

TREATING MIXED CHILDREN: THE IMPACT OF REDUCTIONS IN PARENT-CHILD  
CO-RUMINATION AND MATERNAL DEPRESSION ON CHILD INTERNALIZING AND  
EXTERNALIZING SYMPTOMS

by

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for the degree of Doctor of Philosophy  
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**TREATING MIXED CHILDREN: THE IMPACT OF REDUCTIONS IN PARENT-CHILD CO-RUMINATION AND MATERNAL DEPRESSION ON CHILD INTERNALIZING AND EXTERNALIZING SYMPTOMS**

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**Abstract**

Children with co-occurring internalizing and externalizing problems (MIXED children) represent a distinct aggressive subtype with negative outcomes; understanding what works for them in treatment is imperative. The success of MIXED children in some family-based programs for aggression may be attributable to collateral reductions in internalizing symptoms. The current study examined whether reductions in internalizing behaviour in MIXED children were due to reductions in maternal depression and parent-child co-rumination. Co-rumination, a dyadic interaction related to internalizing symptoms, is defined as excessively discussing problems and dwelling on negative feelings. We investigated 154 MIXED children and 49 pure externalizers who underwent Parent Management Training/Cognitive Behavioural Therapy. Mother-child co-rumination was assessed using videotaped observations of problem discussions gathered at pre-treatment, post-treatment and follow-up. We hypothesized that, at pre-treatment, mother-child co-rumination would mediate the relation between maternal depression and child internalizing problems. During treatment, we expected that co-rumination and maternal depression would predict reductions in child symptoms. Finally, we hypothesized that reductions in co-rumination would mediate the association between improvements in maternal depression and improvements in child internalizing which would, in turn, impact externalizing outcomes. Results did not support our pre-treatment and during treatment hypotheses about the role of co-rumination as a mediator. At pre-treatment, maternal depression was associated with child

internalizing problems and co-rumination; co-rumination was not associated with internalizing when controlling for maternal depression. Reductions in maternal depression were associated with improvements in child internalizing and, marginally, with child externalizing, thus partially supporting our hypotheses. We also found that reductions in co-rumination impacted child externalizing, but not internalizing behaviour, again partially supporting our hypotheses regarding co-rumination changes and child symptom changes. Finally, results demonstrated that internalizing improvements affected externalizing outcomes, partially supporting our treatment-related hypothesis. Findings have implications for understanding the development and treatment of problems in MIXED children.

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More than half of externalizing children and youth referred to treatment also meet criteria for an internalizing disorder (Arredondo & Butler, 1994; Greene et al., 2002). Externalizing problems refer to aggression, delinquency, oppositional behaviour, as well as disorders or symptoms of disorders such as conduct disorder, oppositional defiant disorder and attention-deficit/hyperactivity disorder. Internalizing problems refer to depression, anxiety, somatization problems, as well as disorders or symptoms of disorders such as separation anxiety disorder, generalized anxiety disorder and major depressive disorder. Children with co-occurring externalizing and internalizing problems, hereafter referred to as MIXED<sup>1</sup>, represent a distinct aggressive subtype that is at high risk for suicide, police contact and negative outcomes as adolescents and adults (Capaldi, 1992; Capaldi & Stoolmiller, 1999; Lewinsohn, Rohde, & Seeley, 1995). Therefore, it is imperative to understand what works for MIXED children and youth in treatment.

Interestingly, studies have reported that MIXED children fare well in treatments for aggressive children involving parents and family. In fact, some studies have even demonstrated that they improve to a greater extent than EXT children (Beauchaine, Webster-Stratton, & Reid, 2005). This finding is counter-intuitive mainly because these programs were specifically developed to target aggression, not depression or anxiety. However, it is plausible that these programs are somehow also successfully targeting internalizing problems in children. One way to reduce internalizing problems in children is through changes in the parent-child dynamic during treatment. More specifically, child internalizing problems may be targeted by reductions in a type of interaction known as co-rumination--excessively discussing problems and issues,

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<sup>1</sup> We use the term 'MIXED' to refer to co-occurring externalizing and internalizing symptoms, and 'EXT' to refer to pure externalizing symptoms; MIXED and EXT children may or may not be diagnosed with an actual disorder.



dwelling on negative feelings and over-speculating about problems (Rose, 2002). Co-rumination is related to the development of depression and anxiety in children and youth (Rose, 2002; Rose, Carlson & Waller, 2007; Waller & Rose, 2009). Moreover, it may uniquely characterize the interactions between MIXED children and their parents. The current study examined changes in parent-child co-rumination during treatment and its impact on internalizing and, subsequently, on externalizing outcomes in MIXED children. The treatment program of interest was combined Parent Management Training and Cognitive Behavioural Therapy (PMT/CBT), a program developed to target aggressive behaviour in children.

PMT has not only been shown to reduce children's aggression, it also has a direct impact on maternal depression (Degarmo, Patterson, & Forgatch, 2004; Patterson, Degarmo, & Forgatch, 2004). These findings may be important for our discussion on MIXED children because maternal depression has been demonstrated as a factor related to the development and treatment of problems in MIXED children and youth (Grimbos & Granic, 2009). In other words, collateral reductions in maternal depression during PMT may contribute to reductions in MIXED children's symptoms. In addition, parent-child co-rumination may be more prevalent in dyads where the mother is depressed and, further, levels of parent-child co-rumination may also change as a function of changes in maternal depression status during treatment. Thus, it may be that improvements in maternal depression during treatment impact both internalizing and externalizing outcomes through reductions in parent-child co-rumination.

### **Children with Co-Occurring Internalizing and Externalizing Problems**

A large proportion of children and youth referred for treatment for aggression exhibit comorbid depression and/or anxiety symptoms (Greene et al., 2002). In addition,

epidemiological research suggests that a large proportion of aggressive children and youth also exhibit co-occurring internalizing problems (McConaughy & Achenbach, 1994), and symptoms of conduct or oppositional disorder and depression/anxiety co-occur at higher rates than would be expected by chance (Boylan, Vaillancourt, Boyle, & Szatmari, 2007). The high prevalence of MIXED children has prompted researchers to investigate if and how these children differ from EXT children. To support the distinction between MIXED and EXT children, ample research has shown that the groups differ with respect to risk factors, long term outcomes and treatment prognosis (Capaldi, 1991; 1992; Costin & Chambers, 2007; Kovacs, Paulauskas, Gatsonis, & Richards, 1988). In particular, it has been found that MIXED children are more severely impaired than EXT children. For example, studies have shown that they exhibited poorer academic performance, more substance abuse problems and were more socially rejected by their peers, compared to EXT children (Capaldi, 1991; Cole & Carpentieri, 1990; Oland & Shaw, 2005; Yoo, Brown, & Luthar, 2010). Regarding outcomes, MIXED children tended to have more maladaptive developmental outcomes than EXT children (Capaldi, 1992; Capaldi & Stoolmiller, 1999; Kovacs et al., 1988; Oland & Shaw, 2005). For example, as adolescents, these children were more likely to have police contact, to affiliate with deviant peers and engage in delinquency, and were two times more likely to attempt suicide (Capaldi, 1992; Lewinsohn et al., 1995; Talbott & Fleming, 2003). In addition, MIXED youth were more likely to be poorly adjusted as adults (e.g., substance abuse dependence; Capaldi & Stoolmiller, 1999; Shaw & Gross, 2008). Taken together, MIXED children appear to represent a distinct aggressive subgroup with serious problems and negative outcomes. Therefore, it seems important for researchers to understand how this subgroup fares in treatment and, moreover, what factors contribute to positive treatment outcomes.

## **MIXED Children in Treatment**

Given the severity of their profiles, treating MIXED children should be especially challenging. However, numerous studies have shown that these children fare well in treatment involving parents and family (e.g., PMT; Family Preservation Therapy; Beauchaine, Gartner, & Hagen, 2000; Beauchaine et al., 2005; Connell, Dishion, Yasui, & Kavanagh, 2007; Costin & Chambers, 2007; Dishion & Stormshak, 2007; Wilmhurst, 2002). In addition, it has been found that they improve to a greater extent than EXT children (Connell et al., 2008; Costin & Chambers, 2007; Beauchaine et al., 2000; 2005; Kazdin & Whitley, 2006). For example, Costin and Chambers (2007) found that 5 to 13 year olds with oppositional defiant disorder and an affective disorder (either anxiety disorder or depression) showed more improvements following a parent training program than children diagnosed with oppositional defiance alone. In another study, 4 to 12 year-olds with conduct disorder/attention deficit hyperactivity disorder and comorbid depression/anxiety showed greater improvements over the course of a multidisciplinary treatment program, compared to externalizing children without depression/anxiety diagnoses (Beauchaine et al., 2000). Overall, MIXED children and youth appear to be successful in family-based treatments for aggression. Unfortunately, too few studies have examined processes related to treatment outcomes in MIXED children, and so it remains unclear why and how they achieve these positive outcomes.

## **Reducing Internalizing Problems in Treatment with MIXED Children**

The treatment programs showing favourable outcomes for MIXED children (e.g., PMT) were developed to target externalizing, but not internalizing behaviour in children. Therefore, it is curious why EXT children are not the ones who are achieving these better outcomes. One

plausible explanation is that these programs are somehow also successfully targeting internalizing problems in children. Indeed, many of the treatment programs demonstrating positive externalizing outcomes in MIXED children have also shown improvements in child depressive and/or anxious symptoms (Chase & Eyberg, 2008; Connell et al., 2007; Costin & Chambers, 2007; Eisenstadt, Eyberg, McNeil, Newcomb, & Funderbunk, 1993; Weiss, Harris, Catron & Han, 2003). Taken further, it may be that the collateral effect of reducing internalizing symptoms has a positive impact on externalizing problems, resulting in even greater externalizing improvements in MIXED children. In other words, a dual focus on both internalizing and externalizing problems may enhance outcomes in this aggressive subgroup.

Speculation about the positive impact of a reduction in internalizing problems on externalizing outcomes in MIXED children is supported by two lines of research: 1) comorbidity research on internalizing behaviour as a risk factor for externalizing problems, and 2) intervention/prevention research demonstrating that changes in internalizing behaviour during treatment are associated with changes in externalizing problems. Regarding the former, some studies have found that internalizing problems play a more causal role in the development of externalizing problems (Beyers & Loeber, 2003; Curran & Bollen, 2001; Kovacs et al., 1988; Loeber, Russo, Stouthamer-Loeber, & Lahey, 1994). Kovacs et al. (1988) followed children from ages 8 to 13 and found that, for those who had co-occurring conduct disorder and major depressive disorder or dysthymic disorder, depression was the primary diagnosis in 73% of the cases; 27% developed conduct disorder before depression. In a more recent study examining youths, depressed mood was a stronger predictor of delinquency across time, whereas delinquency only weakly predicted the growth rate of depressive mood (Beyers & Loeber, 2003). One proposed explanation for this causal relation is that depressed mood impairs one's concern

for negative consequences associated with delinquent behaviour, thus increasing the likelihood of such behaviour (Lilienfeld, 2003). Others have suggested that depressed children have difficulties regulating irritability and negative affect, which may result in increased conflict with others and oppositional behaviour (Wolff & Ollendick, 2006). Despite these plausible explanations of the processes by which internalizing affects externalizing, as well as evidence supporting this causal relation, it is noteworthy that there is ample literature demonstrating the opposite—that externalizing problems precede internalizing ones (Capaldi, 1991; 1992; Capaldi & Stoolmiller, 1999; Nock, Kazdin, Hiripi, & Kessler, 2006; Patterson, Reid, & Dishion, 1992). Capaldi (1992) demonstrated that boys with conduct problems at grade 6 were more likely to exhibit depressed mood at grade 8; depressed mood at grade 6 was not predictive of conduct problems two years later. These researchers proposed that social and academic failure resulting from delinquent behaviour causes depression and anxiety in children and youth (Capaldi, 1991; 1992; Capaldi & Stoolmiller, 1999). Overall, the debate remains unresolved, and the causal relation between externalizing and internalizing problems in MIXED children is still in question. It may even be that internalizing and externalizing behaviour are reciprocally related to each other in a feedback loop.

Some more evidence supporting the impact of internalizing on externalizing problems in children comes from the treatment literature. Numerous studies investigating a variety of treatments have demonstrated that a reduction in internalizing behaviour mediates or is associated with changes in externalizing problems (DeGarmo et al., 2004; Griest et al., 1982; Lewis et al., 2008; Puig-Antich, 1982; Weiss et al., 2003). For example, Lewis et al. (2008) found that MIXED children who improved following PMT/CBT exhibited reduced activity in a brain area implicated in anxiety and depression. In response to an emotion induction task,

externalizing improvers showed reduced ventral prefrontal activity from pre-treatment to post-treatment; this pattern was not evident in non-improvers. Interestingly, decreased activity in the ventral prefrontal cortex has been demonstrated in depressed or anxious individuals who improve in their internalizing behaviour following treatment (Drevets & Raichle, 1998; Mayberg et al., 1999). In another study examining the effectiveness of anti-depressant medication on pre-pubertal children who were clinically depressed, Puig-Antich (1982) found that externalizing problems decreased when depression was alleviated due to the medication; a large number of the children in this study had comorbid externalizing problems. Although these two studies demonstrate a concurrent association between changes in internalizing and externalizing symptoms, a more causal link can be found in Degarmo et al. (2004) who used latent growth mediational analyses to examine processes of change during PMT in recently separated families. In this study, the authors found that improvements in child externalizing behaviour following PMT were mediated by improvements in child internalizing problems. In sum, it is possible that alleviating depressive or anxious symptoms in treatment contributes to or enhances improvements in externalizing behaviour. What processes could be associated with reductions in child internalizing symptoms in MIXED children? One fruitful area of inquiry could be parent-child interactions, particularly ones that are implicated in the development of internalizing problems in children.

### **Parent-Child Co-Rumination: A Risk Factor for Internalizing Problems in MIXED Children**

Studies have documented that parental involvement in treatment contributes to positive internalizing outcomes (Mendolwitz et al., 1999), and many scholars have emphasized the importance of analyzing parent-child interactions to understand how interventions for child

anxiety and/or depression work (Barrett, Rapee, Dadds, & Ryan, 1996; Hirshfeld-Becker & Biederman, 2002; Whaley, Pinto, & Sigman, 1999). One specific type of interaction worth examining, related to the development of internalizing problems in children and youth, is called co-rumination--when two people excessively discuss problems and issues, dwell on negative feelings and over-speculate about problems (Rose, 2002). In a co-ruminative interaction, negative feelings are intensified and magnified through repetitive focus and discussion without any effort to actively resolve the problem, potentially leading to internalizing problems. In particular, co-rumination between parent and child should be especially related to child internalizing problems because parents play a key role in socializing emotion in children (for a review, see Eisenberg, Cumberland, & Spinrad, 1998).

It is important to mention that there is a positive side to co-rumination. For example, Amanda Rose has studied co-rumination as a paradoxical process whereby it is related to elevated depression and anxiety but also to positive friendship quality, friendship satisfaction and closeness in relationships (Rose, 2002; Rose et al., 2007; Waller & Rose, 2009). Positive relationship aspects have been found to be the result of self-disclosure and sharing of thoughts and feelings involved in co-rumination (Rose, 2002).

Despite the positive implications related to relationship quality, still, several studies have demonstrated a strong link between co-rumination and internalizing symptoms in children and adolescents. Notably, most of these studies analyzed co-rumination between peers (Rose, 2002; Rose et al., 2007; Starr & Davila, 2009). To date, only two studies have examined parent-child co-rumination (Calmes & Roberts, 2008; Waller & Rose, 2009). In one study, co-rumination between adolescents and their mothers was associated with both adolescent depression and anxiety when the topic of focus was the mother's problems (Waller & Rose, 2009). In another

study, it was reported that co-rumination between undergraduates and their mothers was related to anxiety, but not depression (Calmes & Roberts, 2008). Though preliminary, the findings presented on parent-child co-rumination demonstrate a relation between co-rumination and internalizing problems, but it is unclear whether these findings are applicable to younger children. However, given the prominent role that parents play as emotion socialization agents earlier in development (Eisenberg & Morris, 2002; Kopp, 1989), a strong link between co-rumination and internalizing problems is expected with parents and younger children.

Other studies, without examining co-rumination per se, have found that parent-child interactions resembling co-rumination (e.g., lengthy emotional discourse) are related to child internalizing behaviours (Champion et al., 2009; Denham, Mitchell-Copeland, Strandberg, Auerbach, & Blair, 1997; Sheeber, Hops, Andrews, Alpert, & Davis, 1998). One example comes from a study that used sequential analysis on observed parent-child interactions during a problem-solving task (Sheeber et al., 1998). In this study, when depressed children displayed dysphoric behaviours, mothers were more likely to respond with approving and supportive statements that served to encourage and maintain the conversation (referred to in the study as facilitative behaviour). Acting as a positive reinforcer, this facilitative behaviour then increased the child's subsequent display of dysphoric behaviour (Sheeber et al., 1998).

Given the link with internalizing problems, it is likely that co-rumination characterizes interactions between parents and MIXED children. Although co-rumination has never been studied in this aggressive subgroup, rumination and related coping styles (e.g., catastrophization, internal focus on distress) are common coping strategies used by MIXED children (Cole, Zahn-Waxler, Fox, Usher, & Welsh, 1996; Garnefski, Kraaij, & van Etten, 2005; Hankin, 2008; Leung & Wong, 1998). For example, Garnefski and colleagues found that MIXED 12-18 year-olds



were more likely than EXT children and controls to use ruminative response strategies. In Hankin (2008), rumination interacted with co-occurring externalizing behaviour and anxiety to predict depressive affect in young children. The author proposed that symptom severity in these children triggered ruminative response tendencies by providing more material (including anxiety symptoms and problem behaviours) on which to ruminate. Finally, MIXED adolescents reported higher levels of catastrophization, a correlate of rumination (Garnefski & Kraaij, 2006), compared to EXT adolescents and controls (Leung & Wong, 1998). Because co-rumination is an interpersonal manifestation of rumination and members of a co-ruminative dyad are more likely to individually ruminate, the more frequent use of rumination by MIXED children and youth should also reflect higher levels of parent-child co-rumination.

### **Co-Rumination: A Factor Related to Treatment Outcomes in MIXED Children**

If parents and their MIXED children engage in higher levels of co-rumination, it may be that reductions in parent-child co-rumination following treatment is a mechanism by which internalizing behaviour improves in MIXED children. Only one study has examined co-rumination within the context of treatment (Waters, Donaldson, & Zimmers-Gembeck, 2008). In this study, adolescents with generalized anxiety disorder and comorbid major depressive disorder underwent a treatment that combined CBT with an interpersonal skills component. A major goal of the interpersonal skills component was to target co-rumination. The authors reported reductions in generalized anxiety and major depression for all participants in the study. Notably, these results do not support co-rumination as a predictor of treatment outcome since changes in co-rumination during treatment were not measured. However, given that the interpersonal skills component placed emphasis on reducing co-rumination, and also, given that the bulk of treatment gains occurred once the interpersonal skills component was introduced (it was

introduced after CBT), it is likely that changes in co-rumination had an impact on internalizing improvements.

Rumination has been widely implicated in the treatment of internalizing problems in children and youth (Gudmundsen, 2007; Watkins, 2009; Wilkinson & Goodyer, 2008). In fact, a major component of CBT, one of the most successful intervention programs for children and youth with internalizing problems, focuses on reducing rumination (Wilkinson & Goodyer, 2008). For example, in CBT, children are taught how to avoid ruminative response styles and engage in constructive problem-solving and distraction techniques. Several intervention studies examining the effectiveness of CBT in treating internalizing problems have identified that reducing ruminative thinking in treatment is one important mechanism that explains internalizing improvements (Gudmundsen, 2007; Kaufman, Rohde, Seeley, & Clark, & Stice, 2005; Wilkinson & Goodyer, 2008). Regarding MIXED children, Kaufman et al. (2005) explored mechanisms of change in a group of adolescents with comorbid major depressive disorder and conduct disorder who underwent CBT. The authors found that a reduction in negative ruminative thoughts during treatment mediated positive improvements in depression. Overall, it is apparent that reducing rumination in treatment alleviates internalizing symptoms in children and youth; there is preliminary evidence suggesting that it works for MIXED children and youth as well. Following this, co-rumination, the dyadic version of rumination (Starr & Davila, 2009), is also expected to impact internalizing outcomes.

One main objective of the current study was to examine parent-child co-rumination as a factor related to internalizing and externalizing improvements over the course of combined PMT/CBT in MIXED children. Although the goal of PMT/CBT is to target externalizing behaviour, we hypothesized that reductions in co-rumination would predict reductions in

internalizing symptoms. Based on our review of literature demonstrating the impact of internalizing on externalizing behaviour in the development and treatment of MIXED children, we expected that these internalizing improvements would, in turn, be associated with improvements in externalizing behaviour.

### **Combined PMT/CBT: The Intervention**

PMT combined with CBT for child aggression is documented as one of the most effective treatments for aggressive children (Kazdin, Siegel, & Bass, 1992; Lochman & Wells, 2004).

Both treatment approaches focus on helping the child regulate distressing emotions and maladaptive behaviours: PMT achieves this by targeting poor parenting practices, and CBT does so by targeting the child's aggressive cognitions and behaviours. In CBT, children are taught how to manage their emotions (e.g., anger) and resulting behaviour in response to various anger-inducing social situations. More specifically, children are taught how to appropriately respond to distressing situations by challenging their automatic thoughts, considering the negative consequences of their actions and engaging in alternative solutions that are more prosocial and effective (e.g., walking away from a potential fight). All of this is accomplished through techniques such as problem-solving, modeling, behavioural management, social reinforcement, role-playing and cognitive re-structuring (Barkley, 2000; Bloomquist & Schnell, 2002). The newly-learned skills eventually become a part of the child's behavioural response repertoire, and may likely extend to situations in which the child ruminates over negative feelings and/or problems. A child who ruminates frequently may do so less because he or she has learned, in CBT, how to gain control of negative feelings, distract him or herself, and engage in constructive, effective problem-solving—opposing strategies to rumination (Nolen-Hoeksema, 1987). Importantly, parents are also taught similar anger-management strategies. Thus, parents

may also become less ruminative if they apply their newly-learned skills to the ways in which they deal with negative feelings and emotions. Relevant to the current discussion, co-rumination may also decrease during treatment, partially due to the new emotion regulation skills acquired by both children and parents in CBT. These changes in co-rumination are hypothesized to have an impact on child internalizing problems.

PMT with or without CBT is an effective treatment for aggressive children (Brestan & Eyeberg, 1998; Forgatch & Degarmo, 1999). The treatment model is based on social learning principles and grew out of Forgatch's research on family problem-solving (Forgatch, 1989) and applied observational research conducted by Patterson and colleagues (Patterson, 1982; Patterson et al., 1992). The link between negative parent-child interactions and child aggression has been well established (Harrist & Waugh, 2002; Hollenstein, Granic, Stoolmiller, & Snyder, 2004), and improving poor parenting practices has been shown to positively impact child functioning (Loeber & Farrington, 2000). In PMT, maladaptive parenting practices (e.g., lax or aversive parenting) are targeted and parents are taught more effective ways of managing their children's problem behaviours (e.g., time out). PMT also promotes positive parenting practices such as skills encouragement, positive involvement, monitoring and problem solving (Forgatch & Martinez, 1999).

Some studies have reported an interesting collateral effect of PMT, namely, the reduction of depressive symptoms in mothers (Degarmo et al., 2004; Patterson, 1980; Patterson et al., 2004). Researchers have speculated that this alleviation of symptoms occurs because mothers are feeling more positive and hopeful about their efficacy as parents due to their newly acquired parenting skills (Degarmo et al., 2004). Another possibility is that simply being involved in a structured program like PMT offers a sense of general hope to parents, causing them to feel less

depressed (Patterson et al., 2004). The same studies reporting these collateral effects also show that improvements in maternal depression are associated with positive child outcomes (Degarmo et al., 2004; Patterson, 1980; Patterson et al., 2004).

### **Maternal Depression and MIXED Children**

As previously mentioned, one main objective of the current study was to investigate whether reductions in parent-child co-rumination during PMT/CBT predict improvements in internalizing and, subsequently, externalizing problems in MIXED children. One possible way to reduce co-rumination in treatment is through improvements in maternal depression. The findings on maternal depression in PMT may be relevant to our discussion on MIXED children because maternal depression has been identified as a factor related to the development and, possibly, treatment of problems in MIXED children and youth (Connell et al., 2008; Ge, Best, Conger, & Simmons, 1996; Grimbos & Granic, 2009; Kopp & Beauchaine, 2003; Yoo et al., 2010). In addition, it is likely that depressed parents co-ruminate more with their children, which means that maternal depression is especially relevant for the etiology and treatment of MIXED children. In particular, hypothesized reductions in co-rumination during PMT/CBT may also be due, in part, to improvements in the mother's depressed status. We proposed that a reduction in co-rumination mediates the relation between improvements in maternal depression and improvements in child functioning in MIXED children (see Figure 1).

Many studies have identified maternal depression as a risk factor for the development of internalizing problems in children (Connell & Goodman, 2002; Goodman & Gotlib, 1999; Hammen & Brennan, 2003; Lee & Gotlib, 1991). The presence of internalizing problems in MIXED children has prompted some researchers to investigate whether maternal depression is a

more important risk factor for this aggressive subgroup, compared to EXT children. Indeed, some studies have shown that MIXED children and youth are more likely than pure externalizers to have depressed mothers (Ge et al., 1996; Grimbos & Granic, 2009; Kopp & Beauchaine, 2003; Yoo et al., 2010). For example, Grimbos and Granic (2009) reported that a higher proportion of mothers of MIXED youth were depressed, compared to mothers of EXT youth. Another study reported higher levels of maternal depression in youth with both conduct disorder and depression; lower levels of maternal depression were reported in youth with conduct disorder only (Kopp & Beauchaine, 2003). The authors found that as the severity of mothers' depression increased, children were more likely to develop their own depressive symptoms. Ge et al. (1996) found that lower levels of maternal warmth and higher levels of hostility (affective parenting dimensions, related to maternal depression) together increased the risk for co-occurrence of conduct disorder and depression in children. These affective parenting dimensions did not increase the risk for developing pure conduct disorder or pure depression (Ge et al., 1996). Overall, these findings suggest that maternal depression may be an important risk factor for the development of problems in MIXED children and youth. Following this, reductions in maternal depression should also affect treatment outcomes in MIXED children and youth.

To date, only one study has investigated whether improvements in maternal depression predict treatment outcomes in MIXED youth (Grimbos & Granic, 2009). Consistent with the expected findings, improvements in maternal depression during Multisystemic Therapy were indeed linked to positive outcomes in MIXED youth (Grimbos & Granic, 2009). Numerous other studies have examined changes in maternal depression as a predictor of treatment outcomes in aggressive children in general (Degarmo et al., 2004; Forman et al., 2007; Modell et al., 2001; Patterson et al., 2004; Shaw, Connell, Dishion, Wilson, & Gardner, 2009; van Loon, Granic, &

Engels, 2011). The results of these studies have been mixed: some studies have demonstrated that reducing maternal depression was related to improvements in children's externalizing problems (Degarmo et al., 2004; Modell et al., 2001; van Loon et al., 2011), while others have failed to find an association (Forman et al., 2007; Lee & Gotlib, 1991). These mixed findings may be due to a failure to distinguish between aggressive subtypes. For example, van Loon et al. (2011) may have found that reductions in maternal depression were associated with treatment outcomes because the majority of aggressive children in the sample had comorbid internalizing problems.

Other studies that have identified maternal depression as a factor related to treatment outcome did not look specifically at aggressive subtypes, but did monitor internalizing changes during PMT and Family Check Up, a family-oriented intervention (DeGarmo, Patterson, & Forgatch, 2004; Shaw et al., 2009). These studies showed that reductions in maternal depression were related to improvements in both internalizing and externalizing symptoms in children. Notably, Grimbos and Granic (2009) reported that, for MIXED youth, reductions in self-reported maternal depression were associated with improvements in clinician-rated child internalizing problems. If changes in maternal depression affect both internalizing and externalizing symptoms, then MIXED children, who exhibit problems in both domains, should achieve better outcomes when maternal depression is reduced. Further, better outcomes are to be expected if, as we demonstrated earlier, the dual focus on internalizing and externalizing behaviour enhances outcomes because changes in one domain (i.e., internalizing) further impact changes in the other (i.e., externalizing). Overall, the research supports the claim that maternal depression is associated with treatment outcomes in MIXED children. There are several possible mechanisms by which reductions in maternal depression are related to treatment success in MIXED children,

including changes in parenting style, discipline practices and depressogenic cognitions (Goodman & Gotlib, 2002). We argue that one way in which reductions in maternal depression impacts on child functioning, particularly internalizing behaviour, is through changes in parent-child co-rumination.

### **Depressed Mothers and Co-Rumination**

It is possible that depressed mothers co-ruminate more with their children. Thus, becoming less depressed during treatment may lead to reductions in co-rumination which, in turn, positively affects child functioning. There are no studies that have investigated co-rumination between depressed parents and children. However, evidence supporting that co-rumination may be more prevalent in dyads with depressed mothers is derived from research on the socialization practices of depressed mothers, namely the socialization of rumination and related constructs (e.g., excessive emotion talk).

Due to higher rates of rumination in depressed individuals (Nolen-Hoeksema, 1991; 1998; Watkins & Brown, 2002), depressed mothers may be more likely to model ruminative behaviours for their children and/or encourage rumination as a coping strategy via direct instruction. Several studies have shown that depressed mothers provide compromised models for their children by exposing them to depressogenic affect, behaviours and cognitions (e.g., learned helplessness; Alloy et al., 2001; Garber & Robinson, 1997). Only one study to date has examined the socialization of rumination by depressed parents (Goldman, 2004). In this study, parents' utilization of rumination was hypothesized to be correlated with adolescent rumination and, further, this correlation was expected to be higher among depressed parents and their children. The results did not support the hypothesis. To explain this, the author speculated that



rumination is a covert cognitive response style that is largely internal and, therefore, not easily observable for children to imitate (Goldman, 2004). Thus, it may be necessary to look at more overt processes akin to rumination, such as when parents excessively discuss negative emotions in response to their child's sad or anxious displays. In general, talking about emotions is an adaptive emotion socialization strategy related to positive adjustment in children (Eisenberg et al., 1998). However, it appears that there may be a threshold over which frequency or intensity of emotion talk predicts negative child outcomes (Denham & Auerbach, 1995; Denham et al., 1997). For example, Denham et al. (1997) found that greater use of guiding and socializing emotion language by parents predicted poorer emotional and social competence in children. Similarly, Zahn-Waxler (2000) suggested that too much emphasis on negative emotions (e.g., sadness, anxiety) during conversation could encourage a child to perseverate on problems, potentially leading to the development of ruminative coping styles. One study that examined depressed parents and emotion talk indeed found that depressed mothers were more likely than non-depressed mothers to repeatedly discuss and over-emphasize negative emotions during emotional discourse with their children (Zahn-Waxler, Ridgeway, Denham, Usher, & Cole, 1993). Unfortunately, few studies have specifically examined the impact of parental depression on frequency of negative emotion talk. Future research should be able to replicate the findings in Zahn-Waxler et al. (1993) because a depressed parent's tendency to dwell on their own feelings and problems should extend to the way in which they respond to their child's feelings and problems.

Depressed parents may also be more likely to talk to their children about their own problems (e.g., ruminate out loud). For example, studies have shown that, when emotionally distressed, depressed mothers frequently expressed worries and problems to and solicited help

from their children (e.g., parentification; Barnett & Parker, 1998; Champion et al., 2009). A mother who ruminates out loud about her own problems can certainly teach a child how to ruminate through modeling, but she may also be pulling a sensitive, responsive child into a co-ruminative exchange. Several studies have demonstrated that children of depressed parents are responsive to their parent's emotional distress (Langrock, Compas, Keller, Merchant, & Copeland, 2002; Murray, Halligan, Adams, Patterson, & Goodyer, 2006; Murray, Woolgar, Briers, & Hipwell, 1999; Radke-Yarrow, Zahn-Waxler, Richardson, Susman, & Martinez, 1994). For example, Langrock et al. (2002) found that children of depressed parents were more likely to ruminate in response to their parents' displays of distress. Further, these authors found that rumination was, in turn, associated with symptoms of depression and anxiety in these children (Langrock et al., 2002). Other studies have shown that children of depressed mothers were more emotionally sensitive than children of healthy mothers (Murray et al., 2006), and that distress in depressed mothers elicited caring behaviours in children (Murray et al., 1999; Radke-Yarrow et al., 1994). Thus, the emotionally sensitive child of a depressed parent may be more likely to participate in conversations about mother's problems as a way to offer support. Through reinforcement processes, the co-ruminative interaction pattern may develop and stabilize.

Taken together, depressed mothers may be more likely to ruminate out loud and intensely discuss emotions in response to their child's, as well as their own, problems and negative feelings. Consequently, children may develop ruminative thinking styles during these interactions and/or they may be more likely to actively participate in co-ruminative conversations with their depressed mothers. The higher prevalence of co-rumination between depressed mothers and their children suggests that changes in maternal depression status during treatment may be related to changes in parent-child co-rumination.

## The Current Study

In summary, we have presented research to show that co-rumination may uniquely characterize interactions between MIXED children and their mothers, and that rates of depression may be higher among mothers of MIXED children. In addition, we have developed a model (refer to Figure 1) and provided some preliminary evidence from past research to suggest that depressed mothers are more likely to co-ruminate with their children, and that parent-child co-rumination may be one mechanism by which depressed mothers transmit internalizing problems to their children. Reductions in parent-child co-rumination during combined PMT/CBT may occur due to improvements in maternal depression during PMT, or they may result from changes in child and parent rumination during CBT and PMT, respectively. We have suggested that these reductions in parent-child co-rumination may alleviate internalizing symptoms in MIXED children; in turn, these internalizing improvements may lead to reductions in externalizing problems (see Figure 1). The current study examined these processes to determine what predicts positive outcomes for MIXED children during PMT/CBT.

## Research Questions and Hypotheses

1. *Are there differences in co-rumination between MIXED children and their parents, compared to EXT children and their parents?*
  - Pre-treatment parent-child co-rumination is hypothesized to be correlated with pre-treatment internalizing problems in children.
2. *Do mothers of MIXED children have higher rates of depression, compared to mothers of EXT children?*
  - Pre-treatment maternal depression is hypothesized to be correlated with pre-treatment internalizing problems in children.

3. *Do depressed mothers engage in more co-rumination with their children at pre-treatment, compared to non-depressed mothers?*
  - Pre-treatment parent-child co-rumination is hypothesized to be correlated with pre-treatment maternal depression.
4. *At pre-treatment, does parent-child co-rumination mediate the association between maternal depression and child internalizing problems?*
  - Pre-treatment parent-child co-rumination is hypothesized to mediate the association between pre-treatment maternal depression and child internalizing problems.
5. *Are reductions in maternal depression during treatment associated with reductions in MIXED children's symptoms?*
  - Improvements in child internalizing symptoms are hypothesized to be associated with reductions in maternal depression over the course of treatment.
  - Improvements in child externalizing symptoms are hypothesized to be associated with reductions in maternal depression over the course of treatment.
6. *Are reductions in parent-child co-rumination during treatment associated with reductions in MIXED children's symptoms?*
  - Improvements in child internalizing symptoms are hypothesized to be associated with reductions in parent-child co-rumination over the course of treatment.

- Improvements in child externalizing symptoms are hypothesized to be associated with reductions in parent-child co-rumination over the course of treatment.

7. *For MIXED children, do changes in co-rumination mediate the association between changes in maternal depression and child internalizing changes?*

- Reductions in co-rumination are hypothesized to mediate the association between reductions in maternal depression and improvements in child internalizing problems in MIXED children.

8. *For MIXED children, what are the pathways by which changes in co-rumination affects changes in child internalizing and externalizing behaviour?*

- Reductions in parent-child co-rumination are hypothesized to lead to improvements in internalizing behaviour which, in turn, will lead to improvements in child externalizing problems.

## **Method**

### **Participants**

The current study is part of a larger collaborative study between Ontario Institute for Studies in Education/University of Toronto and the Hospital for Sick Children, led by Dr.'s Marc Lewis and Isabela Granic. Participants from the larger study were recruited from Child Development Institute (CDI) and Kinark Child and Family Services (Kinark), two community children's mental health agencies administering a treatment program called SNAP<sup>®</sup> (Stop Now and Plan; Earls court Child and Family Centre, 2001a, b; Goldberg & Leggett, 1990). SNAP<sup>®</sup> offers a combination of PMT and CBT for aggressive children (between 6 and 12 years old) and

their families. Children were referred to the program by mental health professionals, teachers, and/or parents. To be included in the study, children had to score within the clinical or borderline-clinical range on the externalizing subscales of parent-report form of the Child Behavior Checklist (CBCL; Achenbach, 1991). Children were excluded from the study if they experienced significant developmental delay and/or resided outside the catchment area of the community agencies. There were 203 families who met eligibility criteria and began study participation. Seventy-six percent of these families ( $n = 154$ ) were MIXED children and 26% ( $n = 49$ ) were EXT children. Of the 203 families, 62 (31%) had missing data at post-treatment: 19 did not the complete treatment sessions, seven refused to complete post-treatment assessment and 36 could not be reached for post-treatment assessment. In addition, 55% of the original sample was missing data at follow-up. When families who were missing data at post-treatment were compared to their non-missing counterparts, results showed marginally higher levels of pre-treatment maternal depression,  $t(202) = 1.70, p = .09$ . Missing families at follow-up did not differ from non-missing families at pre-treatment,  $t(202) = 1.02, p = .31$ , or post-treatment,  $t(135) = 1.21, p = .23$ . Multiple imputation analysis was applied to account for the missing data at post- and follow-up (see below for detailed discussion about treatment of missing data).

## **Procedure**

At the intake stage, children and mothers were informed about the study and invited to participate. Families who agreed to participate were guided through an informed consent procedure. Questionnaires used to gather information about parent and child were administered to parents prior to treatment (pre-treatment), immediately after 3 months of treatment (post-treatment) and 1 year after treatment (follow-up).

Mothers and children were also videotaped during a structured discussion task. Some dyads were videotaped at home and some were videotaped at the laboratory at Ontario Institute for Studies in Education. Videotaped observations took place at pre-treatment, post-treatment and follow-up. In each session, children and their mothers were instructed to engage in a series of three discussions: the first involved discussing a positive topic (i.e., what to do with one million dollars), the second involved a negative topic (recent issue or problem between the mother and child), and the third was another positive discussion. For the purpose of this study, we analyzed mother-child interactions during the negative discussion (six minutes) and the positive discussion (four minutes) that followed. Regarding the negative topic, parents and children were instructed beforehand to fill out a modified version of the *Issues Checklist* (Robin & Weiss, 1980). A research assistant then chose the issue that parent and child agreed was one of their most problematic, anger-provoking topics, which had yet to be resolved. Before beginning the negative discussion, the research assistant stated the following to the dyad:

You will have six minutes for this discussion. Start out by saying how you each see the problem, solve it as best you can, and do your best to end on a positive note. After four minutes, I will knock but not come in. This knock is to let you know that there are two minutes left to solve the problem. I will come back at the end of the six minutes.

For our study, the knock was a particularly important part of the negative discussion because we were interested in examining the extent to which the dyad co-ruminated during the 2-minute segment after the knock. We expected the knock to signal the dyad to start problem-solving; however, continuing to discuss and dwell on problems, with no efforts to solve the problem at this point, would be indicative of co-rumination. We expected that discussing problems during

the positive discussion that followed the negative one would also be indicative of co-rumination. Re-hashing or dwelling on problems when told to have a positive discussion may suggest that the dyad is “stuck” on problems, possibly even carrying them over from the previous negative discussion.

## Measures

The following instruments were administered at pre-treatment, post-treatment and follow-up to assess child internalizing behaviour, externalizing behaviour, maternal depression and sources of conflict between parents and children:

*The Child Behavior Checklist (CBCL;* Achenbach, 1991) is a parent-reported standardized instrument that is widely used to measure children’s emotional and behavioural problems. The instrument contains 3 broadband scales: internalizing, externalizing and total problems. It was designed for use with children between 6 and 18 years old, and includes 118 items scored on a 3-point scale ranging from not true to often true. One-week test-retest reliability correlations are high for both internalizing ( $r = .91$ ) and externalizing ( $r = .92$ ) symptoms, and inter-rater reliabilities range from .57 to .88 (Achenbach & Rescorla, 2001). In addition, the instrument has demonstrated good discriminant and concurrent validity. For example, all items discriminate between referred and non-referred demographically similar children (Achenbach & Rescorla, 2001), and CBCL subscales are correlated with comparable scales from the Conners’ Parent Questionnaire (Sattler, 2002). In the current study, the internal consistency of the CBCL externalizing scale at pre-treatment was  $\alpha = .87$  and the CBCL internalizing subscale at pre-treatment was  $\alpha = .90$ .



*Beck Depression Inventory II (BDI-II*; Beck, Steer, & Brown, 1996) is one of the most widely used instruments for measuring the severity of depressive symptoms in adolescents and adults from clinical and non-clinical populations. The BDI-II consists of 21 items which assess symptoms (e.g., weight loss) and attitudes (e.g., self dissatisfaction) that are rated from 0 (not present) to 3 (very intense). The instrument was specifically based on the diagnostic criteria for depressive disorders in the Diagnostic and Statistical Manual of Mental Disorder, 4<sup>th</sup> edition (DSM-IV; American Psychiatric Association, 1994). A review of the inventory demonstrated a strong correlation between self-reported BDI scores and clinician's perceptions (Beck, Steer, & Garbin, 1988). The BDI-II demonstrates good concurrent validity and test–retest reliability (Beck et al., 1996). Finally, it has been shown that the BDI-II is sensitive to changes in depressive symptoms, and differentiates well between depressed and non-depressed individuals (Richter, Werner, Heerlein, Kraus, & Sauer, 1998). Internal consistency of BDI-II in the current study was  $\alpha = .91$  at pre-treatment.

*Issues Checklist (IC*; Robin & Weiss, 1980) contains a list of common problems or sources of conflict (e.g., cleaning up bedroom, homework) between parents and children. Parents and children, who must fill the questionnaire out independently, are asked to circle *yes* for topics they have discussed during the last 4 weeks, and *no* for topics that have not come up. For each issue marked *yes*, the respondent uses a 5-point Likert scale to indicate how “hot” discussion of the issue is. The issue that both parent and child agree is a “hot” topic is chosen by the research assistant as the topic to be discussed during the structured interaction task.

## **Coding**

Mother-child interactions were coded by a team of three upper-level undergraduate students, blind to the hypotheses of the study, using an adaptation of a co-rumination coding

scheme developed by Rose, Schwartz, & Carlson (2005). The adapted coding scheme included an item asking about the extent to which the dyad engaged in co-rumination (defined as rehashing problems, mutually encouraging problem-talk, speculating about problems and dwelling on negative affect). In addition, we included an item assessing the balance of participation in the co-ruminative exchange to determine if mothers and children contributed equally, or if there was a differential contribution to the ruminative discussion. The coding scheme also consisted of a solution-talk item, asking about the extent to which the dyad talked about solutions and/or whether problem-talk served a constructive purpose (i.e., as a teaching tool; see Appendix A, for coding manual and Appendix B, for coding form). For each 2-minute segment of the 6-minute negative discussion, coders provided global ratings for each item using a 5-point Likert scale: from (1) *not at all* to (5) *very much* for the ruminative problem-talk and solution-talk items, and from (1) *all child* to (3) *equal parent and child* to (5) *all parent* for the balance of participation item. For the co-rumination and solution-talk items, the Likert scale represented the duration of time the dyad spent co-ruminating and talking about solutions, respectively. For the positive discussion, coders provided their global impressions of the entire discussion (without dividing it into segments). The positive discussion was not segmented because we were only interested in whether the dyad talked about problems *at all* during the positive discussion. In addition, only items asking about co-rumination (and not solution-talk) were rated for the positive discussion. The negative discussion was segmented because we were interested in examining the last segment (after the knock) in particular.

Prior to initiating coding, observers were trained (for 4 months) to a minimum intraclass correlation coefficient of .75. Once coding was initiated, reliability of the coding team was evaluated every week, and meetings were held each week to address coders' questions, keep

coders on track with the coding rules and prevent coder drift. Twenty percent of the sessions were randomly selected and coded for reliability. In addition, for quality assurance, a random 20% were spot-checked on a regular basis by the coding supervisor (TG). Coders were blind to which sessions were being spot-checked and which sessions were used to assess inter-rater reliability. Using intraclass correlation coefficients, which are best-suited for ordinal scales (Shrout & Fleiss, 1979), inter-rater reliability analysis was performed to determine the extent to which each coder was consistent with the criterion score (i.e., “gold standard” files coded by TG). Average reliability for each coder ranged from .92 to .96.

### **Parent-Child Co-Rumination**

Co-rumination, based on one item, was defined as re-hashing and speculating about problems, encouraging problem-talk and dwelling on negative affect in a ruminative fashion. Ruminative was defined as having a perseverative focus on a problem, brooding, repeating, over-analyzing, getting “stuck” and going on about a problem with no clear problem-solving agenda. Dyads were rated as more or less co-ruminative depending on the duration of time they spent co-ruminating within a given time period, from (1) *not at all* to (5) *very much* (i.e., the entire time). For our analyses, we used two co-rumination variables: co-rumination after the knock and co-rumination during the positive discussion.

Concurrent validity for co-rumination was assessed by examining correlations between co-rumination before and after the knock with other variables, including ones that were not the primary focus of this study. These variables included: family income, mother’s education, child’s age, mother’s age, child internalizing and externalizing behaviour (child-report, clinician-report and parent-report), maternal depression, parent’s perceived level of stress, co-rumination during the positive discussion, solution-talk and whether a solution was reached. We found

some evidence for concurrent validity based on differential associations between pre- and post-knock co-rumination with some of these other variables. Correlational analyses using pre-treatment variables showed that co-rumination before the knock was significantly associated with child internalizing based on self-report ( $r = .24, p = .04$ ) and solution-talk ( $r = -.31, p = .04$ ). Co-rumination after the knock was significantly correlated with clinician-rated child internalizing behaviour ( $r = .15, p = .03$ ), parent's perception of their own stress ( $r = .17, p = .02$ ), co-rumination during the positive discussion ( $r = .41, p < .001$ ), child's age ( $r = .23, p = .04$ ), mother's education ( $r = -.18, p = .04$ ), solution-talk ( $r = -.55, p < .001$ ) and whether a solution was reached ( $r = -.31, p < .001$ ). Before the knock, everyone was expected to talk about problems, and so it is not surprising that this variable was correlated with fewer variables than post-knock co-rumination. Our post-knock correlations suggested some plausible associations for co-ruminating dyads, namely that they had older children and mothers with lower education and higher levels of perceived stress. In addition, dyads who co-ruminated more after the knock also engaged in more co-rumination during the positive discussion and were less likely to discuss and arrive at a solution.

### **Solution-talk**

Solution-talk, also based on one item, was defined as introducing, negotiating and talking about the benefits of certain solutions, discussing the implementation of solutions, as well as back-up plans and past solutions. Solutions were defined as strategies, plans, directives, rules and ways to change behaviour. The solution-talk variable also considered the extent to which the dyad engaged in constructive problem-talk. This included discussing problems with the purpose of advancing forward towards a solution, for example, discussing problems as a teaching tool or as a springboard into solution-talk. Dyads were rated as more or less engaging in solution-talk

depending on the duration of time they spent discussing solutions within a given time period, from (1) *not at all* to (5) *very much* (i.e., the entire time). For the solution-talk variable, we calculated the average solution-talk score across all three segments of the negative discussion.

### **Classification Criteria**

Children were deemed MIXED if, at pre-treatment, they scored at or above the borderline clinical cutoff ( $T=60$ ) on the externalizing scale of the CBCL *and* scored at or above the clinical cutoff ( $T=60$ ) on the internalizing scale of the CBCL. EXT children were those with scores at or above the borderline clinical cutoff ( $T=60$ ) on the CBCL externalizing scale at pre-treatment *and* scores below the clinical cutoff ( $T=60$ ) on the CBCL internalizing scale at pre-treatment.

### **Data Analytic Plan**

To ensure that MIXED and EXT children were similar on demographic dimensions, group differences were assessed by conducting chi-square analyses (for categorical measures) and one-way Analysis of Variance (ANOVA) tests (for continuous measures) on age, gender, ethnicity, living arrangement, income and mother's education. To address the first three research questions, bivariate correlations were performed to examine associations between initial levels of co-rumination, maternal depression and internalizing problems.

Structural Equation Modeling (SEM) techniques were used to investigate research questions four to eight. For research question four, path analysis was conducted to estimate the mediating effects of co-rumination on the relation between maternal depression and child internalizing behaviour at pre-treatment. Path analysis allows for the simultaneous testing of direct effects (as in multivariate regression) and indirect or mediated effects between variables. An applied SEM technique called latent change score (LCS) models was used to examine the

remaining research questions concerning change during treatment (see McArdle, 2001; Selig & Preacher, 2009). In LCS, individual differences in change are explicitly represented in the model, making it ideal for estimating intra-individual change as well as individual differences in within-individual change. LCS models also account for autoregressive effects in that latent change scores for a particular variable (including scores at a given time point, for example Time 2) are a function of the effect of that variable at the previous time. Finally, LCS is an ideal method to use when change is expected to differ across measurement occasions. In the current study, we expected pre- to post- change to differ from post- to follow-up change. Of note, one of the main distinctions between LCS models and Latent Growth Curve models (LGCM) is that the growth curve in LGCM is consistent across all measurement occasions. For questions five and six, bivariate LCS models were run to investigate whether changes in an independent variable (i.e., maternal depression, parent-child co-rumination) predicted changes in child behaviours (i.e., child internalizing and externalizing behaviours). For questions seven and eight, we ran multivariate LCS models in order to analyze the interrelations among three variables (e.g., longitudinal mediation model in question seven). Model fit for path analyses was assessed via change in chi-square and degrees of freedom, as well as root mean squared error of approximation (RMSEA; Browne & Cudeck, 1993), Comparative Fit Index (CFI; Bentler, 1990) and Normed Fit Index (NNFI; Bentler & Bonett, 1980). SEM analyses were performed using LISREL 8.3 (Joreskog & Sorbom, 2001) with maximum likelihood method of estimation.

### **Treatment of Missing Data**

Several participants did not complete post- and follow-up assessments. The rate of missing data averaged 29% for outcome variables at post-treatment (29% missing for CBCL, 31% missing for BDI and observational data). At 1-year follow-up, 55% were missing CBCL

and observational data and 57% were missing BDI data. Due to the higher rates of missing information, we conducted multiple imputation (Rubin, 1987) procedures using SPSS version 17 in order to maximize our sample size. In addition, multiple imputation was used to ensure that our analysis would not be based solely on individuals who completed treatment, which could bias our results. Multiple imputation methods have been shown to produce the most efficient parameter estimates for normally distributed and slightly skewed data when data are missing completely at random (Graham, Hofer, & MacKinnon, 1996). Further, imputation is carried out separately from data analysis. This allows variables that are not included in the analyses (but that may be predictive of missingness) to be part of the imputation model, thus strengthening the accuracy of the multiple imputation analysis (Schafer & Graham, 2002). Results reported in this paper were from 8 imputed datasets that were combined using Rubin's (1987) rules. Where possible, we compared the results from the original, non-imputed dataset with the pooled results from the imputed datasets. Pooled and original data showed a similar pattern of findings (e.g., both datasets showed reductions in child symptoms from pre- to post- to follow-up). However, statistical significance was not always met when we conducted analyses using the original dataset; this was likely due to the small sample size, particularly at follow-up. Unfortunately, we were unable to compare pooled and original dataset results for any of the LCS models because Structural Equation Modeling requires a larger sample with data available at all time points.

## **Results**

### **Demographic Results**

Demographic information for the full sample is provided in Table 1. We also compared EXT and MIXED children on the demographic characteristics. ANOVA tests revealed that MIXED children were significantly older than EXT children,  $F(1, 202) = 4.27, p = .04$ . In

addition, chi-square analysis indicated that there was a larger proportion of MIXED families with incomes under \$19,999, and a larger proportion of EXT families with incomes higher than \$40,000,  $\chi^2(3, N = 203) = 11.68, p = .009$ . There were no differences between the two aggressive subtypes with respect to gender, race/ethnicity, marital status, child living status and mother's education.

### **Pre-treatment Results**

Results are presented below for the first four hypotheses which were concerned with pre-treatment factors, including interrelations among these factors, and their association with pre-treatment problems in MIXED children. Pre-treatment correlations between all variables of interest for the full sample are presented in Table 2. Notably, co-rumination (during the positive discussion) is reported in Table 2 because this particular variable was consistently associated with other pre-treatment variables. Co-rumination (after the knock) was not related to pre-treatment variables.

**Hypothesis 1: Association between child internalizing and maternal depression.** To investigate whether mothers of MIXED children had higher rates of depression than mothers of EXT children, we conducted bivariate correlation analysis on the full sample to examine the association between child internalizing and maternal depression. Results indicated a significant positive association between maternal depression and child internalizing behaviour (see Table 2).

**Hypothesis 2: Association between child internalizing and parent-child co-rumination.** To examine whether MIXED children engaged in more co-rumination with their mothers, compared to EXT children, we ran bivariate correlations on the full sample to examine the association between child internalizing and parent-child co-rumination. Results did not yield a significant association between child internalizing behaviour and co-rumination after the



knock; however, a significant positive association was found between child internalizing behaviour and co-rumination during the positive discussion (see Table 2). When we controlled for solution-talk to investigate the unique variance accounted for by co-rumination (see Table 2, for significant correlations between co-rumination and solution-talk), the association between child internalizing behaviour and parent-child co-rumination during the positive discussion remained statistically significant,  $r(196) = .15, p = .05$ .

**Hypothesis 3: Association between maternal depression and parent-child co-rumination.** In order to examine whether depressed mothers engaged in more co-rumination with their children, compared to less depressed mothers, we ran bivariate correlations on the full sample to examine the association between maternal depression and parent-child co-rumination. There was no significant correlation between maternal depression and co-rumination after the knock; however, a significant positive association was found between maternal depression and co-rumination during the positive discussion (see Table 2). This association remained significant when we controlled for solution-talk,  $r(191) = .22, p = .002$ .

**Hypothesis 4: Statistical mediation of co-rumination.** To test whether, at pre-treatment, parent-child co-rumination statistically mediated the relation between maternal depression and child internalizing behaviour, we compared three path analysis models: a direct effects model, a partially-mediated model and a fully-mediated model. The direct effects model included direct paths leading from maternal depression to parent-child co-rumination<sup>2</sup> and to child internalizing. The partially-mediated model included a direct path from maternal depression to child internalizing, as well as the indirect path from maternal depression to child internalizing through parent-child co-rumination. The fully-mediated model included the indirect

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<sup>2</sup> We analyzed parent-child co-rumination (during the positive discussion) because of significant correlations between this variable and both maternal depression and child internalizing problems.

paths only. Parent-child co-rumination would be indicated as a mediator if the fully-mediated model provided the best fit.

Concerning the direct effects model, each of the specified paths was statistically significant, and the overall model fit the data well,  $\chi^2(1, N = 196) = 1.65, p = .20$ ; RMSEA = .06; NFI = .95; CFI = .98. The partial mediation model was fully saturated and thus provided a perfect fit with the data. Notably, in this model, the pathway from co-rumination to child internalizing was not significant ( $\beta = .09, p = ns$ ). The fully-mediated model failed to provide an adequate fit with the data,  $\chi^2(1, N = 196) = 18.23, p < .001$ ; RMSEA = .30; NFI = .50; CFI = .48. When we compared the direct effects and the partial mediation model, there was no significant difference between the two models,  $\Delta\chi^2 \text{ difference}(1) = 1.65, p = .20$ . Thus, on the basis of parsimony (Loehlin, 1992), the direct effects model provided the better fit (see Figure 2). This result fails to support the hypothesis that co-rumination mediates the relation between maternal depression and child internalizing problems. Instead, maternal depression is independently and significantly related to child internalizing problems and parent-child co-rumination.

We also tested another set of three models in order to examine whether maternal depression mediated the relation between parent-child co-rumination and child internalizing problems. Here, the direct effects model did not provide an adequate fit with the data,  $\chi^2(1, N = 196) = 18.22, p < .001$ ; RMSEA = .30; NFI = .50; CFI = .48. The partial mediation model provided a perfect fit as it was fully saturated, and the fully-mediated model provided a good fit with the data,  $\chi^2(1, N = 196) = 1.65, p = .20$ ; RMSEA = .06; NFI = .95; CFI = .98. A comparison of the partially- and fully-mediated models revealed a non-significant difference between them,  $\Delta\chi^2 \text{ difference}(1) = 1.65, p = .20$ . Thus, the fully-mediated model provided the best fit, indicating that maternal depression mediates the relation between parent-child co-rumination and

child internalizing problems (see Figure 3). The total effect of parent-child co-rumination on child internalizing behaviour was  $\beta = .16$  (direct effect:  $\beta = .09$ , indirect effect:  $\beta = .07$ ).

### **Changes Associated with Treatment**

In the following section, we present our results regarding the association between changes in maternal depression and parent-child co-rumination and changes in child behaviour over the duration of treatment and follow-up. Results were not significant when we analyzed the relation between changes in co-rumination during the positive discussion and changes in other variables. As a consequence we only present analyses for the measure of co-rumination based on after the knock. Before presenting our findings, we report changes associated with treatment in the following variables for MIXED and EXT children: child externalizing symptoms, child internalizing symptoms, maternal depression and parent-child co-rumination (see Table 3, for pre-, post- and follow-up means and standard deviations). Change across treatment was analyzed using linear mixed models<sup>3</sup> in order to account for repeated measures within individuals. For each aggressive subgroup, we examined change from pre- to post, change from pre- to follow-up and change from post- to follow-up.

**Externalizing behaviour.** Both MIXED and EXT children showed pre- to post-improvements in externalizing behaviour across treatment,  $\beta = 5.28$ ,  $t(154) = 4.67$ ,  $p < .001$  for MIXED and  $\beta = 4.03$ ,  $t(49) = 2.19$ ,  $p = .03$  for EXT. Similarly, pre- to follow-up changes were also significant for both aggressive subgroups. However, changes in externalizing behaviour differed between the two subgroups from post- to follow-up. Specifically, MIXED children showed continued externalizing improvements from the end of treatment to the follow-up

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<sup>3</sup> Because we analyzed multiply imputed datasets, pooled estimates reported for linear mixed model (repeated measures) analyses were regression coefficients and corresponding t statistics.

assessment,  $\beta = 2.93$ ,  $t(154) = 2.96$ ,  $p < .001$ , whereas EXT children did not show significant improvements,  $\beta = .80$ ,  $t(49) = 0.45$ ,  $p = .65$  (see Figure 4).

**Internalizing behaviour.** MIXED children showed internalizing improvements from pre- to post-treatment,  $\beta = 5.30$ ,  $t(154) = 4.56$ ,  $p < .001$ , from pre- to follow-up,  $\beta = 9.01$ ,  $t(154) = 14.31$ ,  $p < .001$ , and from post- to follow-up,  $\beta = 3.71$ ,  $t(154) = 3.11$ ,  $p < .001$ . For EXT children, parents indicated that they did not show any internalizing changes from pre- to post-treatment. In addition, EXT children demonstrated a significant increase in internalizing symptoms from pre- to follow-up,  $\beta = -4.23$ ,  $t(49) = -3.39$ ,  $p < .001$ , and from post- to follow-up,  $\beta = -3.84$ ,  $t(49) = -1.98$ ,  $p = .05$  (see Figure 5).

**Maternal depression.** Mothers of MIXED children demonstrated significant reductions in depressive symptoms from pre- to post-treatment,  $\beta = 4.38$ ,  $t(154) = 2.92$ ,  $p = .01$ , and from pre- to follow-up,  $\beta = 7.09$ ,  $t(154) = 7.66$ ,  $p < .001$ . Despite these initial and overall improvements, mothers of MIXED children did not show significant reductions in depressive symptoms from post- to follow-up,  $\beta = 2.71$ ,  $t(154) = 1.50$ ,  $p = .17$ . Mothers of EXT children did not demonstrate significant reductions in depression from pre- to post-treatment, nor did they show reductions from post- to follow-up. However, it was found that mothers of EXT children improved in their depressive symptoms from pre- to follow-up,  $\beta = 3.09$ ,  $t(49) = 2.54$ ,  $p = .01$  (see Figure 6).

**Parent-child co-rumination.** Both aggressive subgroups fared similarly with respect to changes in parent-child co-rumination across treatment. For both MIXED and EXT children, there was no significant change in parent-child co-rumination after the knock across treatment (see Figure 7). For parent-child co-rumination during the positive discussion, there was an

increase from pre- to follow-up for both subtypes:  $\beta = -.15$ ,  $t(154) = -.234$ ,  $p = .02$  (MIXED) and  $\beta = -.21$ ,  $t(49) = -2.48$ ,  $p = .02$  (EXT) (see Figure 8).

In general, for MIXED children, child internalizing, externalizing and maternal depression symptoms improved across treatment and follow-up; however, parent-child co-rumination increased when we examined co-rumination during the positive discussion. The next step was to take a closer look at what contributed to these changes, particularly child symptom changes, by examining various relations between changes in variables during and after treatment.

**Hypothesis 5: The association between changes in maternal depression and changes in child behaviour.** Bivariate LCS models were run in order to examine whether, across treatment, changes in maternal depression predicted changes in child emotional and behavioural problems. Latent change scores are defined in structural equation models (McArdle & Nesselroade, 1994). The following equation represents the latent difference in variable  $Y$  between time  $t - 1$  and time  $t$ :

$$Y_t = (1)Y_{t-1} + (1)\Delta Y_t$$

The equation for  $Y_t$  contains no error term and the coefficients representing associations between  $Y_t$  and  $Y_{t-1}$  and  $Y_t$  and  $\Delta Y_t$  are constrained to one. As a result,  $Y_t$  is the direct sum of  $Y_{t-1}$  and  $\Delta Y_t$ , and  $\Delta Y_t$  can be used as any other latent variable in a model.

First, we ran models investigating the impact of maternal depression changes on internalizing changes. To examine the causal hypothesis that pre- to post- reductions in maternal depression will predict post- to follow-up reductions in child internalizing problems, we originally tested a model that included 10 latent variables. These variables included six latent variables representing maternal depression and child internalizing at each of the time points: pre-treatment (Time 1), post-treatment (Time 2) and one year follow-up (Time 3). In addition, the

model included four latent change score variables: maternal depression change from Time 1 to Time 2 ( $mdep\Delta12$ ), maternal depression change from time 2 to time 3 ( $mdep\Delta23$ ), internalizing change from Time 1 to Time 2 ( $int\Delta12$ ) and internalizing change from Time 2 to Time 3 ( $int\Delta23$ ). A pathway was specified whereby we directly measured a causal association between these two variables, namely the impact of maternal depression changes from Time1 to Time 2 on child internalizing changes from Time 2 to Time 3 ( $mdep\Delta12 \rightarrow int\Delta23$ ). Results of the bivariate LCS analysis did not support the hypothesis that earlier maternal depression was related to later child internalizing.

Our next model tested whether longer term (e.g., from beginning of treatment to one year follow-up) changes in maternal depression were associated with longer term changes in child internalizing behaviour. This model included 6 latent variables: two latent change score variables and four latent variables representing maternal depression and child internalizing at two time waves: pre-treatment and one year follow-up. The two latent change score variables were maternal depression change from Time 1 to Time 3 ( $mdep\Delta13$ ) and internalizing change from Time 1 to Time 3 ( $int\Delta13$ ). We specified a pathway between the two latent change variables to examine the association between pre- to follow-up changes in our two variables of interest ( $mdep\Delta13 \rightarrow int\Delta13$ ). Results showed that this pathway was significant,  $\beta = .88$ ,  $p = .02$ , indicating an association between concurrent changes in both variables: pre- to follow-up improvements in maternal depression were correlated with pre- to follow-up reductions in child internalizing behaviour (see Figure 9).

To examine the impact of maternal depression changes on externalizing changes, we ran a set of models similar to the ones described above, replacing internalizing with externalizing behaviour as the dependent variable. Much like the findings on internalizing outcomes, we did

not find that pre- to post- changes in maternal depression impacted on post- to follow-up changes in child externalizing behaviour. When we ran our next model investigating the relation between the pre- to follow-up changes, a marginally significant pathway was found,  $\beta = .46$ ,  $p = .08$ , indicating that pre- to follow-up reductions in maternal depression tended to be related to pre- to follow-up reductions in child externalizing behaviour.

**Hypothesis 6: The association between changes in parent-child co-rumination and changes in child behaviour.** Bivariate LCS models were run in order to examine whether, across treatment, changes in parent-child co-rumination predicted changes in child emotional and behavioural problems. These models were set up identically to the ones used for the previous hypothesis, only parent-child co-rumination replaced maternal depression as the independent variable. Similar to the findings from our previous hypothesis, we were unable to establish a significant causal relation between changes in parent-child co-rumination and changes in child behaviour. In other words, results did not show that pre- to post- changes in co-rumination impacted on post- to follow-up changes in child internalizing, nor did they support the expectation that pre- to post- changes in co-rumination would impact on post- to follow-up changes in child externalizing behaviour. However, when we investigated the association between longer term changes in our variables of interest, we did find a significant relation between pre- to follow-up reductions in parent-child co-rumination and pre- to follow-up reductions in child externalizing behaviour,  $\beta = .68$ ,  $p = .04$  (see Figure 10). This finding indicates an association between concurrent reductions in co-rumination and child externalizing behaviour. Results did not demonstrate a significant association between pre- to follow-up reductions in co-rumination and pre- to follow-up reductions in child internalizing behaviour.

The results from our bivariate analysis indicated that co-rumination decreases were concurrently associated with child externalizing improvements during and after treatment. In addition, improvements in maternal depression from the beginning of treatment to follow-up were concurrently related to decreases in child internalizing behaviour; maternal depression improvements were marginally related to decreases in externalizing behaviour. Our next goal was to better understand processes by which maternal depression reductions were associated with changes in child behaviour. As such, using a multivariate LCS model, we investigated changes in parent-child co-rumination as a potential mediator. This was followed by our final multivariate analysis, which examined the effect of co-rumination change on internalizing and then externalizing outcomes. This final analysis would allow us to better understand the processes related to positive child outcomes in PMT/CBT.

**Hypothesis 7: Co-rumination as mediator in longitudinal mediation model.** LCS modelling techniques were applied to test whether changes in parent-child co-rumination mediated the relation between changes in maternal depression and changes in child internalizing behaviour (see Figure 11, for LCS model). This longitudinal mediation model included 15 latent variables: six latent change score variables and nine latent variables representing each of the three variables at each time wave, for example, maternal depression at Time 1 (mdep1), parent-child co-rumination at Time 2 (crum2) and child internalizing problems at Time 3 (int3). The six latent change score variables included: maternal depression change from Time 1 to Time 2 (mdep $\Delta$ 12), maternal depression change from time 2 to time 3 (mdep $\Delta$ 23), co-rumination change from Time 1 to Time 2 (crum $\Delta$ 12), co-rumination change from Time 2 to Time 3 (crum $\Delta$ 23), internalizing change from Time 1 to Time 2 (int $\Delta$ 12) and internalizing change from Time 2 to Time 3 (int $\Delta$ 23). There were six mediation pathways that were also represented in our LCS



model, as depicted by dashed arrows. These mediation pathways were:  $mdep1 \rightarrow crum2 \rightarrow int3$ ,  $mdep1 \rightarrow crum\Delta12 \rightarrow int\Delta23$ ,  $mdep\Delta12 \rightarrow crum\Delta12 \rightarrow int\Delta23$ ,  $mdep\Delta12 \rightarrow crum2 \rightarrow int3$ ,  $mdep\Delta12 \rightarrow crum\Delta23 \rightarrow int\Delta23$ , and  $mdep\Delta12 \rightarrow crum\Delta23 \rightarrow int3$ . Due to limited availability of parameters to estimate, we ran two models with each model estimating three mediation pathways. Indirect mediation effects were estimated, as were individual paths within the mediation pathways (e.g., from  $mdep1 \rightarrow crum2$ ).<sup>4</sup>

Results of our LCS analysis indicated no significant indirect effects for the six mediation pathways. Analysis of paths within the mediation pathways revealed that maternal depression changes did not predict changes in co-rumination, nor did changes in co-rumination predict internalizing outcomes (see Table 4).

Given the previous findings showing a stronger relation between externalizing changes and changes in co-rumination, we ran an LCS model with externalizing as the outcome variable (replacing internalizing behaviour in the original model). Similar to findings from the previous model with internalizing behaviour as outcome, parent-child co-rumination did not emerge as a mediator, nor were there any significant paths representing the impact of maternal depression on co-rumination. There was, however, one significant pathway representing the effect of parent-child co-rumination on externalizing outcomes. Namely, decreases in co-rumination from Time 2 to Time 3 predicted lower levels of externalizing behaviour at Time 3,  $\beta = 1.33, p = .05$ . Marginally significant pathways were also found: lower levels of parent-child co-rumination at Time 2 marginally predicted lower levels of externalizing behaviour at Time 3,  $\beta = 1.42, p = .06$ , and there was a trend towards decreases in co-rumination from Time 2 to Time 3 being related to decreases in externalizing behaviour from Time 2 to Time 3,  $\beta = .93, p = .09$  (see Table 4).

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<sup>4</sup> This model is known as a “half-longitudinal” mediation model because, due to a limited number of time waves, the model included some concurrently measured variables (e.g.,  $crum\Delta23 \rightarrow int\Delta23$ ).

These results provided some evidence for a possible causal relation between co-rumination and child externalizing, particularly that reductions in co-rumination from post- to follow-up predicted less child externalizing behaviour at follow-up.<sup>5</sup> Due to the inclusion of maternal depression change in this model, the impact of co-rumination on externalizing behaviour was above and beyond any potential effect that maternal depression change may have had on child externalizing outcomes.

**Hypothesis 8: Pathways through which internalizing change affects externalizing outcomes.** LCS modelling techniques were used to examine our hypothesis that changes in co-rumination across treatment would impact changes in internalizing behaviour which, in turn, would impact externalizing outcomes. For this particular model, mediational processes between the three variables (parent-child co-rumination, internalizing and externalizing behaviour) were of less interest. Although mediation pathways were specified in this model, individual pathways (e.g., from co-rumination to internalizing) were examined, with a particular emphasis on pathways that represented the impact of internalizing changes on externalizing outcomes. The following pathways were included in the model:  $\text{crum1} \rightarrow \text{int2} \rightarrow \text{ext3}$ ,  $\text{crum1} \rightarrow \text{int}\Delta 12 \rightarrow \text{ext}\Delta 23$ ,  $\text{crum}\Delta 12 \rightarrow \text{int}\Delta 12 \rightarrow \text{ext}\Delta 23$ ,  $\text{crum}\Delta 12 \rightarrow \text{int2} \rightarrow \text{ext3}$ ,  $\text{crum}\Delta 12 \rightarrow \text{int}\Delta 23 \rightarrow \text{ext}\Delta 23$ , and  $\text{crum}\Delta 12 \rightarrow \text{int}\Delta 23 \rightarrow \text{ext3}$  (see Figure 12).

Findings from the LCS model did not indicate that co-rumination changes significantly influenced internalizing changes; however, there was some evidence that changes in internalizing behaviour had an impact on changes in externalizing behaviour. Internalizing reductions from Time 2 to Time 3 predicted less externalizing behaviour at Time 3 (see Table 5). This finding

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<sup>5</sup> Notably, in LCS, the score for a particular variable at a given time point (e.g., externalizing at follow-up) is a function of the previous score for that variable (e.g., externalizing at pre-treatment). Similarly, post-treatment externalizing would be a function of pre-treatment externalizing.

suggested that child internalizing reductions following the end of treatment had a causal impact on externalizing behaviour at 1-year follow-up.

## **Discussion**

The current study aimed to understand the role of maternal depression and parent-child co-rumination in the development and treatment of internalizing and externalizing problems in MIXED children. This was the first study to examine parent-child co-rumination in the context of treatment and the first to look at co-rumination in depressed mothers. In addition, this was the first investigation of co-rumination between parents and younger children. Although parent-child co-rumination did not emerge as a mediator explaining how maternal depression impacts child internalizing behaviour, our study nonetheless yielded some important findings regarding the development and treatment of problems in MIXED children. In particular, our findings indicated that maternal depression was associated with both child internalizing problems and levels of parent-child co-rumination at pre-treatment. During treatment, improvements in maternal depression were associated with improvements in child internalizing problems. In addition, we found evidence suggesting that when parent-child co-rumination decreased, so too did child externalizing behaviour. Finally, our results suggested that improvements in child internalizing problems positively affected child externalizing outcomes. Below is a detailed discussion of our findings. We first discuss some of the differences that were found between MIXED and EXT children. Then, we discuss factors related to the development of problems in MIXED children, followed by a discussion concerning factors and processes related to MIXED children's outcomes over the course of treatment and follow-up.

## **Distinct Aggressive Subgroups**

The current study identified some important differences between MIXED and EXT children with respect to demographics, pre-treatment status and changes in behaviour during and after treatment. Concerning demographics, MIXED children were older and had lower income levels, compared to EXT children. The latter finding in particular suggested that MIXED children may come from riskier socio-economic backgrounds. In addition, at pre-treatment, it was found that MIXED children had higher externalizing symptoms than EXT children, which supports some of the existing research demonstrating that MIXED children and youth present as more “clinical” than their non-internalizing counterparts (Capaldi & Stoolmiller, 1999; Oland & Shaw, 2005). Regarding changes during treatment, both MIXED and EXT children showed reductions in externalizing behaviour during treatment. MIXED children continued to show reductions in externalizing behaviour until 1-year follow-up, whereas EXT children did not. These continued improvements for MIXED children may have been due to the fact that they were still quite impaired at post-treatment (slightly more so than EXT children), and so there were greater improvements to be made.

Regarding internalizing changes, we found that internalizing problems worsened by follow-up for EXT children, while MIXED children made improvements across treatment and follow-up. Internalizing increases in EXT children may have been a result of various processes occurring during treatment. One possibility is that being in treatment caused children to reflect on past and present aggressive behaviours, perhaps leading to feelings of guilt, remorse or anxiety about these behaviours. Participation in group therapy may have enabled EXT children’s mothers (who reported on child symptoms) to be more attuned to their children’s distress, and so they may have been able to more readily identify these internalizing changes in their children.

Changes in mother's depressive symptoms also differed between the two aggressive subgroups. MIXED children's mothers, with their higher levels of depression from the start, showed pre- to post- and pre- to follow-up reductions in depressive symptoms. Although EXT mothers showed overall improvements (i.e., from pre- to follow-up), they did not demonstrate the same initial improvements (i.e., from pre- to post-treatment) as did mothers of MIXED children. Overall, these results indicated that MIXED and EXT children differed on several dimensions, including how they presented before treatment, as well as how they fared during and after treatment (Grimbos & Granic, 2009). These differences provided further support for the distinction between the two aggressive subgroups and, moreover, strengthened the impetus to understand some of the unique factors and processes contributing to the development and treatment of problems in MIXED children.

### **Factors Associated with Pre-Treatment Child Behaviour in MIXED children**

Our study sought to examine maternal depression and parent-child co-rumination as factors related to the development of problems in MIXED children. One way to address this was by investigating the relations between these variables before treatment had begun. Initially, results of the independent tests supported our hypotheses that maternal depression and co-rumination were each associated with child internalizing problems, and that maternal depression was related to parent-child co-rumination at pre-treatment. However, a more detailed story emerged when we examined how these variables were interrelated with one another. Namely, co-rumination did not mediate the association between maternal depression and child internalizing problems, nor was it associated with child internalizing behaviour, when controlling for maternal depression. Maternal depression, however, remained independently positively associated with child internalizing problems and parent-child co-rumination. Overall, these

findings supported other research showing that maternal depression plays a critical role in the emotional and social development of children. For one, the findings confirmed a plethora of research indicating maternal depression as a key factor related to the development of child internalizing problems (Goodman, 2007; Hammen & Brennan, 2003; Lee & Gotlib, 1991; Wickramaratne & Weissman, 1998). Moreover, these results were consistent with other research demonstrating high rates of depression in mothers of MIXED children (Ge et al., 1996; Grimbos & Granic, 2009; Kopp & Beauchaine, 2003). Our findings also indicated that depression in mothers was associated with the parent-child interaction (e.g., co-rumination) itself, supporting the literature showing that maternal depression has an impact on parent-child dynamics (Dietz et al., 2008; Hammen, Burge, & Stansbury, 1990; Lovejoy, Graczyk, O'Hare, & Neuman, 2000).

At pre-treatment, parent-child co-rumination did not mediate the relation between maternal depression and child internalizing problems. This null finding may be because co-rumination was more associated with maternal depressive symptoms than child symptoms at pre-treatment. The stronger link with maternal symptoms may reflect pre-existing dynamics whereby mothers contributed more to ruminative conversations as a result of the inherent power differential within the parent-child relationship. For example, when discussing problems, mothers may have been more likely to initiate, lead, prompt and speculate, while children were more likely to follow along and/or humour their mother, with little qualitative engagement. As such, co-rumination may be more related to the mothers' symptoms because they engaged more and were also more affected by the ruminative conversation. The finding that parent-child co-rumination was more associated with maternal symptoms has been replicated in Waller (2005) who demonstrated that parent-child co-rumination was no longer related to youth internalizing problems when controlling for maternal depression.

Depressed mothers appear to have contributed more to the co-ruminative exchange at pre-treatment, which is potentially why co-rumination did not emerge as a mediator in our pre-treatment analysis. It is also important to mention that other factors, not examined in our study, may be more crucial mediators explaining how maternal depression impacts child internalizing problems. For example, several studies have identified parenting practices, maternal stress and genetic factors as important mediators explaining this relation (Dawson et al., 2003; Essex, Klein, Cho, & Kalin, 2002; Hilsman, 2001). Many studies have also found that various parent-child processes (e.g., hostile interactions, interactions characterized by negative affect) played a mediating role linking maternal depression to child internalizing problems (Foster et al., 2008; Goodman, 2007; Goodman & Gotlib, 1999; Hops, 1996; Sheeber, Hops, & Davis, 2001).

In sum, although we did not establish that co-rumination was a mediator at pre-treatment, our results suggested that maternal depression is important for children's social and emotional development, including a positive association with child internalizing symptoms and with levels of co-rumination. The former association has been well-established in the literature, and the latter is part of a growing area of research suggesting that the impaired behaviour of a depressed mother affects the way in which she interacts with her child. The next objective of this study was to investigate changes in behaviour during treatment, including an analysis of factors and processes related to behavioural and emotional outcomes in MIXED children.

### **Factors Associated with Treatment Outcomes in MIXED Children**

**Changes in child, maternal and dyadic behaviours.** In general, we found that MIXED children's symptoms were reduced during PMT/CBT. These findings were in line with research demonstrating improvements in internalizing and externalizing behaviour in MIXED children and youth during family-based treatment programs, including PMT (Beauchaine et al., 2000;

Costin & Chambers, 2007; Kazdin & Whitley, 2006) and CBT (Flannery-Schroeder, Suveg, Safford, Kendall, & Webb, 2004; Kendall, Brady, & Verduin, 2001; Levy, Hunt, & Heriot, 2007). It is important to mention that, although reductions in externalizing symptoms were substantial, MIXED children remained above the borderline-clinical range ( $T > 60$  on CBCL externalizing subscale) at 1-year follow-up. Indeed, MIXED children started off severely impaired in their externalizing behaviour and, as such, it may take some time before reaching sub-clinical levels. This may be especially true in family-based treatment programs where changes in processes within the family system take time to influence one another (Degarmo et al., 2004). Since MIXED children were generally on a downward slope between all time waves, it is possible that they would have eventually made it below clinical levels at additional follow-up assessments. On the other hand, it may also be that PMT/CBT was not maximally effective in treating externalizing problems in children. Notably, the EXT group also did not make it below clinical levels at follow-up.

The collateral reductions in maternal depression during treatment echoed the results from studies that have reported a similar effect during PMT (Degarmo et al., 2004; Patterson et al., 2004; van Loon et al., 2011), as well as in other family-based treatment programs (e.g., the Family Check-Up; Connell et al., 2008; Dishion et al., 2008; Shaw et al., 2009). Researchers have hypothesized that many aspects of PMT may contribute to these improvements in mothers' depressive symptoms. For example, van Loon et al. (2011) suggested that learning how to problem-solve more effectively during PMT may have contributed to reductions in mothers' depressive or anxious feelings. In addition, it has been suggested that the sense of mastery and self-efficacy that mothers gain during PMT led to improvements in their depressive symptomatology (Degarmo et al., 2004; Patterson et al., 2004). It is also possible that, due to



anger management training during PMT, mothers may have learned to minimize or gain control of other negative feelings aside from anger, such as anxiety or depression. Related to the treatment program in general, it may also be that seeing improvements in children's symptoms contributed to feelings of hopefulness, happiness and reduced negativity and anxiety in mothers. Moreover, seeing their children improve during treatment may have encouraged and motivated mothers to work on their own problems. Indeed, more research is needed to unravel the various processes, occurring during treatment, which may result in depressive symptom reductions in mothers.

The findings concerning changes in co-rumination did not support our expectation that co-rumination would decrease across treatment. In fact, increases in co-rumination were found when we examined co-rumination during the positive discussion. Parent-child co-rumination may have increased because mothers and children engaged in more self-reflection during treatment, for example, thinking more extensively about their problems, speculating and trying to understand their feelings, behaviours and issues. With each dyad member reflecting more on their own across treatment, the two of them together may have been more likely to engage and reinforce each other, perpetuating an extensive reflection and discussion about problems (i.e., co-rumination). It is also possible that co-rumination increased because parent-child relationships grew stronger during treatment. Although we have primarily focused on the negative implications of co-rumination (e.g., association with internalizing problems), many researchers have found that individuals who co-ruminated together reported a close, high-quality relationship (Rose et al., 2007; Waller & Rose, 2009). In PMT and other family-based programs, the goal to restructure and build parent-child relationships is often met, leading to improvements in family

relationships over the course of treatment. Thus, when family relationship quality improved, co-rumination--a process linked to close, strong relationships--may have also increased.

Overall, child and maternal symptoms improved during and after treatment, suggesting that PMT/CBT is a promising program for MIXED children and their families. Despite these generally positive outcomes, still, above-clinical levels in externalizing behaviour at follow-up suggested that there is some room for improvement with respect to the effectiveness of this program on externalizing problems in children. To better understand what contributed to successful child outcomes, we investigated whether changes in maternal depression and parent-child co-rumination predicted improvements in externalizing and internalizing behaviour in MIXED children.

**Changes in maternal depression and child outcomes.** The current study yielded some support for the hypothesis that changes in maternal depression would have an impact on changes in child outcomes. We found that, for MIXED children, pre- to follow-up reductions in maternal depression were associated with pre- to follow-up reductions in child internalizing problems; the relation between maternal depression changes and child externalizing changes did not reach statistical significance. The findings regarding internalizing outcomes were in line with other research demonstrating the association between maternal depression improvements and reductions in child internalizing problems (Beardslee, Wright, Gladstone, & Forbes, 2007; Clarke et al., 2001; Compas et al., 2009; Patterson et al., 2004; Shaw et al., 2009; Weissman et al., 2006), specifically in MIXED children and youth (Grimbos & Granic, 2009). There are several possible explanations for this effect. For one, children's mood may be enhanced or feelings of anxiety reduced when they observed mothers becoming less depressed during treatment. Another possibility is that, through modelling processes, children may have learned

new coping strategies for depression or anxiety that mothers had acquired over the course of treatment. In addition, new-found positive affect in mothers may have influenced children to behave similarly through modelling and/or contagion processes. It may even be that alleviations in maternal depression positively influenced other kinds of parent-child dynamics (e.g., hostile interactions), thereby impacting the child's own depressive or anxious symptoms. Since we did not find evidence for a causal effect, it is also possible that child internalizing symptoms affected mothers' symptoms. For example, mothers may have become happier, relieved and/or less worried when their children achieved positive changes in their depressive or anxious symptoms. Of course, it is also possible that the relation between maternal depression and child internalizing problems may have been bidirectional, whereby maternal and child symptoms both influenced each other (e.g., Sameroff, 1995).

Similar to the results of other studies that have reported a null or marginal association between maternal depression improvements and child externalizing outcomes (Compas et al., 2009; Forman et al., 2007; Lee & Gotlib, 1991), our study found a weak association between changes in maternal depression and changes in child externalizing behaviour. To explain this result, we suggest that it may take some time before changes in maternal depression affected changes in child externalizing problems. One reason for lagged effects between these variables could be because of the nature of the mediating processes that have been proposed to explain the relation. Proposed processes, including improvements in parenting practices, child internalizing behaviour and reductions in marital/family conflict (Ashman, Dawson, & Panagiotides, 2008; Patterson et al., 2004; Grimbos & Granic, 2009), may take time to unfold and affect child externalizing symptoms, or they may not occur at all. Similarly, it has been suggested that externalizing behaviour is less responsive to changes in maternal depression because of its

relation to a longer history of maladaptive parent-child interactions (Foster et al., 2008). Child internalizing problems, on the other hand, may be more closely tied to depressive symptoms in mothers, as well as to changes in these symptoms. Some of the candidate processes described above explaining the relation between maternal depression changes and child internalizing changes, including positive affect contagion or modelling, suggest a more proximal relation between these two variables. Perhaps a larger time-frame would have revealed an eventual association between maternal depression changes and changes in child externalizing behaviour in our study.

**Changes in co-rumination and child outcomes.** Our expectation about the impact of reductions in parent-child co-rumination on internalizing outcomes was not supported. We did, however, find evidence of a concurrent association between pre- to follow-up reductions in co-rumination and pre- to follow-up reductions in child externalizing problems. This finding indicated that, in addition to the possibility that changes in co-rumination affected child externalizing changes, it may also be the case that changes in child behaviour affected changes in parent-child co-rumination. For example, with fewer externalizing problems over the course of treatment, dyads may have had less problems or issues about which to ruminate. In addition to these concurrent associations, we also established a more time-based relation between these two variables, whereby reductions in parent-child co-rumination appeared to be driving externalizing outcomes. Possible interpretations for the association between parent-child co-rumination changes and child externalizing outcomes, including our time-based results, are discussed below.

We did not distinguish between anger and sadness/anxiety co-rumination, and so the finding that co-rumination was linked to externalizing problems could be because we were measuring more of anger co-rumination, a process potentially linked to aggression. Anger co-

rumination may also be more prevalent than sadness/anxiety co-rumination in our sample because the children were primarily referred for their aggressive problems. Research has demonstrated that rumination, including anger rumination, is linked to aggression in children and youth (Langrock et al., 2002; Miers et al., 2007; Peled & Moretti, 2007; Repper, 2006). Concerning co-rumination, a small number of studies have investigated the association between co-rumination and aggression (Hankin, Stone, & Wright, 2010; Tompkins, Hockett, Abraibesh, & Witt, 2011), and there is some preliminary evidence indicating a relation between these variables (Tompkins et al., 2011). For example, in a recent study, Tompkins et al. (2011) found that co-rumination between peers was significantly correlated with self-reported aggression in 146 adolescents. Researchers seeking to understand the link between aggression and rumination have proposed that the emotional content of the rumination (e.g., ruminating on sadness or ruminating on anger) determines the development of internalizing or externalizing problems (Peled & Moretti, 2007). Our co-rumination measure focused on general negative emotions, and did not parse out the specific types of emotions. It would have been interesting to examine the specific content of emotions that were discussed in order to get a clearer picture as to whether it was anger co-rumination or co-rumination in general that related to child externalizing problems in our study.

During the SNAP<sup>®</sup> anger management program, children may also gain cognitive strategies, akin to ruminating less, which they bring into their discussions about problems with their mothers. For example, children may be learning to let go of and control negative thoughts and feelings, distract themselves and engage in more effective problem-solving during treatment. These newly-learned strategies, which are effective in reducing aggression, may influence interactions to be less co-ruminative, thus explaining why we found that reductions in co-

rumination led to positive externalizing outcomes. Strategies learned in the SNAP<sup>®</sup> program were intended to help children, referred primarily for aggression, deal with their anger and manage aggressive behaviour. Also, children were taught directly how to apply these strategies to anger-inducing situations (e.g., Stop Now and Plan), and so it makes sense the co-rumination affected changes in externalizing behaviour. In addition, because the program's focus was on anger management, these children were likely not explicitly instructed on how to apply these strategies to anxiety- or depression-inducing situations. Therefore, it may take longer for them to have generalized or applied their new-found cognitive strategies to internalizing-inducing situations, which could explain why we did not find an association between co-rumination changes and internalizing changes.

We propose another explanation as to why we did not find an association between changes in co-rumination and changes in child internalizing behaviour in our study. Perhaps the null findings were due to conflicting effects whereby some families showed reductions in internalizing behaviour when parent-child co-rumination decreased, while others showed reductions in internalizing when parent-child co-rumination increased. Although the existing research suggests a positive association between co-rumination and internalizing behaviour, all of these studies used normative samples. It may be that our clinical sample of aggressive children differed from these normative samples in that some children in our study experienced positive feelings in response to increases in co-rumination during treatment. Ample research has shown that aggressive children have impaired relationships with parents (Patterson, Reid, & Dishion, 1992; Waschbusch, 2002), and so these co-rumination increases could be a sign of closeness or an improved bond for some families. As a result, some children may have

experienced an elevated mood or less anxiety because they appeared to be building a relationship with their parent.

Another interpretation of why co-rumination changes were not related to internalizing changes relates to the fact that our sample consisted mainly of boys. Because the link between co-rumination and child internalizing behaviour has been implicated in girls more so than in boys (Rose, 2002; Rose et al., 2007), the absence of an association between changes in these variables in our study may be due to the large proportion of boys in our sample. Unfortunately, since the subsample of girls was so small, we were unable to conduct any additional models exploring the possibility that co-rumination changes mediated the relation differently for boys and girls.

### **Processes Associated with Treatment Outcomes in MIXED Children**

**Changes in co-rumination as mediator of child outcomes.** Thus far, we have demonstrated that decreases in mother's depressive symptoms were related to decreases in child internalizing and, to a lesser degree, child externalizing behaviour. When we examined whether changes in parent-child co-rumination mediated these relations, results failed to support our hypothesis of co-rumination as a mediator during treatment. Although our longitudinal mediation hypothesis was not supported, examination of individual pathways within our model revealed important information about separate associations between variables, including some clues towards understanding why co-rumination did not emerge as a mediator. For one, it was in our longitudinal mediation model that we found evidence for the time-based relation between changes in co-rumination and child externalizing, but not internalizing outcomes. In addition, a closer look at the individual pathways revealed that the null mediation effect may have been due, in part, to the fact that changes in maternal depression did not impact changes in co-rumination, as we had originally hypothesized. Instead, changes in co-rumination during treatment appeared

to be driven by factors other than maternal depression. One possibility is that these changes were the result of factors linked to changes in the child, a finding that differs from our pre-treatment results which indicated a stronger link between maternal depression symptoms and parent-child co-rumination. During treatment, the child may have an increasing influence on levels of co-rumination as they become more deeply involved in therapy. As they undergo treatment, children may be engaging in more reflection about their problem behaviours--trying to understand their problems and perhaps even thinking of ways to resolve them. As a result, they may become more interested and invested in discussions about their problems with their mothers, thus influencing the discussions to be more or less ruminative. Similar to our point made earlier, children may also be gaining new cognitive strategies during treatment, and they are exercising these strategies during problem discussions with their mothers. For example, a child who has learned new problem-solving strategies may be inclined to demonstrate those strategies during interactions with his or her mother, thus contributing less rumination to their discussion about problems. It is noteworthy that changes in co-rumination may not be entirely attributable to changes in the child. Although co-rumination changes were not affected by changes in maternal depression per se, we cannot discount the possibility that co-rumination may also have been influenced by cognitive changes in mothers as a result of anger management training during treatment.

We must acknowledge that the null effect of maternal depression changes on changes in co-rumination may have been due to the short time period (e.g., 3 months) in which we measured the association between these variables. Perhaps this was not enough time to evidence an association between maternal depression changes and parent-child co-rumination changes. This interpretation is in line with Degarmo et al. (2004), who posited that changes in behaviours and



in reinforcement schedules within the family system should take longer, compared to changes within individuals.

Finally, other mechanisms, aside from changes in parent-child co-rumination, may better explain how reductions in maternal depression impact child outcomes. For example, a recent study by Foster et al., (2008) examined various family processes as mediators explaining how changes in maternal depression during psychopharmacological intervention impacted child and youth functioning. The authors found that improvements in parenting strategies (e.g., increased warmth and acceptance towards her child) mediated the relation between remission of maternal depressive symptoms and reductions in child and youth internalizing problems (Foster et al., 2008).

Overall, we found that co-rumination changes did not mediate the association between maternal depression changes and child outcomes. Rather, we found evidence that processes, other than maternal depression, may have been driving the changes in co-rumination which impacted externalizing outcomes. More specifically, we have suggested that co-rumination changes may be due, in part, to changes in the child during treatment (e.g., cognitive changes).

**The impact of internalizing changes on externalizing outcomes.** Our next multivariate model hypothesized that co-rumination changes would impact internalizing changes, and that these internalizing changes would further affect child externalizing outcomes. Results of this analysis indicated, once again, that changes in co-rumination were not related to child internalizing changes. However, an important result did emerge from this model, namely that internalizing improvements from post-treatment to follow-up positively influenced child externalizing outcomes at follow-up in MIXED children. This time-based effect is similar to the

results in Degarmo et al. (2004) who reported that child internalizing reductions mediated the effect of PMT on child externalizing symptoms. In addition, this finding is consistent with other research demonstrating that reductions in internalizing symptoms were related to reductions in externalizing behaviour during treatment for aggression in children (Griest et al., 1982; Lewis et al., 2008; Weiss et al., 2003). Perhaps the alleviation of depressive or anxious symptoms in children during treatment may have caused them to feel more motivated, energized or simply more optimistic, propelling them to make positive changes in their externalizing behaviour. Similarly, changes in one area of problems may result in children gaining a sense of mastery or confidence about their abilities to improve their symptoms, thus leading to further changes in their behaviour. Overall, the positive impact of internalizing improvements on externalizing outcomes, together with the finding that both types of symptoms were reduced during PMT/CBT, indicated that a dual focus on symptoms may, in fact, lead to enhanced outcomes in MIXED children (Chase & Eyeberg, 2008; Degarmo et al., 2004).

### **The Positive Side of Co-rumination**

Although we have conceptualized co-rumination in terms of its negative implications (e.g., the link with depression and anxiety), the positive side of co-rumination deserves some discussion. Traditionally, co-rumination has been studied as an interpersonal process with trade-offs: it is related to the development of internalizing psychopathology, but also to positive relationship quality and feelings of closeness with others (Rose, 2002). These positive implications may be relevant when interpreting some of our findings. For example, in our study, we consistently found that co-rumination decreases were not related to decreases in child internalizing behaviour, as originally hypothesized. Similarly, we were unable to establish that decreases in maternal depression were related to reductions in co-rumination. These null effects

could be because co-rumination, as it relates to better relationship quality, may have had a positive effect on internalizing symptoms for some families. Earlier, we discussed the possibility that some aggressive children may have experienced decreases in internalizing symptoms when co-rumination increased due to feeling better about improved relationships with parents. In addition to explaining the null relations with internalizing problems, the general increases in co-rumination during treatment could also be explained with the positive benefits of co-rumination in mind. Co-rumination increases during and after treatment may have simply reflected improving relationship bonds during PMT/CBT. In sum, we believe that it is necessary to draw attention to the positive benefits of co-rumination as it is pertinent to explaining some of the findings in the current study that were contrary to what we had expected.

### **Measurement Issues**

In our study, co-rumination during the positive discussion and co-rumination after the knock were used for pre-treatment and change analyses, respectively. This was because co-rumination during the positive discussion was more strongly linked to pre-treatment variables, and co-rumination after the knock was more strongly linked to variables as they changed across treatment. It is important to discuss why we believe the two co-rumination variables related differently to the pre-treatment and change results. Co-rumination during the positive discussion may have best captured the mother-led ruminative discussions at pre-treatment. This is because bringing up problems during the positive discussion was often initiated by one dyad member, likely a more dominant member (i.e., mother) who was able to steer the conversation. Further, the substantial topic change (e.g., from positive to problem) suggested that the individual who initiated may have been especially distressed and bothered by the problem they re-hashed. Our study identified a link between maternal depression and co-rumination at pre-treatment. Co-

rumination after the knock, on the other hand, may have been a good window into a more equal, balanced co-ruminative exchange. This allowed us to capture the increasing role of the child in the interaction, including their contribution as well as the degree to which they were affected by the interactions. We believe that co-rumination after the knock was more representative of an equal exchange because the dyad was explicitly instructed to mutually contribute to the problem discussion. Moreover, the dyad discussed a problem that they mutually agreed was problematic, and so they may have been more equally invested and interested in talking about the problem.

Overall, we believe that co-rumination at pre-treatment was less balanced in terms of mother and child contribution, and so co-rumination during the positive discussion was better-suited for identifying this imbalance at pre-treatment. During treatment, the increasing role of the child in the interaction was best captured when we examined co-rumination after the knock, a variable that potentially required more mutual input into the ruminative discussions.

## **Limitations**

In spite of the promising findings, this study is limited by a number of factors that require some discussion. First, data were lost at post-treatment and more so at follow-up due, in part, to attrition. Although multiple imputation methods were used to enhance sample size at these later time points, multiple imputation still has its limitations, particularly in treatment studies. In treatment studies, families who are not doing well may be more likely to drop out of treatment. Thus, available data may be biased because it represents the more positive outcomes of those that stayed in treatment. It should be noted, though, that we implemented strategies suggested by Graham (2009) in order to reduce the effects of attrition bias. For example, we used several important auxiliary variables (variables correlated with variables in the substantive model) in the

multiple imputation model to get the clearest picture of patterns of missingness. It is also important to mention that we lost 55% of our sample at follow-up. Although this number certainly increases bias in parameter estimates for imputed datasets, we increased the number of imputed datasets to counteract this bias (Graham, Olchowski, & Gilreath, 2007).

Another limitation concerns the fact that we did not compare our sample to a control group as our research was interested in understanding developmental and treatment processes within a specific aggressive subgroup in a “real world” setting. Although this is one of the strengths of our study, it also serves as a limitation that we did not conduct a randomized control trial, rendering it difficult to demonstrate definitively whether the treatment caused reductions in child problems, maternal depression and parent-child dynamics.

A major strength of our study was the application of LCS techniques to examine longitudinal relations between variables. However, due to a limited number of time points, we could only test “half-longitudinal models” for all longitudinal models with more than two variables (e.g., our longitudinal mediation model). Half-longitudinal models include concurrent relations between some variables in the model, often because there are not enough time points available to capture all hypothesized longitudinal relations (Cole & Maxwell, 2003). In such models, one cannot conclude causal relations between the variables that are measured concurrently. In addition, the use of half-longitudinal models may explain why we did not find a longitudinal mediation effect, for example, there were too few time points available for this particular longitudinal process to unfold. Related to concurrent associations, our finding that pre- to follow-up changes in maternal depression were associated with pre- to follow-up changes in child internalizing behaviour also indicates an association between concurrent changes, thus limiting our ability to assert causal associations between these variables. From these results, we

cannot conclude whether maternal depression changes impacted internalizing changes, whether internalizing changes impacts changes in maternal depression, or whether there is a bidirectional relation between these two variables.

Our results were also limited by the fact that a disproportionate amount of time passed between pre- and post- (three months) and between post- and follow-up (one year). Changes between these time points have different meanings, and so this might be one reason why most of our time-based effects were identified between pre- to follow-up and from post- and follow-up—more time had passed between these time points for changes to occur. Furthermore, given the short time span between pre- and post-treatment, the effects found later on may reflect lagged effects of changes that occurred during this 3-month treatment period.

Another limitation concerns the assessment of child and parent psychopathology based solely on parent reports. Research has indicated that depressed mothers have a tendency to over-report emotional symptoms in their children (Goodman et al., 2011). As such, we cannot discount the possibility that the strong relation identified between maternal depression and child internalizing was partially due to the fact that mothers reported on both their children's, as well as their own, internalizing symptoms. In addition, it would have been optimal to assess child and parent outcomes and classify aggressive subtypes based on information from multiple raters (e.g., children, teachers, peers). By using multiple raters, a more complete picture of emotional and behavioural problems across different contexts could be obtained. However, it is noteworthy that bias due to shared method variance was reduced in the current study because parent-child co-rumination was assessed using observer-reports.

Finally, there are some limitations with respect to our measurement of parent-child co-rumination. Since we did not establish validity for our co-rumination measure, we acknowledge the difficulty in concluding whether our instrument captured the construct well. Furthermore, our measurement strategies may not have been ideal for capturing co-ruminative processes. For example, the measurement strategy for one of our co-rumination variables was based on a discrete threshold (i.e., the knock) after which talking about problems was deemed excessive because the dyad was explicitly instructed to try and resolve the problem. Measurement of our other co-rumination variable was based on the idea that ruminating about problems when instructed to engage in a positive discussion was indicative of re-hashing, dwelling or being “stuck” on a problem. Instead, there may be more suitable ways to measure co-ruminative processes and the point at which talking about problems becomes excessive, dwelling or ruminative. Dynamic systems methods, for example, would be highly useful for examining the evolution of co-rumination during a discussion and the extent to which a dyad becomes increasingly entrenched in a co-ruminative exchange (Bukowski, Adams, & Santo, 2006; Granic & Patterson, 2006).

## **Conclusion**

Overall, we have demonstrated some encouraging findings regarding outcomes for MIXED children and their mothers in PMT/CBT. Specifically, we have shown that child internalizing and externalizing symptoms improved during treatment, and that mother’s depressive symptoms improved as well. Importantly, these improvements were maintained after treatment had ended. Although externalizing behaviour remained above-clinical at follow-up, we speculated that changes in family processes were set in motion, and that externalizing problems in MIXED children may have eventually reached below-clinical levels. Co-rumination

increased during treatment; however, this may have positive implications. For example, increases in co-rumination may have represented more reflection about problems and maladaptive behaviours and/or the development of closer bonds between children and parents. At pre-treatment, maternal depression was linked to child internalizing symptoms and with levels of parent-child co-rumination. The former substantiated a large body of literature showing that depressed mothers tend to have children who are also depressed. The latter confirmed research on the influence of maternal depression on parent-child interactions. In particular, our results suggested that depressed mothers may ruminate aloud during conversations with their children, particularly at pre-treatment when problems and distress are at their peak. During treatment, changes in maternal depression continued to be closely linked to changes in child internalizing problems. A causal association was not established, and so we proposed that the relation may be bidirectional whereby decreases in mother's symptoms affected child internalizing changes and vice versa. Changes in maternal depression were weakly linked to changes in child externalizing problems. Again, due to the nature of the mediating processes hypothesized to link these two variables, more time may have been required in order to observe the effect of these variables on one another. Despite our results indicating that improvements in maternal depression were related to improvements in child symptoms, we did not find evidence that reductions in maternal depression affected changes in parent-child co-rumination. Instead, we speculated that children may have become increasingly involved in parent-child discussions about problems as they underwent treatment, developing an interest in understanding their behaviours and problems. As such, changes in parent-child co-rumination may have been partially affected by changes in the child, including changes in cognition acquired during CBT.



We also found evidence that these co-rumination changes impacted child externalizing outcomes, but not internalizing outcomes. The link with externalizing outcomes was in line with the fact that we studied an aggressive sample who were in a treatment program geared towards targeting aggressive symptoms. In addition, the relation between co-rumination changes and externalizing changes was consistent with our previous suggestion that child cognitive changes, effective for reducing aggression, influenced parent-child co-ruminative interactions. Further, we speculated that we may have been measuring anger co-rumination, a process linked to aggression in children. Finally, we found evidence suggesting that improvements in internalizing problems positively impacted externalizing outcomes in MIXED children. This interesting finding, combined with the dual focus on internalizing and externalizing symptoms achieved during PMT/CBT, may explain the enhanced outcomes (e.g., large externalizing reductions) in this aggressive subgroup.

### **Future Directions and Clinical Implications**

For future research, it is important to elucidate the relation between maternal depression and child symptomatology. This includes gaining a better understanding of the causal links between changes in maternal depression and changes in child internalizing and externalizing behaviour. A causal analysis can be accomplished by using a longitudinal design with a greater number of time points and sufficient time intervals in between time points. Researchers may also need to study the mediating processes by which maternal depression changes are associated with child symptom changes, including an investigation of other parent-child processes that are correlated with problems in both children and parents (e.g., poor problem-solving). In addition, research still needs to uncover how changes in parent and child symptoms during treatment are related to one another, for example, do improvements in maternal depression lead to reductions

in child internalizing behaviour, which then predict reductions in externalizing behaviour? It is important to continue to examine parent-child co-rumination as it relates to the development and treatment of adult and child psychopathology; however, it may be necessary to use alternative measurement strategies to better capture the co-ruminative process (e.g., using dynamic systems methods). It may also be interesting to measure other important treatment processes such as cognitive changes (e.g., decreases in rumination) or perceptions about treatment (e.g., how parent/child feels about seeing their child/parent get better during treatment). This would help illuminate processes, occurring during treatment, that contribute to specific outcomes in parents and children. For example, studying cognitive changes in mothers could provide a clearer picture as to why mothers' depressive symptoms are reduced during treatment. Finally, we recommend that future studies distinguish anger co-rumination from sadness/anxiety co-rumination in aggressive samples in order to determine if this process is linked to the development and treatment of problems in aggressive children.

Regarding clinical implications, our results will help inform clinicians on how to best tailor treatment to suit the needs of MIXED children and their families. Specifically, in addition to targeting child externalizing symptoms, clinicians may need to focus on alleviating depressive symptoms in both MIXED children and their mothers. One way to target internalizing symptoms in children and parents is by teaching coping strategies for dealing with depression/anxiety (e.g., improve problem-solving, reduce rumination). It may also be effective to explicitly show parents and children who are in treatment programs for aggression how to apply certain anger-management strategies to depressive/anxious situations. Finally, clinicians may want to emphasize changing maladaptive parent-child interpersonal processes that are related to the development of internalizing and externalizing problems. By targeting both

internalizing and externalizing symptoms, optimal outcomes may be achieved for MIXED children.

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## Tables

**Table 1**  
*Age, Gender, Race, Parent Marital Status, Child Living Status,  
 Mother's Education and Household Income for Full Sample*

Demographic variable	Full sample (N=203)
Age (SD)	9.37(1.28)
Gender (%)	
Male	82
Female	18
Race (%)	
European/White	80
African/Caribbean-Canadian	14
Asian-Canadian	0.5
Latin American-Canadian	2
Native-Canadian	0.5
Mixed ethnicity	3.5
Parent marital status (%):	
Married or common-law	55.5
Separated or divorced	20
Single	21
Other (e.g., widowed)	3.5
Child living status (%):	
Both biological parents	30
Adoptive parents	6
One biological parent + step parent	17
Mother only	37
Joint custody	2.5
Other (e.g., grandparents)	7.5
Mother's education (%):	
Grade 8 or less	2
Some high school-did not graduate	15
Graduated from high school	26
Graduated from community college	32
Graduated from university	12
Post-graduate or professional degree	8
Other	5
Household income (%):	
Under \$19,999	22
Between \$20,000 and \$39,999	20
Between \$40,000 and \$59,999	19
\$60,000 or more	39



Table 2  
*Pre-Treatment Correlations Among Main Variables*

Variable	1	2	3	4	5	6
1. Child externalizing	-					
2. Child internalizing	<b>.54***</b>	-				
3. Maternal depression	<b>.35***</b>	<b>.34***</b>	-			
4. Co-rumination (after knock)	.02	.00	.03	-		
5. Co-rumination (positive)	<b>.16*</b>	<b>.16*</b>	<b>.23**</b>	.03	-	
6. Solution-talk	-.06	<b>-.15*</b>	<b>-.17*</b>	<b>-.55***</b>	<b>-.15*</b>	-

*Note.* \*  $p < .05$ . \*\*  $p < .01$ . \*\*\*  $p < .001$ . Significant  $p$ -values are in bold.

Table 3  
*Pre-, Post- and Follow-up Means and Standard Deviations for Child, Parent and Dyadic Variables*

Measure	Means and Standard Deviations			F/t
	Full sample (N=203)	MIXED (n=154)	EXT (n=49)	
Externalizing (CBCL)				
Pre-treatment	72.39 (5.83)	73.73 (5.23)	68.24 (5.70)	39.04*
Post-treatment	67.41 (11.58)	68.44 (13.12)	64.20 (11.61)	1.93 <sup>†</sup>
Follow-up	65.00 (6.61)	65.51 (6.39)	63.40 (6.57)	1.94*
Internalizing (CBCL)				
Pre-treatment	64.78 (9.17)	68.95 (5.33)	51.82 (5.84)	365.83*
Post-treatment	60.84 (13.16)	63.59 (14.61)	52.21 (11.54)	4.66*
Follow-up	58.96 (7.79)	59.88 (7.71)	56.05 (7.71)	3.02*
Maternal depression (BDI)				
Pre-treatment	14.07 (9.86)	15.53 (9.91)	9.63 (8.33)	13.85*
Post-treatment	10.29 (22.85)	11.25 (22.40)	7.26 (11.24)	2.36*
Follow-up	8.08 (4.96)	8.54 (5.22)	6.64 (3.96)	2.36*
Parent-child co-rumination (after knock)				
Pre-treatment	1.81 (1.08)	1.81 (1.05)	1.82 (1.19)	0.00
Post-treatment	1.79 (2.27)	1.78 (2.43)	1.81 (2.39)	0.01
Follow-up	1.92 (1.23)	1.92 (1.22)	1.92 (1.40)	0.01
Parent-child co-rumination (positive)				
Pre-treatment	1.12 (.45)	1.15 (.50)	1.04 (.20)	0.40
Post-treatment	1.20 (2.53)	1.25 (2.33)	1.04 (1.67)	0.25
Follow-up	1.29 (.63)	1.30 (.67)	1.25 (.53)	0.62

*Note.* CBCL=Child Behavioural Checklist; BDI=Beck Depression Inventory. All post- and follow-up means and standard deviations are pooled estimates from 8 multiply imputed datasets (pooled estimates reported for variable when > 15% of data is missing). F and t statistics refer to comparison between MIXED and EXT subgroups; t statistics are reported for pooled differences in lieu of F statistic.

<sup>†</sup>  $p < .10$ . \*  $p < .05$ .

Table 4  
*Parameter Estimates for Pathways from the Latent Change Score Mediation Models:  
 Internalizing and Externalizing Outcomes*

Pathways	Parameter estimate	95% Confidence interval, t-statistic
Internalizing as outcome:		
co-rumination2 → internalizing3	0.83	[-1.24 to 2.89], 0.92
co-ruminationΔ12 → internalizingΔ23	0.02	[-1.45 to 1.48], 0.03
co-ruminationΔ23 → internalizingΔ23	0.44	[-1.08 to 1.96], 0.69
co-ruminationΔ23 → internalizing3	0.98	[-0.94 to 2.81], 1.18
Externalizing as outcome:		
co-rumination2 → externalizing3	1.42	[-0.20 to 3.19], 1.90 <sup>†</sup>
co-ruminationΔ12 → externalizingΔ23	0.72	[-0.63 to 2.06], 1.26
co-ruminationΔ23 → externalizingΔ23	0.93	[-0.28 to 2.26], 1.65 <sup>†</sup>
co-ruminationΔ23 → externalizing3	1.33	[0.02 to 2.84], 2.07*

*Note.* Results are based on pooled estimates and standard errors from 8 multiply imputed datasets [using Rubin's (1987) rules].

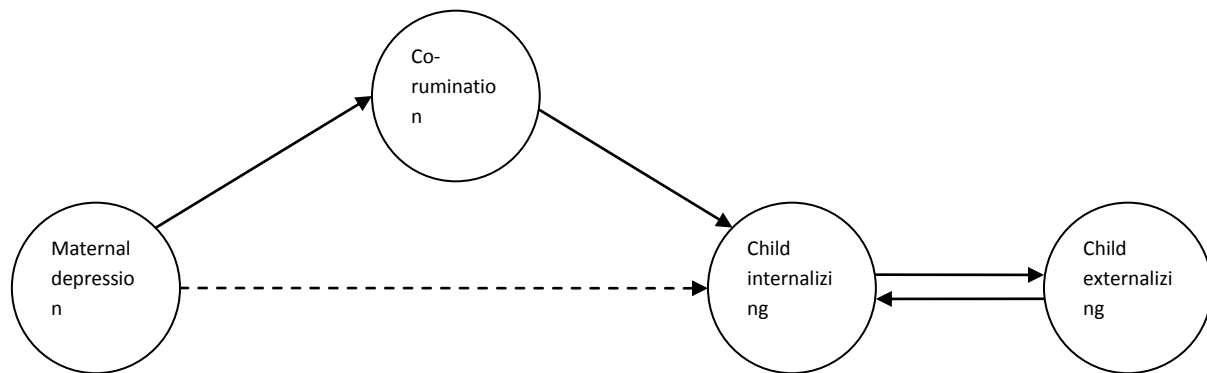
<sup>†</sup>  $p < .10$ . \*  $p < .05$ .

Table 5  
*Parameter Estimates for Pathways from the Latent Change Score Models: Internalizing Predicts  
 Externalizing*

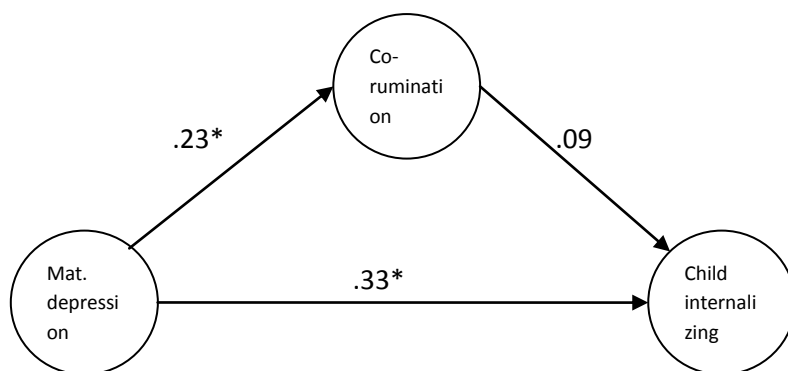
Pathways	Parameter estimate	95% Confidence interval, t-statistic
internalizing2 → externalizing3	0.39	[-0.13 to 0.92], 1.77
internalizingΔ12 → externalizingΔ23	0.05	[-0.47 to 0.58], 0.23
internalizingΔ23 → externalizingΔ23	0.22	[-0.28 to 0.72], 1.02
internalizingΔ23 → externalizing3	0.49	[0.02 to 0.96], 1.96*

*Note.* Results are based on pooled estimates and standard errors from 8 multiply imputed datasets [using Rubin's (1987) rules].

<sup>†</sup>  $p < .10$ . \*  $p < .05$ .

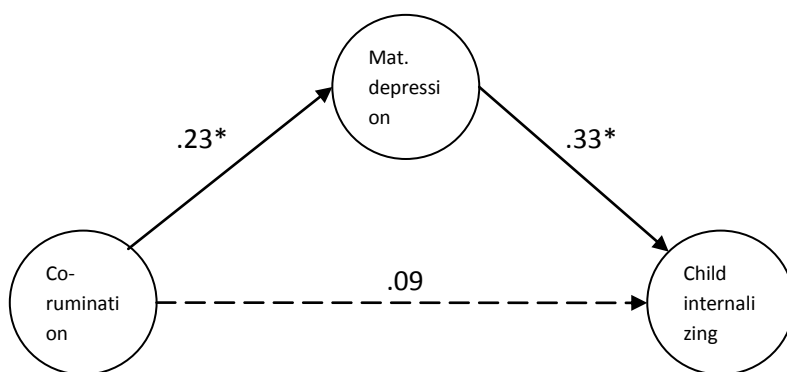
**Figures**

*Figure 1.* Model depicts hypothesized interrelations between: Maternal depression, parent-child co-rumination, child internalizing and child externalizing problems. Model encompasses both static interrelations (at pre-treatment) and time-based interrelations (changes across treatment). Dashed line represents hypothesized mediation effect.



*Figure 2.* Parent-child co-rumination not a significant mediator: pre-treatment model.

\*  $p < .05$ .



*Figure 3.* Maternal depression as mediator: pre-treatment model.

\*  $p < .05$ .

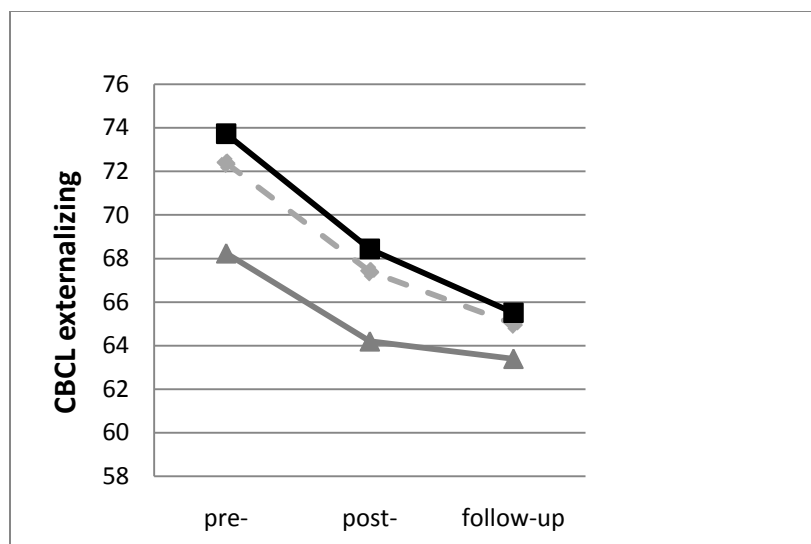


Figure 4. Parent-rated child externalizing behaviour across treatment by subgroup.

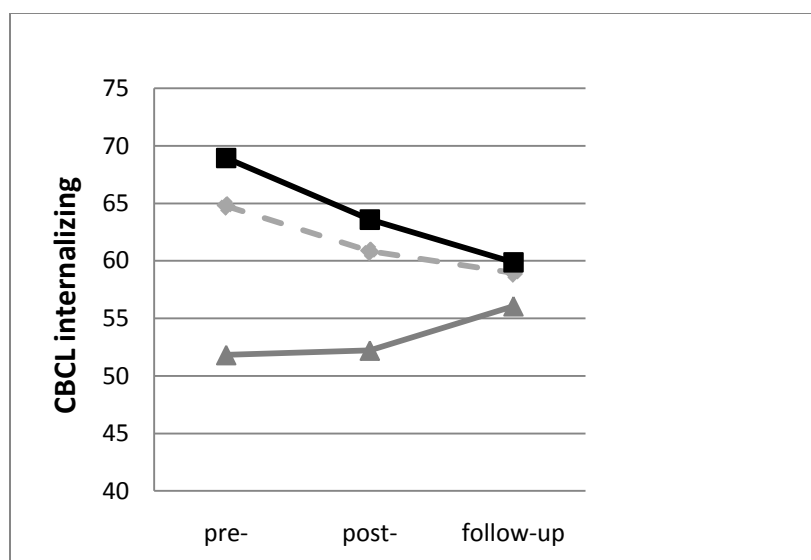


Figure 5. Parent-rated child internalizing behaviour across treatment by subgroup.

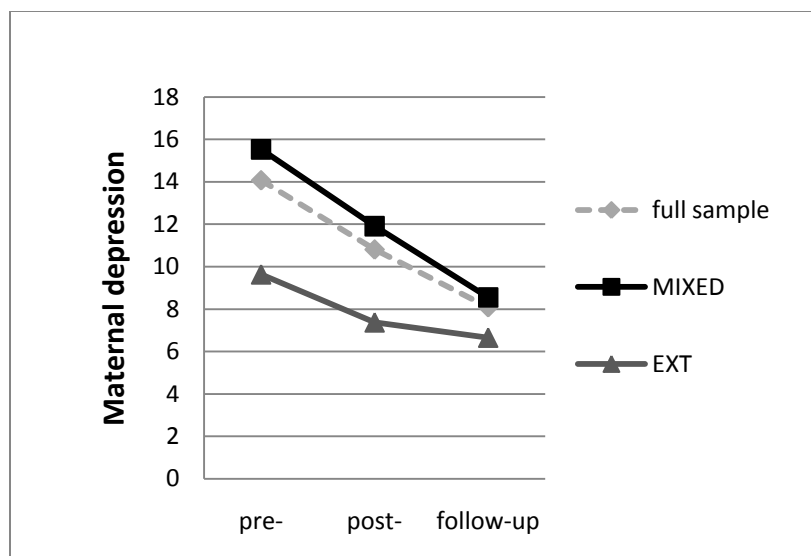


Figure 6. Maternal depression across treatment by subgroup.

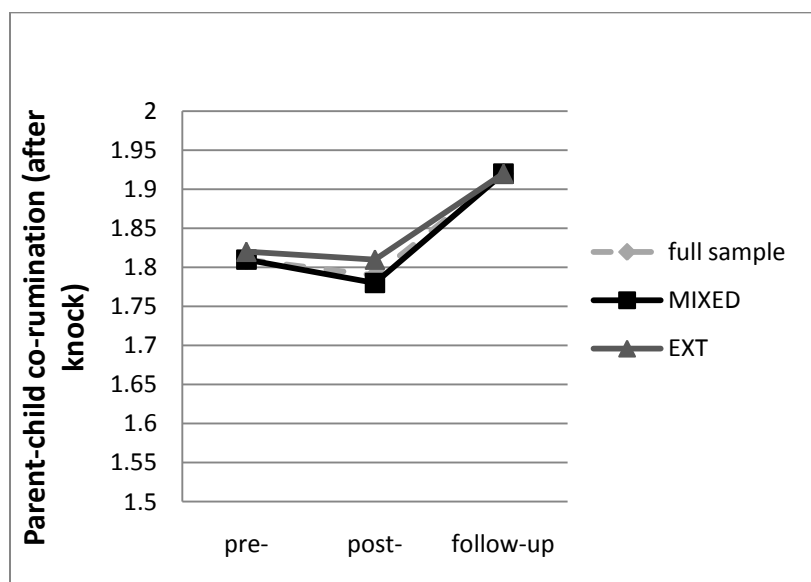


Figure 7. Parent-child co-rumination (after the knock) across treatment by subgroup.

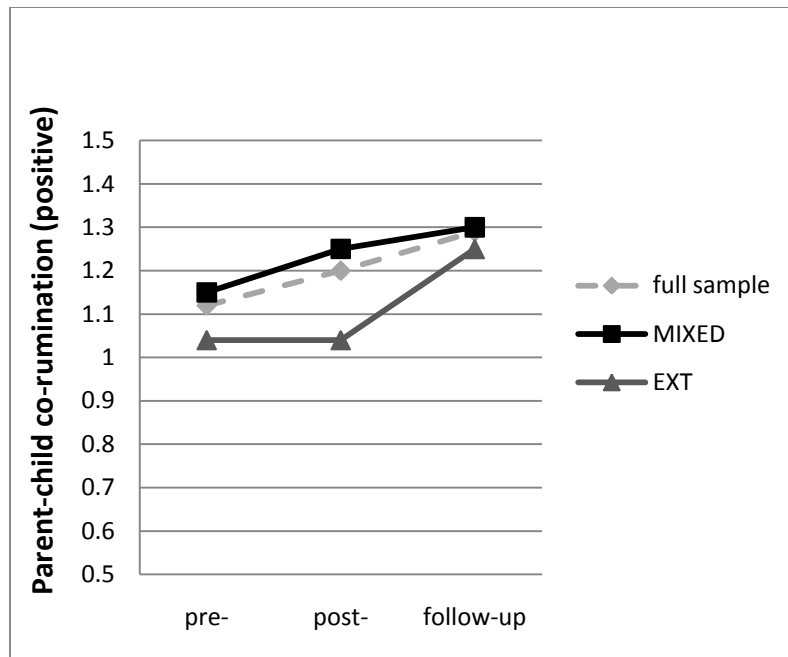
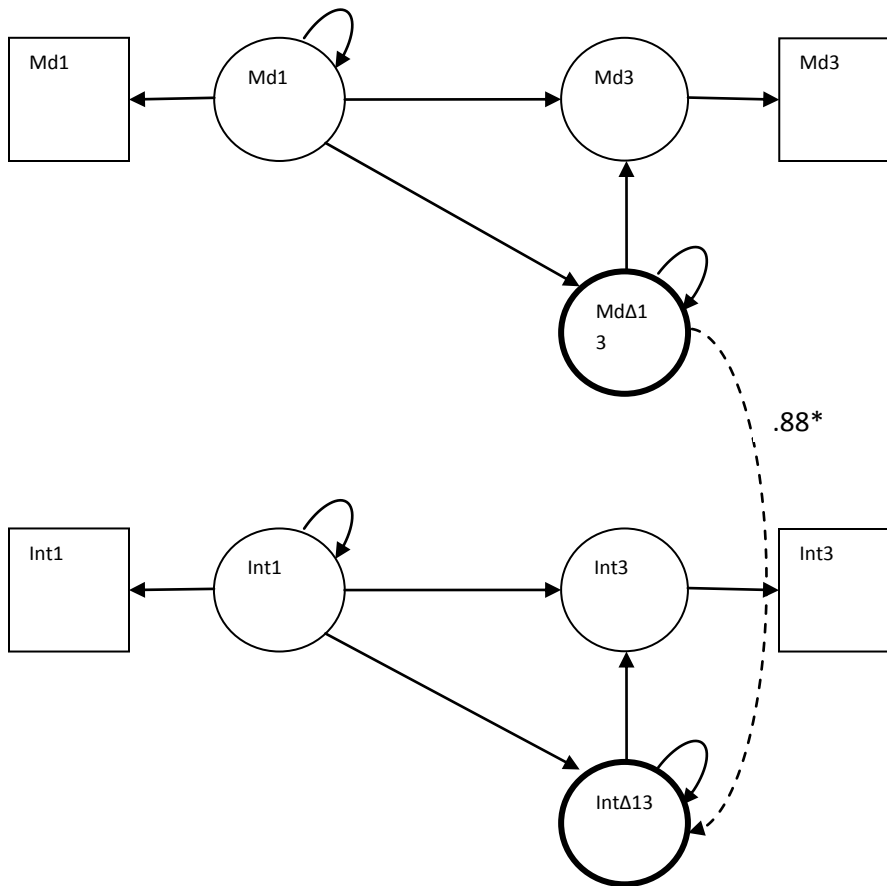


Figure 8. Parent-child co-rumination (during positive discussion) across treatment by subgroup.

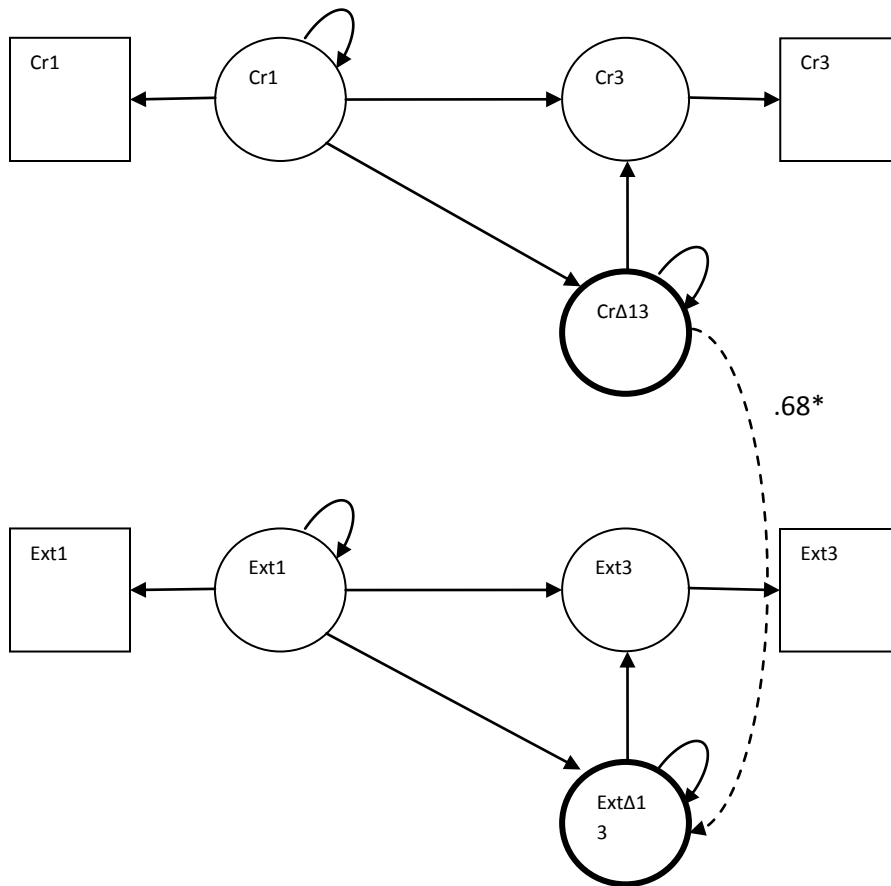




*Figure 9.* Latent Change Score (LCS) model depicting the association between pre- to follow-up changes in maternal depression and pre- to follow-up changes in child internalizing behaviour.

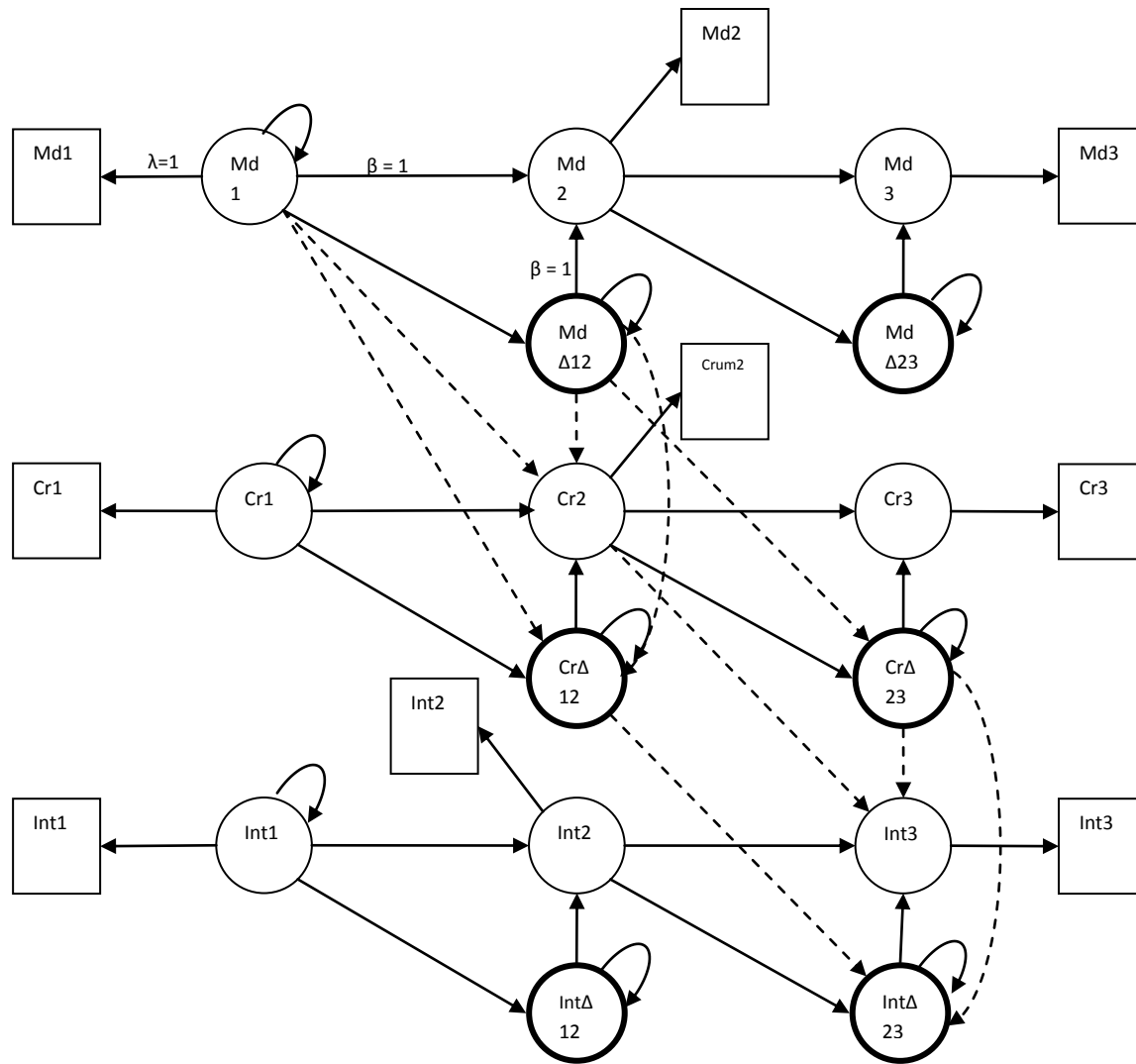
Bold circles represent latent change variables, dashed path represents the path of interest; boxes = observed or manifest variables, circles = unobserved or latent variables; Md = maternal depression, Int = child internalizing behaviour.

\*  $p < .05$ .

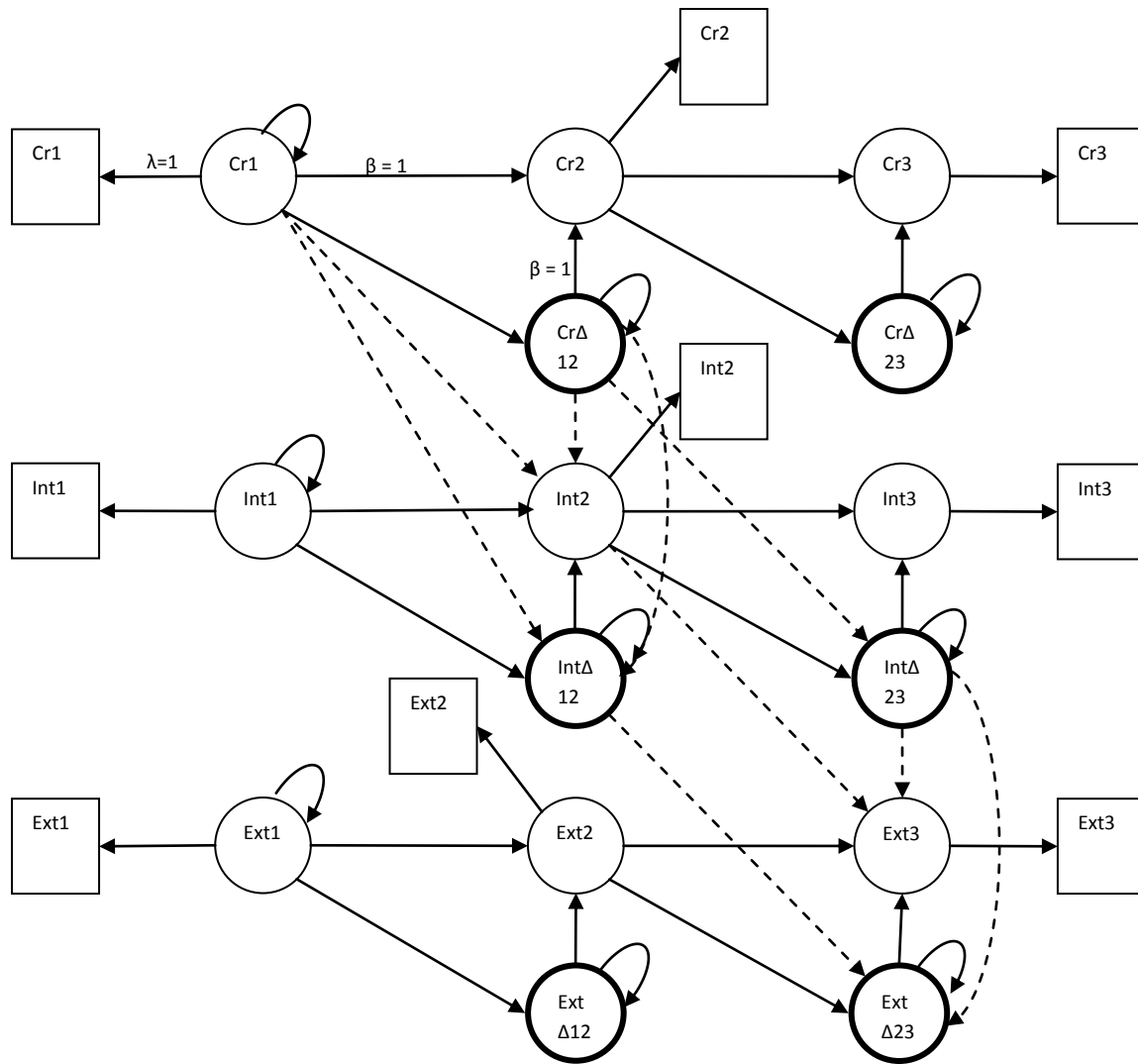


*Figure 10.* Latent Change Score (LCS) model depicting the association between pre- to follow-up changes in parent-child co-rumination and pre- to follow-up changes in child externalizing behaviour. Bold circles represent latent change variables, dashed path represents the path of interest; boxes = observed or manifest variables, circles = unobserved or latent variables; Cr = parent-child co-rumination, Ext = child externalizing behaviour.

\*  $p < .05$ .



*Figure 11.* Latent Change Score (LCS) model representing hypothesis that co-rumination changes mediates the relationship between changes in maternal depression and internalizing outcomes. Bold circles represent latent change variables, dashed paths are the meditational paths of interest; boxes = observed or manifest variables, circles = unobserved or latent variables; Md = maternal depression, Cr = co-rumination, Int = internalizing behaviour.



*Figure 12.* Latent Change Score (LCS) model representing hypothesis that changes in co-rumination impact changes in internalizing, which then impact externalizing outcomes. Bold circles represent latent change variables, dashed paths are the paths of interest; boxes = observed or manifest variables, circles = unobserved or latent variables; Cr = co-rumination, Int = internalizing behaviour, Ext = externalizing behaviour.

## Appendix A: Co-rumination Coding Manual

# Global Co-rumination Coding Manual

Comokids Project  
July 2010

Co-rumination is defined as talking extensively about problems with a relationship partner (e.g., friend, parent) and is characterized by a) a large amount of time spent talking about problems, b) mutual encouragement of problem-talk, c) rehashing problems, d) speculating about problems, and e) dwelling on negative affect (Rose, 2002).

Another key element of co-rumination is that individuals talk about problems with little or no effort to solve them.

In this study, parent-child interactions will be coded for co-rumination. To capture this, coders will provide their global impressions of ruminative problem-talk for each 2-minute segment of the parent-child interaction. In addition, for each 2-minute segment, coders will provide their global impressions of problem-solving within the interaction (e.g., talking about solutions, constructive problem-talk). These various items will eventually be combined to form the construct, co-rumination.

This manual contains detailed descriptions of these items, as well as guidelines for coding them. Before moving forward, it is important for coders to know how we define a problem.

Problems include things that are stressful, fearful, upsetting, frustrating, or annoying to the participant, or that the participant specifically deems a problem (as in discussion 2). A problem could also be an issue that you could foresee being a negative discussion topic of focus in a future testing session. Examples of problems include: lying, not doing homework, fighting with siblings, talking back to parents, getting into trouble at school, not brushing teeth, keeping a messy room, swearing, etc.

Note: All items in this manual will be coded for discussion 2; only two items will be coded for discussion 3 (marked by an asterisk in the manual).

Discussion 2 = negative discussion (about a problem)

Discussion 3 = positive discussion (imaginary fun topic)

Golden coding rules:

- 1) YOU CANNOT CODE EVERYTHING**
- 2) YOUR CODING SUPERVISOR IS ALWAYS RIGHT**

Start time instructions:

Start times for discussions 2 and 3 are listed on a sheet that is located in the DVD binder. The start time for segment 1 of discussion 2 will be the start time for the discussion itself. Segment 2's start time will be exactly 2 minutes after the start time for segment 1. The start time for segment 3 will be denoted when the knock occurs. For reliability purposes, please adhere to these start times. Coding must be based on what happens within a segment (i.e., the tail end of segment 1 must NOT be considered when coding segment 2).

Discussion 3 will not be coded in segments, and so the start time for discussion 3 is the same as the start time listed on the sheet provided in the binder.



\*TO WHAT EXTENT DOES THE SEGMENT CONSIST OF RUMINATIVE PROBLEM-TALK?

This item assesses the extent to which the dyad **re-hashes problems, speculates about problems, encourages problem-talk** and **dwells on negative affect** in a **ruminative** fashion.

To assist coders in providing a global code for ruminative problem-talk, descriptions for each dimension, as well as descriptions for “ruminative” are detailed below.

**Ruminative** includes a perseverative focus on a problem, getting “stuck” on a problem, dwelling, over-analyzing the problem, brooding, arguing about the problem, going on and on about a problem (e.g., way more than is necessary to demonstrate a point), repeating the same things over and over again, etc. *without moving forward towards a solution* (e.g., no clear problem-solving agenda, no springboarding into discussion about solutions). With ruminative problem-talk, talking about and analyzing the problem occur for the sake of talking about and analyzing the problem; seemingly, there is no over-arching problem-solving goal behind talking about the problem.

**Re-hashing**

One or both members of the dyad talks about specific parts of the problem over and over again; talking in details about the problem. It also includes re-stating the problem.

Attributes

- problem stated in other words
- presenting one’s view of the problem in detail
- talking/explaining in detail about the problem, every possible part of the problem
- reminiscing about problem or past instances related to problem (“for examples”)
- Arguing about the problem can be considered rehashing

Example rehashing

Parent: *“What happened the other day at school when Mrs. Smith sent you to the office?”* (Note that this is Encouragement)

Child: *“I was fighting with Daniel”*

Parent: *“Yeah...and you gave him a bloody nose”*

Child: *“I was just playing around, plus he hit me first”*

**Speculating about problems**

One or both members of the dyad ponders the origins of the problem or parts of the problem, why the problem is an issue, why the problem happens, what may happen as a result of the problem.

Attributes

- talking about potential causes and consequences of the problem.

- trying to understand the problem or parts of the problem that are not understood (as in analyzing in order to make sense of it)

#### Examples speculating

##### Why the problem happens (causes):

Parent: *"Why do you hit your sister?"*

Child: *"I dunno, she bothers me and then I get angry and then I hit her"*

Parent: *"Why does she upset you so much?"*

Child: *"'Cause she's annoying, she takes my stuff without asking"*

##### What happens as a result of the problem (consequences)?

Parent: *"Can you think of any reasons why lying is wrong?"*

Child: *"It makes you look bad"*

Parent: *"Right...and it makes people not trust you."*

Child: *"Uh huh, that's true"*

Parent: *"So then why do you do it?"*

##### Why the problem is such an issue (also consequences)?

Parent: *"Why do you think that swearing is such a problem for us?"*

Child: *"Because you don't want me to, and then we fight"*

Parent: *"Yeah, and because it is very disrespectful to both me and your father"*

#### **Mutual encouragement of problem-talk**

One or both members of the dyad keep the problem-talk going; trying to get each other to tell every detail of the problem. This may include trying to bring back the problem-talk after the topic has been switched.

#### Attributes

- explicitly asking partner to talk about the problem
- asking questions about the problem. Note: some questions about the problem could be speculating (e.g., *"could it be because of your intelligence or because of your father?"*). These questions would be considered both encouraging and speculating.
- prompting, cueing, eliciting partner to tell details
- returning to the problem; bringing it back

#### Example encouraging

##### Mom Encouragement of problem-talk—explicitly asking:

Parent: *"So, talk about fighting"*

Child: *"What about it?"*

Parent: *"Well, how to you see the problem?"*

Child: *"I don't know"*

Parent: *"Come on, you need to talk about this—like what happened the other day at the breakfast table?"*

#### **Dwelling on negative affect**

One or both members of the dyad focuses on the experience of negative emotions like feeling worried, nervous, irritated, sad, anxious, angry, depressed, low, scared, distressed, anguished, shameful, embarrassed, frustrated, hopeless, defeated, stuck, etc.

#### Example dwelling

Parent: *"I can see that you're very frustrated just about this right now"*

Child: *"Yeah, it makes me angry, but I like being mad"*

Parent: *"You like being mad? Why do you like being mad?"*

#### Examples ruminative problem-talk (in general)

Parent: *"So you make all this noise in morning. Why is you making noise such a problem?"*

Child: *"'Cause I wake up Katie?"*

Parent: *"Yeah--do you want to wake her up?"*

Child: *"I guess not"*

Parent: *"So then why do you do it? I just don't understand why you do it then"*

Parent: *"What happens if doggie chokes on the toys you leave on the floor? How would you feel about that?"*

Child: *"I wouldn't like it"*

Parent: *"You come home one day and see a dead doggie on the floor 'cause he got one of your small toys lodged in his throat"*

Child: *"Okay, that's just weird"*

Parent: *"Or maybe you'll crawl into bed one day and find a dead puppy in your bed"*

Parent: *"And then what happened?"*

Child: *"Then I slapped him"*

Parent: *"Why? Why did you think you could slap him?"*

Child: *"'Cause he's a goof"*

Parent: *"What if he said that about you?"*

Child: *"I'd knock his daylights out"*

Parent: *"Is that appropriate?"*

Child: *"No"*

Parent: *"Then why do you say things like that?"*

Parent: *"Are you angry 'cause you got caught, or are you angry 'cause you did it?"*

Child: *"'Cause I got caught"*

Parent: *"So it doesn't make you angry that you did it?"*

Child: *"Not really"*

Parent: *"Well, it makes me really angry when you do it"*

### Ruminative problem-talk anchorings

1	2	3	4	5
Not at all		Moderate amount		Very much

- 1) **Not at all.** The dyad is clearly not rehashing, speculating, encouraging and/or dwelling on negative affect in a ruminative way at any point during this segment.
- 2) **A little.** The dyad rehashes, speculates, encourages and/or dwells on negative affect in a ruminative way once or twice during the segment (e.g., derailment; substantial moment of getting “stuck” on problems, etc.). Note: Do not count bouts that last less than 5 seconds.
- 3) **A moderate amount.** The dyad does some rehashing, speculating, encouraging and/or dwelling on negative affect in a ruminative way during this segment (either intermittently throughout or for half the segment).
- 4) **A lot.** The dyad is actively rehashing, speculating, encouraging and/or dwelling on negative affect in a ruminative way for most of the segment. Talking about problems does not take up the entire segment because there may be a short bout of problem-solving, off-topic discussion or mutual silence.
- 5) **Very much.** The dyad is actively rehashing, speculating, encouraging and/or dwelling on negative affect in a ruminative way for the entire segment.

Note: For the positive discussion, a derailment of ruminative problem-talk is still coded as “A little”. First, you must identify whether a “problem” is brought up (according to the manual’s definition). Then, you must ask yourself this: are they speculating, mutually encouraging, dwelling on negative affect and/or rehashing in a ruminative way?

### \*DOES ANY ONE MEMBER OF THE DYAD DOMINATE THE RUMINATIVE PROBLEM-TALK DISCUSSION?

This item assesses the balance of child and parent participation during the ruminative problem-talk discussion.

### Ruminative problem-talk participation anchorings

1	2	3	4	5
All child	More child	Equal	More parent	All Parent

- 1) **All Child.** Child is participating in all or almost all of the discussion about problems; parent is barely participating or is not participating at all in ruminative problem-talk discussion.
- 2) **More child than parent.** Child is taking part in the ruminative problem-talk discussion significantly more than the parent (parent is participating minimally).
- 3) **Equal child and parent.** Parent and child are contributing approximately equally in the ruminative discussion about problems (e.g., back and forth).
- 4) **More parent than child.** Parent is taking part in the ruminative problem-talk discussion significantly more than the child (child is participating minimally).
- 5) **All parent.** Parent is participating in all or almost all of the ruminative discussion about problems; child is barely participating or is not participating at all in the ruminative problem-talk discussion.

**Consideration:** The anchorings listed above are applicable when ruminative problem-talk is coded a “3” or more. Special consideration is given for short bouts of ruminative problem-talk (a “2” on the scale) because it is more difficult to judge balance of participation when bouts are shorter. The following are the anchorings when ruminative problem-talk is coded as a “2”:

- 1) All Child. Child ruminates out loud and parent dismisses, ignores, doesn’t respond or changes the topic.
- 2) More child than parent. Child ruminates out loud, parent entertains the comment(s) (e.g., asks question, prompts), but no “back and forth-ish” ruminative conversation ensues.
- 3) Equal child and parent. Parent and child engage in a brief, “back and forth-ish” ruminative conversation about problems.
- 4) More parent than child. Parent ruminates out loud, child entertains the comment(s) (e.g., asks question, prompts), but no “back and forth-ish” ruminative conversation ensues.
- 5) All parent. Parent ruminates out loud and child dismisses, ignores, doesn’t respond or changes the topic.

#### TO WHAT EXTENT DOES THE SEGMENT CONSIST OF PROBLEM-SOLVING/SOLUTION-TALK?

Sometimes, talking about problems can serve a problem-solving purpose. This next item assesses the proportion of the segment that contains talking about solutions and/or talking about problems in a constructive way. A detailed description of **solution-talk** and **constructive problem-talk** is necessary to code this item.

**Solution-talk** includes introducing solutions/ways to solve the problem (strategies, plans, directives, rules, alternatives to/changing problem behaviour), negotiating solutions, talking about how solutions/changing problem behaviour will be beneficial, how to go about implementing solutions (next steps, what we will do tomorrow), back up plans for a solution, past solutions implemented, etc. *Note* that the dyad does not necessarily need to agree about solutions.

#### Examples Solution-talk

Parent: “So how do you think we should fix this?”  
 Child: “Maybe we could set up a schedule”  
 Parent: “Yeah, that could work. What else?”  
 Child: “Or you could give me a reward every time I brush my teeth?”  
 Parent: “And what should we do if you don’t follow this?”  
 Child: “You could ground me?”

Parent: “Yesterday, before things escalated into a fight, you went and told the teacher—that was a good idea, right?”  
 Child: “Yeah...”  
 Parent: “You should always tell a teacher or someone who is an adult”

#### Example of solution-focused directive given by parent:

Parent: “Tonight, when we get home, I would like you to do your homework at 6. Then, you will brush your teeth, watch some T.V. and go to bed for 9”

**Constructive problem-talk** emphasizes that talking about problems can have a purpose related to advancing forward with the problem, such as working towards a solution. With constructive problem-talk, there is a sense that the parent is talking about problems in order to teach the child why and/or how they should stop engaging in the problem behaviour; constructive problem-talk often springboards into *or* is intermingled with a conversation about solutions. *Note.* Constructive problem-talk could still include any of the dimensions (e.g., rehashing, speculating, mutually encouraging, negative affect), but it must be clear that there is a problem-solving purpose to the discussion about problems.

#### Constructive problem-talk instances

- Discussing consequences of the problem in order to demonstrate why it is important to change the problem behaviour. *Note:* when there is discussion of consequences (in somewhat of a repetitive fashion) for 1 minute, there must be at least one springboard into discussion about solutions in order to be considered constructive, otherwise it is ruminative.
- Discussing parts of the problem in order to help come up with ideas for the solution
- Using an example of a problem event (past or future) for the purpose of demonstrating how things could be/were done differently
- Using an example of a problem event to discuss “what if” scenarios

#### Examples constructive problem-talk

Parent: *“If you get into another fight, what will happen?”*

Child: *“The principal said I’ll get expelled from school”*

Parent: *“Do you want that?”*

Child: *“No”*

Parent: *“Then tell me, what you could do to avoid getting expelled?”*

Parent: *“Here’s the problem with not doing your homework: 1) you won’t understand what the teacher is talking about the next day, and 2) your grades will drop”*

Child: *“I know I know”*

Parent: *“So you see why it’s important that you do your homework?”*

Parent: *“Let’s think of ways to get you two to stop fighting. When do you normally find that you are most annoyed by your brother?”*

Child: *“Usually in the morning when I’m grumpy”*

Parent: *“Okay, so maybe you could express to him that he needs to leave you alone, especially during morning time?”*

Parent: *“So the other day when you didn’t brush your teeth, was it because you didn’t like the new toothpaste I bought?”*

Child: *“Yeah, I don’t like the new toothpaste”*

Parent: *“Okay, so maybe if I but another brand, you might be more inclined to brush your teeth?”*

Child: *“Sure”*

Parent: *“Okay, so you remember that time at the rink when you got upset at me for not tying you skates fast enough?”*

Child: *“Yeah”*

Parent: “Knowing what you know now, how would you do it differently to avoid getting into a fight with me?”

Parent: “Okay, so in the future, when you two are fighting and you get so upset that you wanna’ punch him, what should you do?”

Child: “Call either you or dad”

### Problem-solving/solutions anchorings

1	2	3	4	5
Not at all		Moderate amount		Very much

- 1) **Not at all.** The segment does not consist of any problem-solving (no instances of constructive problem-talk and/or solution-talk).
- 2) **A little.** There are some weak or infrequent signs of constructive problem-talk and/or solution-talk. For example, a solution was introduced once or twice during the entire segment, but there was no/very little further elaboration. “A little” is also coded when the segment consists of several general questions asking how to solve the problem (e.g., “How will we solve this?”, “What can we do to fix our problem?”) without any substantial responses/suggestions.
- 3) **A moderate amount.** Constructive problem-talk and/or solution-talk take up approximately half the segment.
- 4) **A lot.** Constructive problem-talk and/or solution-talk take up a substantial proportion of the segment. Constructive problem-talk and/or solution-talk, however, do not dominate the entire segment. For example, there may still be some ruminative problem-talk, an off-topic bout or some mutual silence.
- 5) **Very much.** There is no doubt that the entire segment was about problem-solving, solutions, constructive problem-talk, etc.

Note: Brief directives (e.g., “don’t lie”, “stop swearing”) that are sprinkled in the middle of ruminative problem-talk and are without any surrounding problem-solving support should be discounted from coding.

### DOES THE CHILD CONTRIBUTE TO THE SOLUTION-TALK?

Child participation can vary during the problem-solving/solution-talk. This item assesses the level of child contribution/involvement/interest in the discussion about solutions.

### Child contribution anchorings

1	2	3	4	5
Not at all		Moderate amount		Very much

- 1) **Not at all.** Child is not contributing to the discussion about solutions (e.g., child is consistently dismissive\* or mocking of solution-talk, not listening, not talking, ruminating about problems). \*Child must be dismissive about having the solution-talk discussion.

- 2) **A little.** Child is contributing minimally to the discussion about solutions (e.g., agreement/disagreement with mother's suggestions; verbal signs of listening, such as "uh huh", "ok"); no ideas\*\* or suggestions are brought to the table. Note that the child may be talking a bit, but they are not advancing things forward because they have not brought anything new to the table (e.g., they may be re-stating, arguing, etc.).
- 3) **A moderate amount.** Child is starting to bring something relatively new (i.e., not proposed in a previous segment) to the solution-talk table (e.g., ideas, suggestions, solutions; includes a new case or defense for a previously proposed idea, suggestion, solution). By bringing something new to the table, child is advancing things forward and showing some interest in the solution-talk discussion. However, their participation is inconsistent and they are not entirely committed to helping solve the problem.
- 4) **A lot.** Child is very active in the solution-talk discussion with mother—communicating ideas, proposing solutions, elaborating, etc. Mother and child are consistently engaged in the discussion and they are working together towards a solution (Note: whether they succeed in coming up with a solution/plan is irrelevant).
- 5) **Very much.** Child dominates or drives the problem-solving/solution-talk discussion.

\*\*Generally, most ideas are valid, but they have to be reasonable—e.g., not "selfish" ideas that clearly only serve a purpose for the child and are not compromising in any way. Mother's response to ideas (dismiss versus entertain) does not play a role in deciding when ideas are valid.

#### TO WHAT EXTENT IS THE DYAD MUTUALLY SILENT?

This item assesses the amount of time that there is complete silence during the segment (both mother and child are not speaking). *Note: if you add up numerous mutually silent bouts within a segment, each bout must be at least 10 seconds long and uninterrupted (e.g., no meaningful sounds).*

##### **Mutual silence anchorings**

1	2	3	4	5
<b>Not at all</b>		<b>Moderate amount</b>		<b>Very much</b>
<b>(0 seconds)</b>		<b>(60 seconds)</b>		<b>(120 seconds)</b>

- 1) **Not at all.** No substantial mutual silence (e.g., under 15 seconds).
- 2) **A little.** A small proportion of the segment is spent in mutual silence (e.g., 20-30 seconds).
- 3) **A moderate amount.** Approximately half of the segment is spent in mutual silence (e.g., 60 seconds).
- 4) **A lot.** Approximately  $\frac{3}{4}$  of the segment is spent in mutual silence (e.g., 90 seconds).
- 5) **Very much.** Almost the entire segment is spent in mutual silence (e.g., 120 seconds).

#### TO WHAT EXTENT IS THE DYAD OFF-TOPIC?

This item assesses the amount of time that the dyad spends discussing things that are completely unrelated to the problem and/or solutions to the problem. *Note: if you add up numerous off-topic bouts within a segment, each bout must be at least 10 seconds long and uninterrupted.*



### Off-topic anchorings

1	2	3	4	5
Not at all (0 seconds)		Moderate amount (60 seconds)		Very much (120 seconds)

- 1) **Not at all.** The dyad is always talking about the problem and/or solutions to the problem (e.g., under 15 seconds of off-topic).
- 2) **A little.** The dyad spends a small proportion of the segment talking about things unrelated to the problem and/or solutions (e.g., 20-30 seconds).
- 3) **A moderate amount.** The dyad spends approximately half of the segment talking about things unrelated to the problem and/or solutions (e.g., 60 seconds).
- 4) **A lot.** The dyad spends approximately  $\frac{3}{4}$  of the segment talking about things unrelated to the problem and/or solutions (e.g., 90 seconds).
- 5) **Very much.** The dyad never talks about the problem and/or solutions to the problem (e.g., 120 seconds).

### TO WHAT EXTENT IS THE SEGMENT UNCODABLE?

This item assesses the amount of time that the segment is uncodable because, due to some interruption, the dyad is unable to have their discussion (e.g., one member is talking to someone else, one member leaves the room). *Note* this is mostly relevant for home visit files.

### Uncodable anchoring

1	2	3	4	5
Not at all (0 seconds)		Moderate amount (60 seconds)		Very much (120 seconds)

- 1) **Not at all.** The entire segment is codable.
- 2) **A little.** A small proportion of the segment is uncodable (e.g., 20-30 seconds).
- 3) **A moderate amount.** Approximately half of the segment is uncodable (e.g., 60 seconds).
- 4) **A lot.** Approximately  $\frac{3}{4}$  of the segment is uncodable (e.g., 90 seconds).
- 5) **Very much.** The entire segment is uncodable (e.g., 120 seconds).

General notes:

In circumstances where you are unsure about how to code/categorize a certain bout (e.g., utterance in a different language), you must consider the closest conversation theme, and include it with that.

A bout of conversation that is seemingly neutral, but somehow linked to the problem and/or solution (therefore, not off-topic) should be coded in context. Think about the “root” of the discussion (was it derived from discussion about the problem or the solution?) and code accordingly. When this happens, please provide a comment on your coding form.

In situations where there is a lot of switching back and forth between codes, it is recommended that you “Go Gestalt” (instead of calculating the elapsed time of every single bout).

If you are ever unsure about your code, please bring it up at the next team meeting and we will discuss it collectively.

## Appendix B: Co-rumination Coding Form

File name: \_\_\_\_\_ Family ID: \_\_\_\_\_ Session: \_\_\_\_\_ Coder: \_\_\_\_\_  
 Date coded: \_\_\_\_\_ Disk#: \_\_\_\_\_ Discussion: \_\_\_\_\_  
 Start time: \_\_\_\_\_ The problem: \_\_\_\_\_

### NEGATIVE DISCUSSION – SEGMENT 1:

**Is the dyad engaged in ruminative problem-talk (e.g., rehashing, speculating, encouraging, dwelling on negative affect)?**

1	2	3	4	5
Not at all		Moderate amount		Very much

**Does any one member dominate the ruminative problem-talk discussion? N/A**

1	2	3	4	5
All child	More child	Equal child/parent	More parent	All parent

**To what extent is the dyad engaged in problem-solving/solution-talk?**

1	2	3	4	5
Not at all		Moderate amount		Very much

**Does the child contribute to the solution-talk? N/A**

1	2	3	4	5
Not at all		Moderate amount		Very much

**To what extent is the dyad mutually silent?**

1	2	3	4	5
Not at all (0 seconds)		Moderate amount (60 seconds)		Very much (120 seconds)

**To what extent is the dyad off-topic?**

1	2	3	4	5
Not at all (0 seconds)		Moderate amount (60 seconds)		Very much (120 seconds)

**To what extent is the discussion uncodable?**

1	2	3	4	5
Not at all (0 seconds)		Moderate amount (60 seconds)		Very much (120 seconds)

Comments/Notes:

File name: \_\_\_\_\_ Family ID: \_\_\_\_\_ Session: \_\_\_\_\_ Coder: \_\_\_\_\_  
 Date coded: \_\_\_\_\_ Disk#: \_\_\_\_\_ Discussion: \_\_\_\_\_  
 Start time: \_\_\_\_\_ The problem: \_\_\_\_\_

### NEGATIVE DISCUSSION – SEGMENT 2:

**Is the dyad engaged in ruminative problem-talk (e.g., rehashing, speculating, encouraging, dwelling on negative affect)?**

1	2	3	4	5
Not at all		Moderate amount		Very much

**Does any one member dominate the ruminative problem-talk discussion? N/A**

1	2	3	4	5
All child	More child	Equal child/parent	More parent	All parent

**To what extent is the dyad engaged in problem-solving/solution-talk?**

1	2	3	4	5
Not at all		Moderate amount		Very much

**Does the child contribute to the solution-talk? N/A**

1	2	3	4	5
Not at all		Moderate amount		Very much

**To what extent is the dyad mutually silent?**

1	2	3	4	5
Not at all (0 seconds)		Moderate amount (60 seconds)		Very much (120 seconds)

**To what extent is the dyad off-topic?**

1	2	3	4	5
Not at all (0 seconds)		Moderate amount (60 seconds)		Very much (120 seconds)

**To what extent is the discussion uncodable?**

1	2	3	4	5
Not at all (0 seconds)		Moderate amount (60 seconds)		Very much (120 seconds)

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Comments/Notes:

File name: \_\_\_\_\_ Family ID: \_\_\_\_\_ Session: \_\_\_\_\_ Coder: \_\_\_\_\_  
 Date coded: \_\_\_\_\_ Disk#: \_\_\_\_\_ Discussion: \_\_\_\_\_  
 Start time: \_\_\_\_\_ The problem: \_\_\_\_\_

### NEGATIVE DISCUSSION – SEGMENT 3:

**Is the dyad engaged in ruminative problem-talk (e.g., rehashing, speculating, encouraging, dwelling on negative affect)?**

1	2	3	4	5
Not at all		Moderate amount		Very much

**Does any one member dominate the ruminative problem-talk discussion? N/A**

1	2	3	4	5
All child	More child	Equal child/parent	More parent	All parent

**To what extent is the dyad engaged in problem-solving/solution-talk?**

1	2	3	4	5
Not at all		Moderate amount		Very much

**Does the child contribute to the solution-talk? N/A**

1	2	3	4	5
Not at all		Moderate amount		Very much

**To what extent is the dyad mutually silent?**

1	2	3	4	5
Not at all (0 seconds)		Moderate amount (60 seconds)		Very much (120 seconds)

**To what extent is the dyad off-topic?**

1	2	3	4	5
Not at all (0 seconds)		Moderate amount (60 seconds)		Very much (120 seconds)

**To what extent is the discussion uncodable?**

1	2	3	4	5
Not at all (0 seconds)		Moderate amount (60 seconds)		Very much (120 seconds)

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Comments/Notes:

File name: \_\_\_\_\_ Family ID: \_\_\_\_\_ Session: \_\_\_\_\_ Coder: \_\_\_\_\_  
 Date coded: \_\_\_\_\_ Disk#: \_\_\_\_\_ Discussion: \_\_\_\_\_  
 Start time: \_\_\_\_\_ The problem: \_\_\_\_\_

**POSITIVE DISCUSSION:**

**Is the dyad engaged in ruminative problem-talk (e.g., rehashing, speculating, encouraging, dwelling on negative affect)?**

1	2	3	4	5
Not at all		Moderate amount		Very much

**Does any one member dominate the ruminative problem-talk discussion? N/A**

1	2	3	4	5
All child	More child	Equal child/parent	More parent	All parent

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Comments/Notes: