Happonen et al., 2002; Rice, 2009). Therefore, future studies should make efforts to account for possible risk factors including the effect of genetics. The addition of risk factors common to the development of externalizing and internalizing difficulties could provide clarification on whether the relation is in fact in accordance with a *shared risk model*, or in fact, whether it is consistent with a bi-directional development of these difficulties above and beyond the presence of shared factors contributing to the development of both syndromes. Further, certain factors such as irritability have been shown to have a stronger relation to depression (Rowe et al., 2010; Stingaris & Goodman, 2009). We considered symptoms of ODD as a whole and therefore, future studies should consider the dimensions of ODD and their unique association to subsequent outcomes. Finally, although we made use of a well-validated measure to assess symptoms of externalizing difficulties (Cunningham et al., 2000), our Cronbach's alpha on the Conduct scale could be considered poor. However, it has been argued that a low alpha does not necessarily reflect the quality of a test and can easily be inflated due to redundancy of items (Tavakol & Dennick, 2011).

**Conclusion**

Understanding the longitudinal relation between externalizing and internalizing difficulties is important as it has the potential to guide research, assessment, and clinical intervention, which can lead to more accurate and improved treatment. Our findings add to those suggesting that symptoms of ODD precede those of CD, as well as depressive symptoms pointing to the importance of early intervention of youth displaying oppositional traits. Although more limited, our findings also yield evidence that symptoms of depression preceded symptoms of ODD and CD, suggesting a bi-directional relation between externalizing and internalizing problems. Thus, despite the different presentation of externalizing and internalizing difficulties, our findings suggest that the predictive relation is bi-directional in nature.

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Table 1.

*Bivariate correlations*

	SES1	ODD1	CD1	Dep1	ODD3	CD3	Dep3	ODD5	CD5	Dep5	ODD7	CD7	Dep7
Time1													
SES1	1												
ODD	-.21**	1											
CD	-.15**	.42**	1										
Dep	-.21**	.31**	.23**	1									
Time3													
ODD	-.15**	.68**	.33**	.29**	1								
CD	-.08	.35**	.59**	.22**	.44**	1							
Dep	-.17**	.26**	.06	.41**	.25**	.13*	1						
Time5													
ODD	-.20**	.61**	.33**	.30**	.60**	.33**	.30**	1					
CD	-.11*	.30**	.45**	.26**	.28**	.50**	.17*	.39**	1				
Dep	-.18**	.23**	.06	.38**	.25**	.11*	.44**	.39**	.19*	1			
Time7													
ODD	-.17**	.59**	.29**	.25**	.62**	.27**	.25**	.74**	.32**	.34*	1		
CD	-.16**	.26**	.30**	.12*	.68**	.44**	.11*	.28**	.31**	.14*	.36**	1	
Dep	-.22**	.18**	.04	.27**	.14*	.05	.35**	.28**	.06	.52**	.25**	.30**	1

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

ODD, Oppositional defiant disorder; CD, Conduct Disorder; Dep, Depression.

Table 2.

*Means, standard deviations, and sex difference tests*

	Boys		Girls		Test		Total	
	<i>M</i>	<i>SE</i>	<i>M</i>	<i>SE</i>	<i>t-test</i>	<i>df</i>	<i>M</i>	<i>SE</i>
Time 1								
ODD	3.85	0.21	3.67	0.17	0.68	173574	3.76	0.13
CD	0.28	0.04	0.24	0.41	0.77	72257	0.26	0.04
Dep	4.80	0.38	6.78	0.43	-3.39**	92180	5.87	0.29
Time 3								
ODD	3.86	0.22	3.89	0.18	-0.11	457	3.87	0.14
CD	0.23	0.04	0.15	0.04	1.26	285	0.19	0.03
Dep	3.12	0.29	4.42	0.35	-2.80**	472	3.82	0.24
Time 5								
ODD	3.70	0.21	4.27	0.19	-2.04	125	4.01	0.14
CD	0.15	0.03	0.18	0.03	-0.86	257	0.17	0.02
Dep	3.29	0.38	5.71	0.43	-4.14**	74	4.60	0.30
Time 7								
ODD	4.05	0.21	4.57	0.18	-1.90	1198	4.33	0.14
CD	0.20	0.05	0.15	0.04	0.69	197	0.17	0.03
Dep	3.71	0.36	6.31	0.47	-4.31**	46	5.11	0.31

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

ODD, Oppositional defiant disorder; CD, Conduct disorder; Dep, Depression.

Table 3.

*Model fit and comparison statistics*

Model	Fit statistics					Difference tests			
	$\chi^2$	<i>df</i>	CFI	RMSEA (90% CI)	AIC	vs.	$\Delta\chi^2$	$\Delta df$	$\Delta CFI$
1. Covariance only	1364.229**	54	0.240	0.222 (0.212-0.232)	1436.229	2 vs. 1	1142.85**	9	0.66
2. Covariance and stability	221.379**	45	0.898	0.089 (0.078-0.101)	311.379	3 vs. 2	78.82**	18	0.04
3. Covariance, stability, and cross lagged Control Variable	142.559**	27	0.933	0.093 (0.078-0.109)	268.559				
4. Model 3 with addition of control variable	171.041**	30	0.920	0.098 (0.084-0.112)	319.041				
5. Covariance, stability, and cross lagged sex specific (unconstrained)	187.261**	70	0.932	0.058 (0.048-0.069)	407.261	6 vs. 5	52.201**	19	0.019
6. Covariance, stability, and cross lagged sex invariant (constrained)	239.462**	89	0.913	0.059 (0.050-0.068)	421.462				

*Note.* \* =  $p < .01$ , \*\* =  $p < .001$ .

CFI, comparative fit index; RMSEA, root mean square error of approximation; AIC, Akaike information criterion.

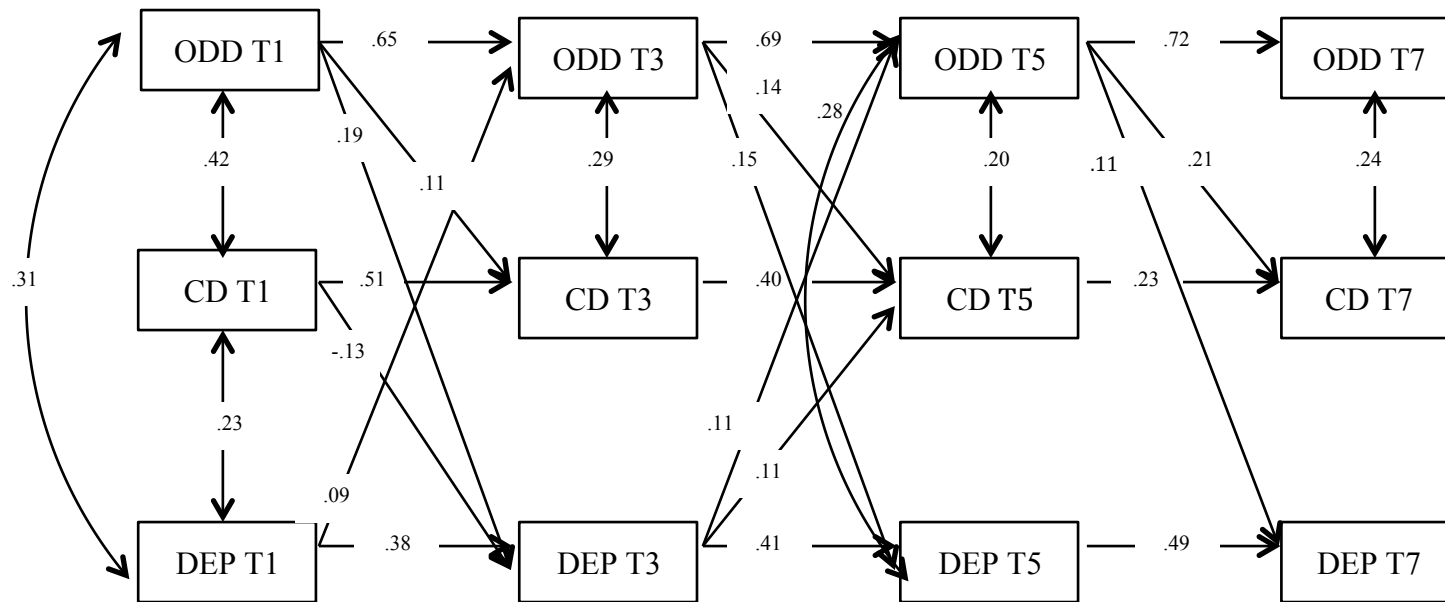


Figure 1. Cascade model for the full sample

Note. Statistically significant standardized path coefficients and within time correlations ( $p < .05$ ). Nonsignificant parameters remain in the model but are not displayed in the figure.

CD, Conduct disorder; ODD, Oppositional defiant disorder; Dep, Depression.

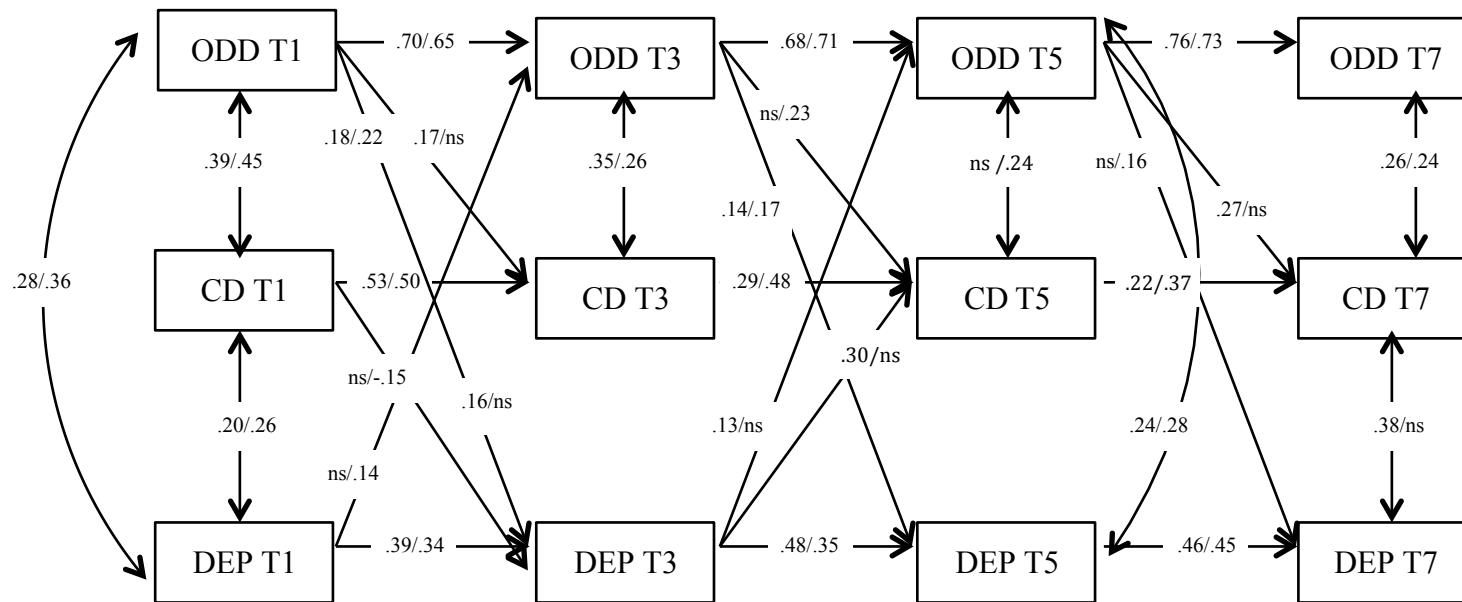


Figure 2. Cascade model by sex.

Note. Boys/girls, statistically significant standardized path coefficients and within time correlations ( $p < .05$ ).

CD, Conduct disorder; ODD, Oppositional defiant disorder; Dep, Depression.

## **Chapter 5. General Discussion**

Identifying the relation between externalizing and internalizing problems over time is important in order to better our understanding of children and adolescent mental health due to the high prevalence rates of these difficulties in youth. To date, attempts to chronical the development and progression of children and adolescents' symptoms of externalizing and internalizing problems have resulted in inconsistent findings. Certain hypotheses have been proposed in order to explain how externalizing and internalizing problems co-relate over time. These include the *failure model* (Capaldi & Stoolmiller, 1999; Kosterman et al., 2010), which proposes that externalizing problems precede internalizing problems, the *acting-out model* (Ritakallio et al., 2008), which suggests that internalizing problems preceded externalizing problems, the *shared-risk model* (Caron & Rutter, 1991; Fergusson et al., 1996; Wolff & Ollendick, 2006), which suggests that both difficulties share a bi-directional relation due to shared factors common to both syndromes, or finally a reciprocal association above and beyond these common factors (Beyers & Loeber, 2003; Measelle et al., 2006). . Further, certain factors that may underlie the relation between externalizing and internalizing problems have been proposed. In order to further our understanding of the chronological relation between these commonly co-occurring difficulties in children and adolescents, Study 1 examined the possible underlying role of worry in qualifying the aggression and depression relation. Studies 2 and 3 used fully recursive structural equation models to examine the longitudinal associations between externalizing and internalizing problems. Below I summarize the results of these three studies.

### **Summary of Study Findings**

#### **Study 1**

Study 1, is to the best of my knowledge, the first study to identify the moderating role of worry in the relation between aggression and depression in a sample of Canadian teenage girls. The focus on girls was motivated by the fact that they have higher rates of depression than boys in adolescence (Cole et al., 2002; Hankin et al., 1998), and they also experience higher rates of co-occurring difficulties such as aggression and depression than boys (Angold et al., 1999).

Competing hypotheses concerning the role of anxiety on aggressive behaviour have been proposed, with some researchers suggesting that the presence of anxious symptoms might increase future aggressive behaviour, and others suggesting an attenuation of subsequent aggressive behaviour (Gray, 1987; Ialongo, Edelsohn, Wethamer-Larsson, Crocket, & Kellam,

1995; Quay, 1988). Since worry commonly occurs in adolescents, is predictive of, and highly present in depression (Rickels & Rynn, 2001; Starcevic, 1995), examining its possible role in the aggression-depression link could help understand the progression of these difficulties.

Through moderation analyses, it was identified that the interaction between physical aggression and worry was statistically significant, suggesting that the relation between physical aggression and depression was moderated by worry within-time and across-time. Specifically, when worry was low there was no significant relation between physical aggression and depression, however, when worry was moderate or high, there was a significant relation between physical aggression and depression. Worry did not moderate the relation between relational aggression and depression. These findings are important because they suggest that the presence of symptoms of worry might further exacerbate the relation between physical aggression and depression, thus, these physically aggressive girls might be particularly at risk for the development of depression more so than relationally aggressive or non-aggressive girls. Further, these findings also suggest that girls who engage in non-normative forms of aggression might be at an increased risk of subsequent depression (Crick, 1997).

### **Study 2**

In Study 2, three competing models on the progressive sequence between aggression and depression were compared in a sample of Canadian children and adolescents spanning 7 years. The *failure model* (Capaldi, 1991, 1992; Capaldi & Stoolmiller, 1999) was compared to the *acting out model* (Carlson & Cantwell, 1980) and to a *reciprocal model*. Because of the developmental changes in the form of aggression used over time (e.g., Côté et al., 2007; Vaillancourt et al., 2003), it is important to consider both relational and physical aggression.

Results of this study, through cross-lagged paths analyses using structural equation modeling, provide support for the *failure model*. Engaging in relational and physical aggression predicted future depressive symptoms. Moreover, engaging in physical aggression predicted future depressive symptoms for girls but not for boys. These findings add to those of Study 1 suggesting that engaging in atypical forms of aggression confers greater risks.

### **Study 3**

In Study 3, the sequential relation between externalizing and internalizing symptoms was again examined in a sample of Canadian children and adolescent spanning 7 years. However, in this study, ODD and CD, and depression were examined and not aggression per se. Researchers

have attempted to identify the developmental trajectory between externalizing and internalizing difficulties by making use of cascade models, but findings have been inconsistent (Bornstein et al., 2010; Kiesner, 2002; Ladd & Troop-Gordon, 2003; Mesman et al., 2001; Moilanen et al., 2010; Obradovic et al., 2010; Vaillancourt et al., 2013; van Lier & Koot, 2010; van Lier et al., 2012).

Findings from this study suggest that externalizing and internalizing symptoms share a reciprocal relation. Specifically, it was found that symptoms of ODD predicted symptoms of depression across all time points. Symptoms of CD at the first time point also predicted subsequent symptoms of depression. However, the inverse relation was also found where symptoms of depression predicted symptoms of ODD and CD across earlier time points only. Therefore, these difficulties appear to concurrently affect each other across time, possibly due to co-occurring risk factors.

### **Research Implications**

Collectively, the studies in this dissertation attempted to shed light on the longitudinal links between externalizing difficulties and depression, which remains unclear to date. One reason for the conflicting results among researchers may be in part due to the statistical approaches used. In order to address the question of directionality between externalizing difficulties and depressive symptoms, fully recursive models were used in Studies 2 and 3. These models contained cross-lagged paths not only from externalizing behaviour to depressive symptoms but also from depressive symptoms to externalizing behaviour. Findings from these two studies largely provided evidence for the *failure model* (Capaldi & Stoolmiller, 1999; Kosterman, et al., 2010), which is largely consistent with other researchers employing similar statistical approaches (Curran & Bollen, 2001; Moilanen et al., 2010; Van Lier & Koot, 2010; Wiesner, 2003). Hence, engaging in externalizing behaviour appears to predict subsequent depressive symptoms.

The use of the fully recursive model approach in Study 3 also provides evidence for the inverse relation, wherein depressive symptoms predict externalizing symptoms, thus indicating that these two difficulties might actually share a reciprocal relation. Despite symptoms of ODD predicting depressive symptoms across all time point, depressive symptoms also predicted symptoms of ODD at two time points. Therefore, had cross-lagged paths only been included in one direction, this inverse relation would not have been identified. Overall, the findings of these

studies seem to indicate that aggressive behaviour does in fact predict depressive symptoms, but externalizing symptoms, which may or may not include aggressive behaviour, seem to share a different relation with depressive symptoms. Failing to use fully recursive models has contributed to an incomplete perspective on the progressive sequence between externalizing and internalizing difficulties. Although the aim for this dissertation was to identify the temporal ordering of externalizing and internalizing symptoms, exploring the mechanism underlying this relation to continue to shed light on the inconsistent findings is warranted. Findings across Studies 2 and 3 might be pointing to different mechanism underlying the relation of aggression and depressive symptoms than when dealing with symptoms of externalizing, ODD and CD, and depressive disorders. A possible explanation for these different findings across Studies 2 and 3 might be related to social competence, or interpersonal skills, which have been linked to emotion regulation (Masten, Burt, & Coatsworth, 2006). Failures in social competence have been shown to result in problem behaviour, such as aggression, whereas internalizing difficulties have also been shown to result in poor social competence, and in turn increase the likelihood of engaging in problem behaviour (e.g. Bornstein, Hahn, & Hayes, 2010). Therefore, it is possible that another underlying factor, social competence, might contribute to these findings. The use of cascade models, which allow researchers to study the longitudinal effects of symptoms and behaviour across different domains over time while accounting for the stability of these variables at multiple time points, could help identify these factors (Masten & Cicchetti, 2010).

Another limitation of past research on the temporal ordering of these difficulties is that many fail to identify important moderators in this relation, namely a person's sex. For instance, Capaldi and Stoolmiller (1999) originally proposed the *failure model* following the examination of conduct difficulties and depression across time in adolescent boys. Neglecting the inclusion of sex differences could lead to unclear results, especially since girls have been shown to also engage in externalizing behaviour (Broidy et al., 2003). Thus, exploring the moderating effect of sex in Studies 2 and 3 provide evidence for the differences in the relation between externalizing difficulties and depression by sex. Findings from Study 2 indicate that physical aggression, which is a gender non-normative form of aggression in girls, conferred higher risks than engaging in relational aggression. These findings, along with those of Study 1, further corroborate those indicating that atypically aggressive girls are particularly at risk for later difficulties including depression and even personality traits such as those of borderline personality disorder (Crick,

1997; Loeber & Keenan, 1994; Vaillancourt et al., 2014), a finding that would have been overlooked without the inclusion of sex as a moderator in Study 2.

### **Implications for Practice**

Identifying the longitudinal relation between externalizing and internalizing difficulties is important as it has the potential to lead to more accurate and improved assessment and treatment of children and adolescents. Adding to the studies reviewed and discussed, the results from this dissertation lend support to the co-occurrence of externalizing and internalizing difficulties. In addition to this, findings from this dissertation largely provide support that the presence of aggression in Studies 1 and 2, and symptoms of ODD in Study 3, place children and adolescents at risk of experiencing subsequent depressive symptoms. These difficulties have been found to persist throughout adolescence (Roeser, Eccles, & Freedman-Doan, 1999; Roeser, Eccles, & Strobel, 1998) and into adulthood (Kessler et al., 2001; Kessler et al., 2005). Accordingly, the findings of this dissertation suggest that clinicians should pay particular attention to aggressive and oppositional children and adolescents in order to curtail the progression of mental health difficulties such as depression.

Despite inconsistent outcomes in the temporal relation between externalizing and internalizing difficulties, the findings of Study 3 largely suggest that symptoms of ODD precede those of depression, pointing to the importance of early intervention of children and adolescents displaying oppositional traits. Although not consistently found across all time-points, evidence that symptoms of depression preceded symptoms of ODD and CD was found which suggests a reciprocal relation between externalizing and internalizing problems. Therefore, despite the presentation of internalizing symptoms, clinicians should be aware that these children and adolescents are also at risk of subsequent externalizing difficulties including ODD and CD.

The findings of this dissertation also suggest the possibility that the progressive relation between aggressive behaviour and depression and externalizing problems and depression might in fact be different. ODD and CD are considered externalizing problems and often include the presence of aggressive behaviour, yet this is not a necessary condition for meeting diagnostic criteria. Therefore, the findings largely supporting that aggression predicts symptoms of depression in Studies 1 and 2, and that in Study 3 symptoms of ODD and CD do predict depressive symptoms but, more limited, also support the inverse relation, suggests that perhaps certain other symptoms of externalizing problems than aggressive behaviour account for the

direction of effect. Future research would be needed to clarify this hypothesis, however, clinicians should still consider the importance of intervening for both externalizing and internalizing symptoms in children and adolescents.

Findings from Studies 1 and 2 of this dissertation largely provide support for the *failure model* (Capaldi, 1991, 1992; Capaldi & Stoolmiller, 1999), yet it remains unclear what other variables may be underlying the externalizing behaviour and depression relation since failure in relationships was not considered. Findings from Study 1 suggest that worry might play an exacerbating role in the relation between physical aggression and depression. Therefore, it would be warranted for clinicians to be particularly attentive to physically aggressive girls who also present with significant worries as this may place them at higher risk of developing subsequent depressive symptoms. For instance, worry has been suggested to function as a way to attend to potential threat, whether physical or emotional, and thus be protective (Mathews, 1990). Therefore, the adolescents in this study may be reacting in an aggressive manner to potential threat as a means to protect themselves from harm. Further, worry in adolescents has also been shown to have detrimental outcomes such as impaired social skills (Pryor-Brown & Cowen, 1989; Silverman, La Greca, & Wasserstein, 1995). Taken together, these findings, as well as those of Study 1, suggest that perhaps it would be most beneficial for intervention in physically aggressive girls to focus on fostering healthy peer relations in an effort to protect against subsequent depression. Although more limited, findings from Study 3 suggest that depressive symptoms can also be predictive of externalizing difficulties. Therefore, overall, the current findings of this dissertation support the need to continue focusing intervention efforts on promotion of healthy peer relationships in an effort to protect these vulnerable children and adolescents from experiencing subsequent difficulties, as healthy peer relations have been shown to be protective of both internalizing and externalizing difficulties (Parker, Rubin, Erath, Woislawowicz, & Buskirk, 2006).

### **Limitations and Future Directions**

There are certain limitations to the current studies that warrant discussion and could be addressed in future research. Firstly, despite Study 1 being the first to demonstrate a link between worry and depression in aggressive adolescents, these findings cannot be generalized due to the sample comprised uniquely of girls. Perhaps a different sequence would have been identified for boys. Second, certain limitations of the studies concern measurement. Although we were able to

identify that worry might exacerbate depression in physically aggressive girls in Study 1, the measure used only considered worries related to the self and verbal communication. Research suggests that social anxiety, and particularly fear of negative evaluation by peers, is most often related to anxiety (Bjorkqvist et al., 1992; Loudin, Loukas, & Robinson, 2003; Loukas, Paulos, & Robinson, 2005). Therefore, a different pattern may have emerged with the use of a social anxiety measure or a worry measure assessing worries related to peer relations. Aggressive behaviour in Studies 1 and 2 was measured as either physical or relational and it was not identified whether these children and adolescents were reactive, impulsively aggressive as a reaction to a perceived threat, or instrumental, proactively aggressive with the aim to hurt another, in their use of aggression (Dodge & Coie, 1987). There is growing evidence suggesting that reactive, rather than proactive, aggression is associated with depression (Card & Little, 2006; Fite, Colder, Lochman, & Wells, 2008; Fite, Stoppelbein, & Greening, 2009; Fite, Rathert, Colder, Lochman, & Wells, 2012; Vitaro & Brendgen, 2011). Similarly, it has been suggested that the irritability dimension of ODD is the most accurate predictor of depression (Rowe, Cestello, Angold, Copeland, & Naughan, 2010; Stringaris & Goodman, 2009). Therefore, the measurement of aggression and symptoms of ODD in the studies may be too broad and not fully reflect the relation between these externalizing problems and depression. All studies included self-reported data on depressive symptoms, which may be subject to biases including self-serving bias. The use of different measures of worry, anxiety, and aggression would be warranted in future studies in order to replicate and extend the current results.

Third, the findings of these studies suggest evidence of the directionality of the relation between externalizing behaviour and depressive symptoms, however, other unexamined factors may also account for the relation. Certain familial factors, such as high parental conflict, low parental warmth, and parental psychopathology have been found to contribute significantly to the development of depressive symptoms in children and adolescents (Sheeber, Hops, & Davis, 2001). In addition, genetic vulnerability has been suggested to contribute from 15% up to 80% of the development of depressive symptoms in children and adolescents (Happonen et al., 2002; Rice, 2009). Therefore, future studies on mental health in children and adolescents should consider including a measure of familial factors such as parental mental health and home environment. However, the findings of the studies are consistent with those of the interactional model of depression, which posits that symptoms of depression are maintained by difficulties in

interpersonal relationships (Joiner & Coyne, 1999). Although not related to the familial context, the findings of these studies may be providing evidence that the development of depressive symptoms is strongly related to environmental factors.

Finally, the longitudinal design of the studies provides support of directionality, however, causal conclusions still cannot be drawn. Additionally, it is not possible to identify any other factors that may be underlying the relation between externalizing and depressive symptoms. Findings from Study 2 suggest evidence for the *failure model* (Capaldi, 1991, 1992; Capaldi & Stoolmiller, 1999), while those of Study 3 suggest evidence of a bi-directional relation between the constructs. However, it remains unclear what other third-variables might explain the relation between externalizing behaviour and depressive symptoms. Therefore, the inclusion of a quality of peer and parental relations should be considered as a possible mediator in the relation between externalizing and internalizing problems. If the addition of these common risk factors decreases the association between the syndromes then we can assume that a *shared risk model*, rather than a bi-directional association, explains the longitudinal relation between these constructs. Therefore, future research should aim at identifying the mechanism underlying the complex relation between externalizing and internalizing difficulties, rather than continue to identify the sequential ordering between these syndromes, which has resulted in diverging results.

### **Conclusion**

Taken together, the studies in this dissertation examined the longitudinal links between externalizing and internalizing difficulties in children and adolescents. The results of the first study are the first to provide evidence that worry plays a role in the emergence of depressive symptoms in physically aggressive girls. Results of the second study build on those of the first by providing evidence to support the *failure model* in which aggression predicts depression, as well as provides further support for the unique vulnerability of physically aggressive girls. Finally, findings from the third study suggest that externalizing and internalizing difficulties share a reciprocal relation. This dissertation furthers our understanding of the complexity of the relation between externalizing and internalizing difficulties in children and adolescents by exploring the role of unexamined variables, such as worry, and by making use of robust statistical analyses, such as mediation and path analysis.

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### Appendix A – Tables of Main Effects

Table 1.

*Predicting depression from physical aggression, relational aggression, and worry*

Predictors	$\beta$	$t$	$\Delta R^2$
Step 1: control			0.02
Age	0.14	2.30*	
Step 2: main effects			0.25
Physical Aggression	0.31	3.15**	
Relational Aggression	-0.02	-0.20	
Worry	0.47	7.71***	
Step 3: interaction			0.03
Physical Aggression X Worry	0.26	2.15*	
Relational Aggression X Worry	-0.11	-0.89	

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

Table 2.

*Predicting depression T2 from physical aggression T1, relational aggression T1, and worry T1*

Predictors	$\beta$	$t$	$\Delta R^2$
Step 1: control			0.02
Age	0.13	1.94	
Step 2: main effects			0.15
Physical Aggression	0.33	3.10**	
Relational Aggression	-0.04	-0.34	
Worry	0.37	5.53	
Step 3: interaction			0.06
Physical Aggression X Worry	0.43	3.22**	
Relational Aggression X Worry	-0.20	-1.46	

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

Table 3.

*Predicting depression T2 from physical aggression T1, relational aggression T1, worry T1, and depression T1*

Predictors	$\beta$	$t$	$\Delta R^2$
Step 1: control			0.02
Age	0.05	0.86	
Step 2: main effects			0.45
Physical Aggression	0.08	0.89	
Relational Aggression	-0.02	-0.23	
Worry	0.07	1.07	
Depression	0.62	9.39***	
Step 3: interaction			0.01
Physical Aggression X Worry	0.23	1.98*	
Relational Aggression X Worry	-0.12	-1.09	

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