A real-time investigation of the effectiveness of adolescent girls' interpersonal emotion regulation with parents and peers

by

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Adolescence is a developmental period distinguished by heightened emotion and social sensitivity that warrant the use of emotion regulation strategies. It is believed that parents and peers play key socializing roles in adolescents' emotion regulation development. Yet, little is known about how parents and peers directly co-regulate with teens in daily life, including their effectiveness in down regulating negative affect and links to longer term adjustment. This study examined adolescent girls' use of interpersonal emotion regulation strategies with parents and peers in response to negative social interactions. We also tested differential associations between rates of parental and peer co-regulation and concurrent as well as future depressive symptoms. One-hundred and twelve adolescent girls (M_{age}=12.39, ages 11-13; 68.8% White, 18.8% Black, 9.8% Biracial, 8.9% Hispanic/Latino) at temperamental risk for anxiety and depression completed a 16-day ecological momentary assessment protocol measuring daily negative reactivity to negative social interactions, interpersonal emotion regulation strategies used with parents and peers, and momentary negative affect. Participants reported depressive symptoms at baseline and at the one-year follow-up assessment. Results indicated that adolescents used generally adaptive strategies (acceptance, problem solving, cognitive reappraisal, support seeking) with peers (*Mdn*=.76) more frequently than parents (*Mdn*=.69), and generally maladaptive strategies (rumination, cognitive and behavioral avoidance) with parents (*Mdn*=.31) more frequently than peers (*Mdn*=.24), in daily life—although this was a small effect (*r*=.09). Multilevel models showed

that both parental and peer co-regulation effectively down regulated negative affect, as indicated by adolescents' decreased likelihood of experiencing continued negative affect. Longitudinal analyses indicated that higher proportions of parental involvement in adaptive strategy use in daily life were linked to reduced depressive symptoms one year later. Findings suggest key potential for leveraging adolescents girls' natural tendency to engage in adaptive co-regulation with peers. Findings also show that both parents and peers are effective at helping teens down regulate everyday negative emotions—even when teens tend to engage in more maladaptive strategies with parents. However, findings suggest that parents offer more enduring benefits for adolescent girls' long-term adjustment by engaging in everyday adaptive co-regulation.

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1.0 Introduction

Adolescence is a unique developmental period characterized by shifts in emotional intensity (Larson, Csikszentmihalyi, & Graef, 1980), neurobiological capacities to regulate emotion (Crone & Dahl, 2012), and social influences wherein peers become increasingly influential as youth place greater importance on peer acceptance and rejection (O'Brien & Bierman, 1988; Silk et al., 2012). Relative to adults and, to some extent, younger children, adolescents experience elevated levels of negative affect in their everyday lives (Larson et al., 1980; Larson & Lampman-Petraitis, 1989). Such pronounced negative affect underscores the need for adolescents to learn and implement adaptive emotion regulation strategies. Indeed, meta-analytic reviews have shown associations between generally adaptive and maladaptive emotion regulation strategy use and depressive symptomatology among adolescents (Aldao, Nolen-Hoeksema, & Schweizer, 2010; Compas et al., 2017; Schäfer, Naumann, Holmes, Tuschen-Caffier, & Samson, 2017).

Yet, almost nothing is known about the role of key socializing agents, such as parents and peers, in emotion regulation during adolescence—a process hereafter referred to as "interpersonal emotion regulation" (Barthel, Hay, Doan, & Hofmann, 2018). Adolescent girls in particular show increased reliance on interpersonal strategies for managing emotion (Rose, 2002). Further, relative to boys, adolescent girls are at increased risk for developing depression (Nolen-Hoeksema & Girgus, 1994). To this end, the current study used a novel ecological momentary assessment (EMA) approach to understand how parents and peers engage with adolescent girls in enacting generally adaptive (problem solving, cognitive reappraisal, acceptance, support seeking) and

maladaptive (rumination, cognitive and behavioral avoidance) emotion regulation strategies in real life.

1.1 Early life influences on emotion regulation development

Emotion regulation is accomplished through both intrapersonal and interpersonal processes. Intrapersonal processes refer to one's internal efforts to manage one's emotions, such as dampening negative emotion by reframing one's thoughts about an unfair situation (Thompson, 1994). Equally important to the development of emotion regulation, however, are the interpersonal processes (i.e., external influences) affecting one's ability to subdue, maintain, or enhance emotional arousal (Thompson, 1994). Of particular interest to the current study are parental and peer influences on emotion regulation development among youth, as both parents (Buckholdt, Parra, & Jobe-Shields, 2014; Butterfield et al., 2019; Gottman, Katz, & Hooven, 1996; Saarni, Campos, Camras, & Witherington, 2007; Yap, Allen, & Ladouceur, 2008; Yap, Schwartz, Byrne, Simmons, & Allen, 2010) and peers (Criss et al., 2016; Glick & Rose, 2011; Legerski, Biggs, Greenhoot, & Sampilo, 2015; Rose, 2002; Smith & Rose, 2011) are key external influences on youth socialization.

Prior to adolescence, youth engage with various interpersonal behaviors in order to regulate their emotions. Infants, for instance, will engage in "social referencing" behaviors in which gazing toward caregivers acts as a form of information seeking on how to respond to their emotional states appropriately (Saarni et al., 2007). This reliance on caregivers as external influences on developing emotion regulation skillsets continues into childhood through both explicit parental guidance (i.e., "emotion coaching") (Gottman et al., 1996) and observational and modeling mechanisms

(McDowell & Parke, 2005). As youth progress through childhood, their social networks begin to broaden and peers become increasingly important reference points for emotion regulation development (Zeman & Garber, 1996). Examining these overlapping parental and peer influences on youths' emotion regulation development becomes particularly critical during adolescence, a period of rapid socioemotional transition among youth.

1.2 Parent and peer influences on emotion regulation and socioemotional adjustment

The shift from childhood to adolescence involves changes in salient social and emotional stimuli, influences, and motivations in youth's interactions. Adolescents undergo cognitive changes that increase their sensitivity to the social context (Blakemore & Mills, 2014) and are particularly sensitive to social evaluation, such as peer acceptance and rejection (O'Brien & Bierman, 1988; Silk et al., 2012). Adolescents also begin to spend more time with peers relative to family members (Larson & Richards, 1991), thus presenting increased opportunities for socially salient peer interactions that may be associated with emotional distress. Indeed, previous work has shown that, relative to adults, adolescents' neural responses during an fMRI-based social exclusion task are associated with increased self-reported negative affect outside the scanner (Sebastian, Viding, Williams, & Blakemore, 2010). Coupled with the average increases in negative affect (Larson & Lampman-Petraitis, 1989) and emotional volatility (Larson et al., 1980) that characterize adolescents' everyday experiences, these socioemotional shifts prompt adolescents to employ emotion regulation skills in response to negative emotionality. As teens continue to develop their emotion regulation repertoires, both parents and peers act as key socializing agents influencing how teens learn to manage their emotions and experience socioemotional adjustment.

Despite adolescents' changing social contexts wherein time spent with parents decreases (Larson & Richards, 1991), some limited empirical work suggests that parents continue to facilitate adolescents' emotion regulation development (Buckholdt et al., 2014; Butterfield et al., 2019; Yap et al., 2008; Yap et al., 2010). For instance, one study showed that parents with emotion regulation difficulties not only invalidated adolescents' emotional expressions frequently, but such parental invalidation was then linked to adolescents' increased difficulties with emotion regulation (Buckholdt et al., 2014). Notably, adolescents' own emotion dysregulation mediated the association between parental invalidation and adolescents' internalizing symptoms (Buckholdt et al., 2014). Other work has also shown that, through the mediating effects of adolescents' emotion dysregulation, parental expression of negative emotion (Yap et al., 2010) and invalidation of adolescents' positive emotion (Yap et al., 2008) during an interaction task were associated with elevated depressive symptoms among adolescents. Further, among clinically anxious youth participating in a stress-inducing laboratory task, parental use of coping socialization strategies (e.g., problem solving, cognitive reappraisal) was linked to youths' decreased reliance on disengagement coping strategies (e.g., avoidance, distraction) in everyday life, as reported via ecological momentary assessment (Butterfield et al., 2019). Taken together, the extant empirical work, though limited, provides evidence that parental emotion socialization influences both adolescents' emotion regulation and internalizing symptoms.

In addition to parental influences, peers become increasingly influential socializing agents for adolescents' emotion regulation development and socioemotional adjustment (Criss et al., 2016; Glick & Rose, 2011; Legerski et al., 2015; Rose, 2002; Smith & Rose, 2011). For instance, a study examining the differential effects of youths' friendship quality and quantity on emotion regulation strategy use showed that greater friendship *quantity* was associated with increased use

of some disengagement (e.g., distraction) strategies and decreased use of others (e.g., avoidance) (Glick & Rose, 2011). Greater *quality* in friendship, however, was linked to increased use of engagement strategies (e.g., discussing the problem) and decreased use of distraction strategies (Glick & Rose, 2011). Other researchers have found that, during emotion talk within same-sex dyadic friendships, friends' supportive responses to teens' emotion talk was associated with greater target participants' likelihood to disclose emotions at later points of the conversation (Legerski et al., 2015). Another study examining associations among peer factors, emotion regulation, and adolescent socioemotional adjustment found that greater peer use of adaptive emotion regulation was linked to target participants' own increased emotion regulation use, which in turn was linked to fewer target adolescent depressive symptoms (Criss et al., 2016). Co-rumination, a more direct form of interpersonal emotion regulation in which peers ruminated *with* target participants, showed both direct and indirect associations with teens' depressive symptoms (Criss et al., 2016). While there was a positive direct link between greater co-rumination and target adolescents' depressive symptoms, the authors also found that greater co-rumination was positively linked to target adolescent's emotion regulation use, which was then linked to fewer target adolescents' depressive symptoms (Criss et al., 2016).

Criss and colleagues' (2016) finding of direct and indirect associations between peer co-rumination and adolescents' depressive symptoms is in line with well-established research on the complexities of co-rumination in adolescents' peer relationships, such that increased self-disclosure appears to enhance peer relationship quality, while continued rumination with another individual may exacerbate depressive symptoms among adolescents (Rose, 2002; Rose, Schwartz-Mette, Glick, Smith, & Luebbe, 2014; Rose et al., 2012). Co-rumination among peers is the most heavily researched interpersonal emotion regulation strategy in the extant literature, and few

studies have examined interpersonal emotion regulation strategies beyond co-rumination (Christensen, 2019; Horn & Maercker, 2016; Morris et al., 2011, as exceptions). Even fewer have investigated adolescents' use of such strategies with both parents and peers in tandem (Stone et al., 2018; Waller, Silk, Stone, & Dahl, 2014, as exceptions). Such co-regulation processes are critical to examine simultaneously, as differences in parent and peer relationships may impact how they differentially engage in adolescent emotion socialization.

While parents share a vertical, top-down relationship structure with adolescents, peers share a more horizontal relationship structure (von Salisch, 2001). The top-down, parent-child relationship may motivate parents to seek emotion coaching opportunities to subsequently guide their children towards more effective emotion regulation development (Gottman et al, 1996; von Salisch, 2001). Peers, however, adopt a horizontal relationship structure, aiming to strengthen social closeness without assuming the responsibility of guiding a fellow peer through emotion coaching (von Salisch, 2001). Unlike adults equipped with more advanced cognitive capacities (Tottenham, Hare, & Casey, 2011; Zimmerman & Iwanski, 2014), peers may not have the emotion regulation repertoire needed to emotion coach others effectively (Miller-Slough & Dunsmore, 2016). The horizontal relationship thus suggests that peers may provide support, but are less adaptive co-regulators relative to parents' emotion coaching (von Salisch, 2001).

Limited empirical evidence indicates that both parents and peers engage in more supportive responses to teens' negative emotion talk relative to unsupportive responses (Jobe-Shields et al., 2014; Klimes-Dougan et al., 2014; Legerski et al., 2015). However, one study found that parents engaged in emotion coaching more frequently than peers across both laboratory observations and target adolescents' self-reports (Miller-Slough & Dunsmore, 2020). Coupled with the paradox of peer co-rumination increasing both relationship closeness and depressive symptoms in teen girls

(Rose, 2002), extant work suggests that peers provide support during emotion talk—but may lack the intentional guidance that parents offer through emotion coaching. As such, peers' limited emotion regulation repertoires may lead to emotion talk aimed at providing support, but peers may instead focus on ruminative details that are ultimately characterized as maladaptive co-rumination (Miller-Slough & Dunsmore, 2020). Thus, parents and peers play influential, yet differential, roles in adolescent emotion socialization that may translate to differential levels of adaptive versus maladaptive emotion regulation engagement. Given the gender differences between adolescent boys and girls in interpersonal orientation toward building relationships (Smith & Rose, 2011), involvement in emotion talk (Rose, 2002; Rose, Carlson, & Waller, 2007), and susceptibility to developing depressive symptoms (Merikangas et al., 2010; Nolen-Hoeksema & Girgus, 1994), it is critical to understand how adolescent girls in particular co-regulate with parents and peers in response to negative affect.

1.3 Interpersonal emotion regulation: Strategy use with socializing agents

Meta-analytic reviews on adolescent intrapersonal emotion regulation have shown that, despite the context-dependent nature of emotion regulation (Dixon-Gordon, Aldao, & De Los Reyes, 2015), some strategies are generally adaptive and maladaptive in relation to reducing negative affect and internalizing symptomatology (Aldao et al., 2010; Compas et al., 2017; Schäfer et al., 2017). Compas and colleagues' (Compas, Connor-Smith, Saltzman, Thomsen, & Wadsworth, 2001; Connor-Smith, Compas, Wadsworth, Thomsen, & Saltzman, 2000) prominent model of coping responses proposes that primary and secondary control coping responses are generally adaptive for reducing negative affect. Primary control responses involve one's attempts

to modify either the external stimuli or one's emotional reactions directly, whereas secondary control responses refer to one's internal efforts to adapt to external circumstances (Compas et al., 2001; Connor-Smith et al., 2000). Thus, generally adaptive emotion regulation strategies include those that are characterized by active engagement with emotionally salient stimuli, such as cognitive reappraisal, problem solving, acceptance, and social support seeking. In contrast, the coping response model suggests that generally maladaptive strategies include disengagement and involuntary engagement responses (Compas et al., 2001; Connor-Smith et al., 2000). Disengagement responses involve one's attempts to dissociate from one's internal thoughts and emotions or the external stressor (Compas et al., 2001). Involuntary engagement responses, however, include one's approach toward external stressors or one's internal reactions without much voluntary control (Connor-Smith et al., 2000). Thus, strategies such as behavioral and cognitive avoidance and rumination comprise generally maladaptive emotion regulation strategies, as they involve disengagement and involuntary engagement responses that perpetuate negative affect. Indeed, meta-analytic reviews provide evidence that generally adaptive strategies are associated with lower levels of negative affect and internalizing symptoms, whereas those that are considered to be generally maladaptive are linked to higher levels of such internalizing symptoms and negative affect (Aldao et al., 2010; Compas et al., 2017; Schäfer et al., 2017).

Most extant work on emotion regulation has examined such processes from an intrapersonal approach while neglecting to address the interpersonal influences on emotion regulation processes—despite the evidence that socializing agents are key contributors toward adolescent emotion regulation development (Buckholdt et al., 2014; Butterfield et al., 2019; Criss et al., 2016; Glick & Rose, 2011; Legerski et al., 2015; Rose, 2002; Rose et al., 2007; Smith & Rose, 2011; Yap et al., 2008, 2010; Rose, 2002; Smith & Rose, 2011). Employing an interpersonal

emotion regulation approach by examining how parents and peers directly engage with adolescents' attempts to regulate negative emotion thus provides a rich lens into the study of emotion regulation development, as it highlights the salience of the adolescent's overarching social context.

Existing research on interpersonal emotion regulation is limited in myriad domains. First, few studies on interpersonal emotion regulation examine adolescent samples. Morris and colleagues (2011) showed associations between parental use of adaptive strategies (i.e., cognitive reappraisal) with preschool- to primary school-aged children and reductions in negative affect. Other work examining interpersonal cognitive reappraisal focused on adult samples, finding inverse associations between interpersonal cognitive reappraisal and depressive symptoms among adult women (Christensen, 2019; Horn & Maercker, 2016). Second, among the studies linking interpersonal emotion regulation among adolescents to anxiety and depressive symptoms, most are limited to co-rumination (Hankin, Stone, & Ann Wright, 2010; Rose, 2002; Rose et al., 2007; Tompkins, Hockett, Abraibesh, & Witt, 2011; Waller & Rose, 2013), thus neglecting the many other strategies that, from an intrapersonal approach, are also associated with internalizing symptomatology (Aldao et al., 2010; Compas et al., 2017; Schäfer et al., 2017) and warrant further investigation from an interpersonal lens.

Third, few studies employ the same measurements to examine both parental and peer influences on adolescents' emotion regulation strategy use within the same adolescent sample (Stone et al., 2018; Waller & Rose, 2013; Waller et al., 2014, as exceptions). The remaining few studies that have measured both parental and peer influences within the same sample show negative associations between supportive emotion socialization and adolescents' internalizing symptoms (Desjardins & Leadbeater, 2011; Stocker, Richmond, Rhoades, & Kiang, 2007). These

studies, however, did not examine teens' direct selection of interpersonal emotion regulation strategy use with parents and peers in response to negative stimuli. Instead, these studies' measures of emotion socialization were derived from teens' self-reported ratings of how their parents and peers provided emotional support on a global scale (Desjardins & Leadbeater, 2011; Stocker et al., 2007). Thus, while few studies use standardized measures of parental and peer influences on adolescents' emotions within the same participant sample (Desjardins & Leadbeater, 2011; Stocker et al., 2007; Stone et al., 2018; Waller & Rose, 2013; Waller et al., 2014), even fewer studies use consistent measures across parents and peers to account for adolescents' selective use of interpersonal emotion regulation strategies with each respective socializing agent (Stone et al., 2018; Waller & Rose, 2013; Waller et al., 2014, as exceptions).

Finally, to our knowledge, only two studies (Stone et al., 2018; Waller et al., 2014) have examined both parental and peer influences on adolescent emotion regulation using ecological momentary assessment (EMA) as an ecologically valid approach toward understanding such strategy use within the social contexts that are most salient in adolescents' everyday lives. With multiple EMA prompts administered within a single day, researchers are better equipped to capture participants' experiences in real time, thus limiting retrospective biases (Silk et al., 2011). Further, by collecting data as participants navigate their everyday lives, researchers are poised to examine fine-grained reports that are more representative of participants' affective ratings in relation to salient social stimuli occurring in real time (Silk et al., 2011). Thus, EMA is a critical tool to advance the field of emotion regulation development among adolescents. One EMA study showed that, in response to high-intensity negative affect, adolescents used a host of adaptive and maladaptive strategies, such as problem solving, social support, rumination, and avoidance; in response to lower-intensity negative affect, however, adolescents were more likely to employ

acceptance (Lennarz, Hollenstein, Lichtwarck-Aschoff, Kuntsche, & Granic, 2019). With regard to successful down regulation of negative affect, adolescents' use of acceptance, problem solving, and cognitive reappraisal were more effective strategies relative to rumination (Lennarz et al., 2019). Lennarz and colleagues' (2019) measures, however, did not account for interpersonal emotion regulation use among adolescents. Given that we are aware of only two studies (Stone et al., 2018; Waller et al., 2014) that used EMA to investigate adolescents' use of interpersonal emotion regulation, we describe those studies' findings in greater detail below.

In the first study, Waller and colleagues (2014) examined prevalence rates of co-rumination and co-problem solving among teens with and without major depressive disorder (MDD) diagnoses. Findings suggest that, relative to healthy controls, adolescents with MDD co-ruminated more frequently with both parents and peers (Waller et al., 2014). While adolescents with MDD co-problem solved less frequently with peers relative to their non-depressed counterparts, group differences were not shown for co-problem solving between adolescents and their parents (Waller et al., 2014). Indeed, these findings replicated prior evidence on the relation between co-rumination and depression among teens (Hankin et al., 2010; Rose, 2002; Rose et al., 2007; Tompkins et al., 2011; Waller & Rose, 2013). The authors also provided evidence that adolescent engagement with co-problem solving manifests differently between parents and peers in the context of depressive symptomatology (Waller et al., 2014).

Stone and colleagues (2018) conducted the second EMA study on co-problem solving and co-rumination, which differed from the Waller et al. (2014) study in two notable ways: first, the authors compared levels of strategy effectiveness in reducing youths' negative affect; and second, this sample comprised youth meeting clinical thresholds for anxiety rather than for depression (Stone et al., 2018). Using a similar EMA protocol, the authors showed that co-rumination was

least effective for reducing youths' daily negative affect, but interestingly did not find any effects of co-problem solving on reducing negative affect (Stone et al., 2018). Of note, both studies (Stone et al., 2018; Waller et al., 2014) were conducted in clinical samples. In the present study, we used a prospective high-risk design based on temperament reports to investigate the role of interpersonal emotion regulation in the development of depressive symptoms among healthy adolescent girls at risk for the development of depression.

In sum, the extant literature provides evidence that both parents (Buckholdt et al., 2014; Butterfield et al., 2019; Yap et al., 2008, 2010) and peers (Criss et al., 2016; Glick & Rose, 2011; Legerski et al., 2015; Rose, 2002; Smith & Rose, 2011) engage in various forms of emotion socialization that are linked to both teens' emotion regulation and socioemotional adjustment (i.e., internalizing symptoms). Despite the associations among parental and peer emotion socialization, adolescent emotion regulation, and internalizing symptoms, almost no studies to date (Stone et al., 2018; Waller et al., 2014, as exceptions) have examined how adolescents engage in interpersonal emotion regulation strategies with both parents and peers in order to reduce negative affect stemming from negative social interactions. It is also critical to investigate further the nuances in how frequently teens are engaging with each socializing agent as they attempt to modulate negative affect. Though it is known that adolescents spend increased time with peers (Larson & Richards, 1991; Larson, Moneta, Richards, Holmbeck, & Duckett, 1996) and adolescent girls are particularly prone to co-regulating with peers (Rose, 2002; Rose et al., 2007; Smith & Rose, 2011), only one known study to date (Waller et al., 2014) has directly compared rates of parental and peer interpersonal regulation use among adolescents.

1.4 The current study

To address the limitations in the extant literature, the current study examined adolescent girls' use of generally adaptive and maladaptive interpersonal emotion regulation strategies with their parents and peers in response to negative affect resulting from social interactions. In identifying the frequency with which teen girls engage with parents and peers when regulating their emotions, the effectiveness of each co-regulation strategy type in reducing negative affect, and the associations of each strategy type with concurrent and prospective depressive symptoms, this study provides a unique lens into adolescent emotional development that has not yet received thorough investigation. We also examined the rates of interpersonal emotion regulation strategy use and the differential effectiveness of strategy type in real time, as assessed via EMA. Thus, the current study's use of a novel EMA approach allowed us to investigate emotion regulation development within the salient social contexts that characterize adolescents' everyday lives.

1.5 Aims and hypotheses

First, we examined the frequency of adolescent interpersonal emotion regulation strategy use by socializing agent (Aim 1). We anticipated that adolescent girls would: 1a) use maladaptive interpersonal emotion regulation strategies more often with peers than with parents in response to negative emotion; and 1b) use adaptive interpersonal emotion regulation strategies more often with parents than with peers in response to negative emotion.

Second, we investigated the differential effectiveness of adolescent interpersonal emotion regulation strategy use in reducing negative affect at the time of the EMA prompt (Aim 2). We

hypothesized that there would be a main effect of strategy type use, such that: 2a) relative to adaptive interpersonal emotion regulation strategies, adolescent girls' use of maladaptive strategies would be associated with increased likelihood of experiencing continued negative affect (suggesting that maladaptive strategies are ineffective strategies for reducing negative affect); and 2b) relative to maladaptive interpersonal emotion regulation strategies, adolescent girls' use of adaptive strategies would be associated with decreased likelihood of experiencing continued negative affect (indicating that the adaptive strategies are effective for reducing negative affect). Given the paucity of research examining parental and peer influences on adolescent negative affect and measuring such influences in tandem, we did not have directional hypotheses for the effects of socializing agents. Thus, we explored if there was a main effect of socializing agent (i.e., parent, peer) and/or an interaction between socializing agent and strategy use in relation to the likelihood of experiencing continued negative affect.

Third, we examined how the frequency of interpersonal emotion regulation strategy use is associated with concurrent and future depressive symptoms (Aim 3). We hypothesized that: 3a) higher proportions of adolescent girls' maladaptive strategy use with *both* parents and peers at Time 1 would be associated with higher levels of depressive symptoms reported both concurrently and one year later; and 3b) higher proportions of adolescent girls' adaptive strategy use with *both* parents and peers at Time 1 would be associated with lower levels of depressive symptoms reported both concurrently and one year later. We also planned to compare whether any significant correlations differed in magnitude for frequencies of parental versus peer involvement in interpersonal regulation and depressive symptoms.

2.0 Method

2.1 Participants

Participants were drawn from an ongoing longitudinal study examining social interactions, affective states and regulation, and depressive symptoms spanning three years of adolescent development. Time 1 (participant ages 11-13) data collection included baseline measures. The one-year follow-up (ages 12-14) measures included prospective reports of depressive symptoms. To assess interpersonal emotion regulation in real time, we used an innovative EMA approach.

The current sample stems from the University of Pittsburgh's Girls' Interactions in Real Life Study of Brain Development (GIRLS: Brain Study), a multi-wave, longitudinal investigation into the neural and socio-affective influences on the development of depression and social anxiety symptoms among adolescent girls. We recruited 129 adolescent girls ranging between ages 11 and 13 and their primary caregivers via community and online announcements. We also oversampled for adolescent girls with shy and/or fearful temperament, as prior research has shown increased vulnerability for the development of depression and social anxiety among youth with this temperament (Chronis-Tuscano et al., 2009; Gladstone & Parker, 2006). Two-thirds of the sample were defined as "high-risk" and one-third as "low-risk" regarding participants' susceptibility to developing depression and social anxiety. To determine participant risk status at Time 1, we used the Fear and Shyness subscales of the Early Adolescent Temperament Questionnaire-Revised as a screening measure (EATQ-R; Ellis & Rothbart, 2001). Adolescent girls scoring 0.75 standard deviations above the mean on one or both of the Fear and Shyness subscales, based on parent or

adolescent report, comprised the "high-risk" status group, whereas the remainder of participants were considered to be "low-risk."

Study participants were excluded if they met current or lifetime DSM-5 diagnostic criteria for major depressive disorder, any anxiety disorder (n.b., specific phobia as an exception), or any autism spectrum disorder or psychotic disorder. Diagnostic criteria were determined by administration of the Kiddie-Schedule for Affective Disorders and Schizophrenia (K-SADS-PL; Kaufman et al., 2016; updated from the 1997 version to align with the DSM-5). As determined by the Wechsler Abbreviated Scale of Intelligence (WASI; Wechsler, 1999), participants with an IQ less than 70 were excluded from the current study. Moreover, participants were excluded due to: any lifetime presence of a neurological or serious medical condition; the presence of neurological anomalies or head injury; the presence of MRI contraindications (e.g., metal in body, including braces); use of psychoactive or other medications interacting with brain functioning (n.b., stimulants as an exception); the presence of uncorrected ocular impairments that would interfere with eye-tracking measurements; and the presence of acute suicidality or risk of presenting harm to oneself or to others.

Among the 129 participants recruited, 117 participants completed the EMA protocol. Three participants were excluded from analyses, as their EMA reports did not meet a negative reactivity threshold of distress warranting the use of regulatory strategies. Two additional participants were excluded from analyses because they did not endorse strategies that were operationalized as generally adaptive or maladaptive. Thus, the final sample consisted of 112 participants (M_{age}=12.39 years, *SD*=.78 years). See Table 1 for key demographic characteristics.

Table 1. Demographic characteristics of the total sample

	Participant N (*%*)	*M* (*SD*)	Range
Age		12.39 (0.78)	11.05 – 13.98
Pubertal status		3.45 (1.10)	1.00 – 5.00
Socioeconomic status (SES; total family income)		7.28 (3.02)	0.00 – 10.00
Race/Ethnicity			
Asian	2 (1.8%)		
Biracial	11 (9.8%)		
Black/African-American	21 (18.8%)		
Native American	1 (0.9%)		
White	77 (68.8%)		
Hispanic or Latino	10 (8.9%)		

Note. M and *SD* are used to represent mean and standard deviation, respectively. Both coded as continuous variables, pubertal status was reported from 1 (low) to 5 (high) according to the PDS, and SES was based on total family income reports ranging from 0 ($0-$10,000) to 10 ($100,000+) in $10,000 increments.

2.2 Procedure

The GIRLS: Brain Study's multi-wave, longitudinal design includes three time points. Of interest to the current investigation were Time 1 (the first laboratory visit) and the one-year follow-up. Time 1 included the laboratory visit wherein participants completed the initial diagnostic interview and the 16-day EMA protocol. At the one-year follow-up, participants completed an online questionnaire measuring depressive symptoms.

2.2.1 Instruments: Eligibility assessment and self-report measures

2.2.1.1 Diagnostic interview

In order to assess participants' diagnostic statuses, a trained clinical interviewer (doctoral or master's-level candidate) administered the K-SADS-PL (Kaufman et al., 2016) to both the adolescent participant and her caregiver at the Time 1 laboratory visit. The K-SADS-PL yields high levels of validity for depressive and anxiety disorder diagnoses among youth (Kaufman et al., 1997, 2016).

2.2.1.2 Intelligence measure

At Time 1, participants also completed the Wechsler Abbreviated Scale of Intelligence (WASI; Wechsler, 1999), as administered by research assistants. The WASI's measure of general intelligence among youth yield high levels of internal consistency (α=.93) and test-retest reliability (ICC=.95; McCrimmon & Smith, 2013).

2.2.1.3 Self-reported symptoms of depression

Adolescent participants completed the Mood and Feelings Questionnaire-Child Version (MFQ-C; Angold et al., 1987) as an index of depressive symptoms. The 33 items on the MFQ-C assessed self-reported depressive symptoms from the past two weeks relative to the date of assessment. Participants completed the MFQ-C at Time 1 and at the one-year follow-up. The MFQ-C yields good (α=.88) and excellent (α=.90) levels of internal consistency at Time 1 and at the one-year follow-up, respectively.

2.2.2 Ecological momentary assessment (EMA)

2.2.2.1 Protocol

EMA data were collected through brief survey prompts delivered to participants via study-provided smartphones. On the weekend immediately following their Time 1 laboratory visit, participants began completing EMA surveys for 16 consecutive days, with three prompts delivered on weekdays and four prompts on weekends. For the first weekday prompt delivery, participants confirmed a time prior to the beginning of the school day. Otherwise, participants received prompt alerts randomly after school hours. On weekdays, prompts alerted participants randomly within two pre-specified blocks of time (i.e., after school and evening hours); on weekends, prompts alerted participants randomly within four pre-specified blocks of time (i.e., morning, early afternoon, late afternoon, and evening hours). In total, participants received 54 prompts throughout data collection. Each survey lasted approximately 3-5 minutes. Surveys included information on participants' emotional experiences (i.e., negative affect), social interactions, and interpersonal emotion regulation strategy use.

2.2.2.2 Current ratings of negative affect

Each EMA survey began with a prompt to assess participants' concurrent negative affect ratings at the time of the survey. Participants were asked, "Please rate how you were feeling just before the phone beeped." Participants were then prompted to rate their current negative emotions (e.g., sadness, worry, stress, anger) on a sliding scale from "*Not at all (0*)" to "*Extremely (100)*," thus comprising a measure of current levels of negative affect at the time of the EMA prompt. The four discrete ratings were then averaged to create a composite rating of current negative affect.

2.2.2.3 Real-time social interactions and peak negative reactivity

The present study focused on EMA items assessing emotion regulation in response to negative social interactions. Questions regarding social interactions instructed participants to consider any interactions occurring since their last EMA survey to capture interactions that may have occurred during times when EMA prompts were not feasible (i.e., during school hours). Participants were asked, "*Think about the interaction with other kids your age that made you feel the worst since the last beep on (prior EMA collection time).What happened?*" Participants then indicated the medium through which the interaction occurred (e.g., in person, online, over the phone/text messaging), when it occurred (e.g., within the last 15 minutes, 4 hours ago, today, yesterday), as well as the number and types people (e.g., friend, significant other/romantic interest, another peer) involved in the interaction. Participants then rated their negative emotional reactions to the interaction (e.g., sadness, worry, stress, anger) on a sliding scale from "*Not at all (0*)" to "*Extremely (100)*," thus providing a measure of peak negative reactivity to the social interaction. To ensure that participants' negative reactivity to social interactions met a threshold of moderate distress that would warrant the use of emotion regulation strategies, only EMA calls reporting negative affect ratings at or above a threshold of 20 out of 100 were included in analyses. This

approach regarding negative reactivity thresholds to examine emotion regulation strategy use is consistent with extant work using similar EMA methods (Stone et al., 2018; Tan et al., 2012; Waller et al., 2014).

2.2.2.4 Interpersonal emotion regulation strategy use

Participants then indicated the emotion regulation strategies employed to respond to their negative reactivity. Participants were asked, "*Did you react in any of the following ways? (choose the one response that fits best)*" among 8 potential strategies. Of interest to the current study were the following adaptive strategies: acceptance ("*I realized I just had to live with things the way they are*"); problem solving ("*I did or planned something to make things better*"); cognitive reappraisal ("*I tried to think of the problem in a different way so it didn't seem as bad*"); and social support seeking ("*I talked to someone about it*"). The following maladaptive strategies were included in the current study: rumination ("*I kept thinking about how bad I was feeling or how bad the situation is*"); cognitive avoidance ("*I tried not to think about it or to forget all about it*"); and behavioral avoidance ("*I tried to avoid being around the people or situation that was bothering me*"). Subsequently, participants were asked, "*Did anybody help you, encourage you, or participate with you in this reaction?*" Response choices included friends, mothers, fathers, siblings, other, and nobody. We coded "friends" as peer socializing agents and "mothers" and "fathers" as parental agents. Thirty-two EMA calls endorsing co-regulation with *both* parents and peers simultaneously were excluded from analyses in order to examine differential parental and peer influences.

2.2.3 Covariates

Demographic information, such as adolescent age, pubertal status, and socioeconomic status, was examined for potential associations with analysis variables of interest (i.e., type of emotion regulation strategy, type of socializing agent). These variables were included as covariates if significant associations were detected.

2.2.3.1 Time elapsed since the most recent negative interaction

Participants could vary in the amount of time elapsed since their most recent negative interaction. We calculated the amount of time elapsed between each participant's most recent negative interaction and their report of the event. This value was entered as a continuous person-mean centered covariate.

2.2.3.2 Age

Participant age was calculated to the date of data collection.

2.2.3.3 Pubertal status

Pubertal status was assessed at Time 1 using the Pubertal Development Scale (PDS; Petersen, Crockett, Richards, & Boxer, 1988). Total response scores were summed to indicate female youths' overall pubertal status across gonadal and adrenal hormonal development on a 5-point scale (Shirtcliff, Dahl, & Pollak, 2009). Examining pubertal status may provide nuances in adolescent emotional development that may not be detected in age analyses. To address potential collinearity, we examined the correlation between age and pubertal status.

2.2.3.4 Socioeconomic status

The current study measured socioeconomic status as a mean-centered continuous variable at Time 1, with the reports of annual gross income in U.S. dollars from a scale of $0–10,000 (*0*) to $100,000+ (*10*) in $10,000 increments.

2.3 Statistical analyses

2.3.1 Preliminary analyses

All analyses were conducted in R 4.0.3 (R Core Team, 2020). We examined descriptive statistics and correlations between study variables. We also examined assumptions of multilevel modeling and assessed potential patterns of missing data in the study sample prior to conducting analyses for Aims 1 through 3.

2.3.2 Aim 1 analyses

Aim 1: To examine the frequency of adolescent interpersonal emotion regulation strategy use by socializing agent. We determined the frequency of strategy use by calculating separate proportions for parental and peer involvement in both maladaptive and adaptive strategy use. With those calculated proportions and the rstatix package in R (Kassambara & R Core Team, 2020), we conducted Wilcoxon signed-rank tests—a non-parametric alternative to parametric t-tests—to compare the frequency of use for each strategy type by each socializing agent, as the variable distributions were zero-inflated.

2.3.3 Aim 2 analyses

Aim 2: **To examine the differential effectiveness of adolescent interpersonal emotion regulation strategy use in reducing negative affect at the time of the EMA prompt.** We used multilevel modeling to examine within-person associations, with EMA surveys nested within person. Using the nlme package in R (Pinheiro, Bates, DebRoy, Sarkar, & R Core Team, 2018), we first examined an unconditional model to confirm adequate variance at the within- and between-person levels. Current negative affect (i.e., at the time of the EMA prompt) not only violated assumptions of normality, but also showed a zero-inflated distribution. Thus, with the GLMMadaptive package in R (Rizopoulos & R Core Team, 2017), we used a two-part mixed effects model for semi-continuous data (Olsen & Schafer, 2001); one model was a conditional linear model providing the mean response for continuous, non-zero data, whereas the other was a logistic model providing the probability of a non-zero response. To allow for individual variability in both parts (conditional linear; logistic) of the multilevel model, we included a random intercept; likelihood ratio tests of model fit did not justify the inclusion of random slopes. To measure fluctuations in negative affect, current negative affect was entered as the dependent variable, and negative affect in response to the negative interaction (i.e., peak negative reactivity) and time elapsed since event occurrence were entered as fixed effects.

The model included the following predictor variables: 1) the type of strategy used (i.e., maladaptive or adaptive), and 2) the type of socializing agent involved in strategy use (i.e., parents or peers), such that 2a) one binary variable indicated if a parent was (1) or was not (0) involved, and 2b) another binary indicated if a peer was (1) or was not (0) involved. Given that participants could select only one emotion regulation strategy used in response to the negative social

interaction, the two types of strategies used were direct inverses of the other. To aid in model interpretation, we applied effects (sum) coding to the type of strategy used variable.

For Hypothesis 2, we examined the main effect of emotion regulation strategy type and its association with current negative affect. With regard to our exploratory aims, we examined both the main effect of socializing agent involvement and the interaction between socializing agent and strategy type in relation to current negative affect.

2.3.4 Aim 3 analyses

Aim 3: To examine how the frequency of interpersonal emotion regulation strategy use may affect concurrent and future depressive symptoms. Using the stats package in R (R Core Team, 2020), we conducted linear regressions to examine predictive associations between the proportions of parental and peer involvement in maladaptive and adaptive strategy use, respectively, and depressive symptoms as reported at Time 1 (concurrent symptoms) as well as at the one-year follow-up. Of note is that measures of depressive symptoms at the follow-up were measured above and beyond baseline depressive symptoms at Time 1. We used the proportion calculations of interpersonal emotion regulation strategy use frequencies from Aim 1.

3.0 Results

3.1 Preliminary analyses

Descriptive statistics and correlations between study variables are shown in Table 2. Participants completed an average of 42.95 EMA prompts (range=15-54). Age and pubertal status were significantly associated; thus, only pubertal status was included as a covariate, as it may provide more nuanced measures of development among youth aged 11-13. With the exception of peer involvement in co-regulation, socioeconomic status (SES) was also significantly associated with all study variables, thus justifying its inclusion as a covariate.

Consistent with expectations, both MFQ-C reports of depressive symptoms at baseline (Time 1) and at the one-year follow-up were positively associated with one another as well as with negative affect reactivity (to the negative social interaction), current negative affect (negative affect at the time of the EMA call), and peer involvement in co-regulation. Adaptive emotion regulation strategy use was negatively associated with both baseline and follow-up MFQ-C reports. Further, parental involvement in co-regulation was negatively associated with MFQ-C reports only at the one-year follow-up. Negative affect reactivity was significantly associated with current negative affect, adaptive strategy use, and both parental and peer involvement, whereas current negative affect was only significantly associated with peer involvement. Parental and peer involvement were also negatively associated.

Table 2. Means, standard deviations, and correlations of study variables

Variable	*M (SD)*	1	2	3	4	5	6	7	8	9
1. Age	12.39 (0.78)									
2.Pubertal status	3.45 (1.10)	**.51****								
3. SES	7.28 (3.02)	**.25****	**-.10****							
4. Depressive symptoms (baseline)	9.77 (7.13)	.02	.01	**-.15****						
5. Depressive symptoms (1 year follow-up)	10.31 (8.51)	**.17****	**.21****	**.09****	**.48****					
6.Reactive NA	58.89 (24.13)	**.05***	**.12****	**.07****	**.24****	**.26****				
7. Current NA	11.61 (15.64)	**.17****	**.17****	**.10****	**.25****	**.32****	**.38****			
8. ER strategy used (BP)	0.21 (0.23)	**-.04***	**-.17****	**.14****	**-.09****	**-.19****	**-.10****	.00		
9. Parent involved (BP)	0.13 (0.16)	**-.13****	-.02	**-.34****	.04	**-.17****	**.10****	**-.04***	**-.08****	
10. Peer involved (BP)	0.20 (0.21)	**.15****	**-.07****	-.01	**.19****	**.12****	.02	**.03**	**-.07****	**-.22****

Note. M and *SD* are used to represent mean and standard deviation, respectively. SES = Socioeconomic Status; NA = Negative Affect; ER = Emotion Regulation; BP = Between-Person level calculations derived from binary variables. Reactive NA indicates the peak negative reactivity rating (0-100) to the negative social interaction. Current NA indicates the continued experience of negative affect (0-100) at the time of the EMA prompt. * indicates $p<.05$. ** indicates $p<.01$.

For Aim 3, 8 participants were excluded from analyses for not completing: the baseline MFQ-C measure (n=1), the MFQ-C one-year follow-up (n=4), neither the baseline nor the one-year follow-up MFQ-C measure (n=1), and the SES measure (n=2)—thus resulting in a subsample of 104 participants for Aim 3 analyses. These 104 participants who completed all MFQ-C and SES measures differed from those who did not on pubertal status (p<.001). Specifically, youth who completed all MFQ-C and SES measures had a mean pubertal status of 3.47 (range=1-5) compared to youth who did not contribute these data, whose mean pubertal status was lower (M=2.88). No other patterns of missingness related to the study variables were observed. See Figure 1 for detailed information on EMA call inclusion and descriptive statistics.

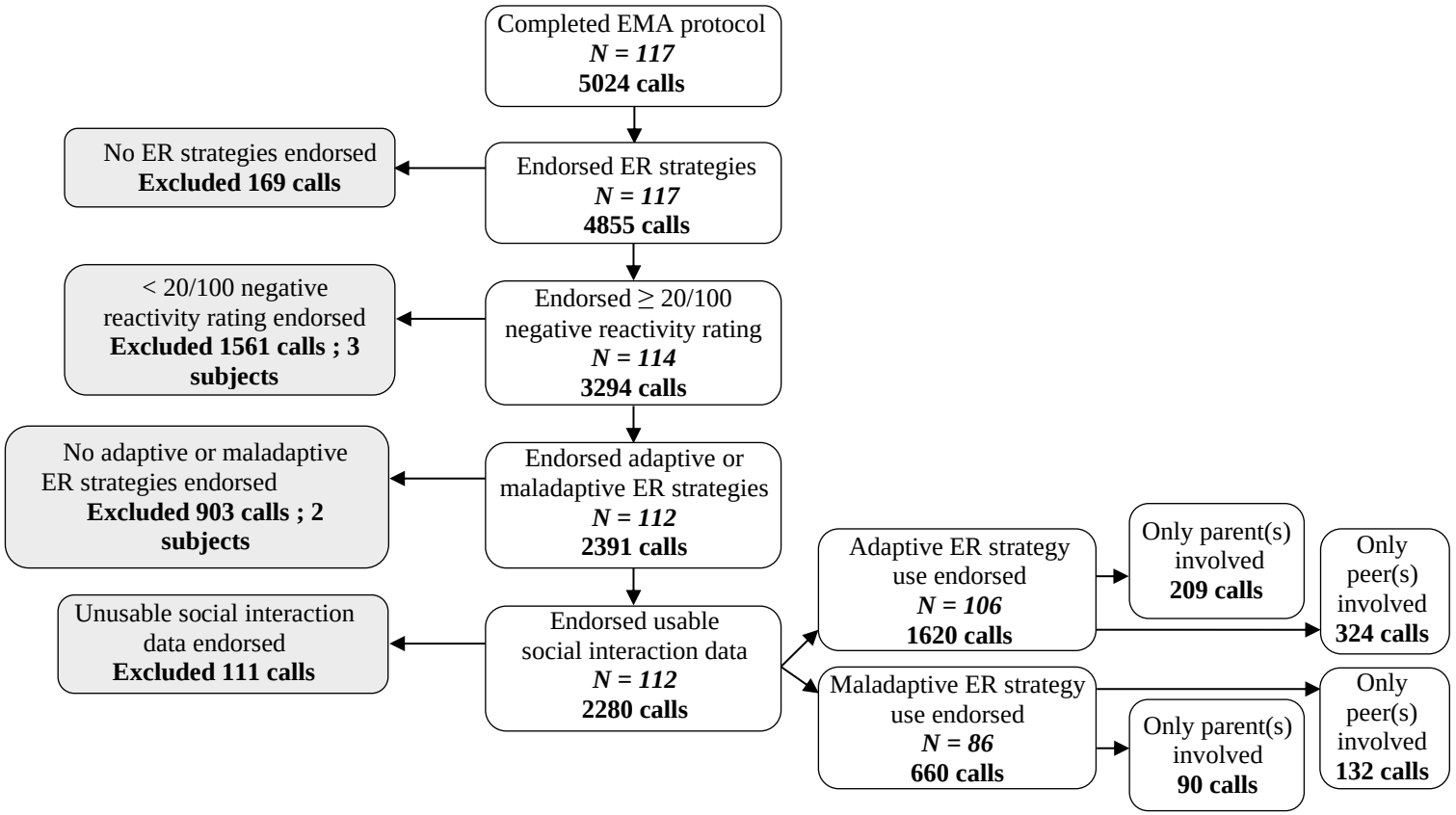

Figure 1. Ecological momentary assessment (EMA) of emotion regulation strategy use with parents and peers

Note. ER = Emotion Regulation. Reasons for EMA call exclusion included: endorsing "nothing" or nonsensical (i.e., gibberish) reports about the social interaction; not endorsing any interactions with others (e.g., sleeping); not endorsing ER strategy use; or endorsing reports with a negative reactivity rating below the 20/100 threshold to warrant ER strategy use.

To confirm the justification of using multilevel modeling, we conducted a means-only model in order to calculate the intraclass correlation coefficient (ICC). The model yielded an ICC of .41, indicating that 41% and 59% of the variance in current negative affect was explained by between-person factors and within-person factors, respectively.

3.2 Aim 1. Frequency of interpersonal emotion regulation strategy use by socializing agent

Adolescent girls significantly differed in the frequencies with which they used adaptive and maladaptive strategies with parents and peers (Table 3). Contrary to the hypothesized direction of effects, youth engaged in maladaptive emotion regulation strategies with parents more frequently (*Mdn*=.31, reflecting 31% of total EMA calls endorsing *any* emotion regulation use) than with peers (*Mdn*=.24, *W*=75332, *p*=.015). Further, youth engaged in adaptive emotion regulation strategies with peers more frequently (*Mdn*=.76) than with parents (*Mdn*=.69, *W*=61012, *p*=.015). For both Wilcoxon signed-ranks tests conducted, effect sizes were small in magnitude (*r*=.09). Note that while proportions of parent and peer involvement by strategy use were unique calculations, the proportions of adaptive and maladaptive strategy use were direct inverses of one another.

Table 3. Descriptive statistics and Wilcoxon signed-ranks test results (Aim 1)

	N of EMA Observations	*Median (IQR)*	*W-Statistic*	*p*	*Effect Size (r)*
Total observations of ER strategy use (both *intra* and *inter*personal)	2280				
Comparisons of adaptive ER use, *grouped by* proportion of socializing agent involvement observations (num.) out of total ER use observations (denom.)					
With parents	299	.69 (.31)	61012	.015*	.09 (small)
With peers	456	.76 (.38)			
Comparisons of maladaptive ER use, *grouped by* proportion of socializing agent involvement (num.) out of total ER use observations (denom.)					
With parents	299	.31 (.31)	75332	.015*	.09 (small)
With peers	456	.24 (.38)			

Note. Medians and interquartile ranges (IQRs) were used due to the non-parametric nature of Wilcoxon signed-ranks tests. ER = Emotion Regulation; Num. = Numerator; Denom. = Denominator. *N*=299 corresponds to the total ER calls enlisting only parents; *N*=456 corresponds to the total ER calls enlisting only peers. Wilcoxon signed-ranks tests comparing rates of adaptive and maladaptive ER use were grouped by socializing agent. * indicates $p<.05$.

3.3 Aim 2. Effectiveness of interpersonal emotion regulation in reducing negative affect

Results from the two-part mixed effects model are shown in Table 4, complete with both the continuous portion and the zero-inflated portions of the model. For the continuous portion of the multilevel model that assessed current negative affect above zero, only the covariates (time elapsed [*OR*=.97, *p*=.017] and negative reactivity [*OR*=1.01, *p*<.001]) significantly predicted the likelihood of experiencing negative affect at the time of the EMA call.

The zero-inflated portion of the model, however, indicated that both parental (*OR*=.60, *p*=.022) and peer (*OR*=.58, *p*=.008) involvement had significant effects on current negative affect at the within-person level. At the within-person level, we saw a significant association between enlisting parents' help with emotion regulation and girls' *decreased* likelihood of experiencing any negative affect above zero at the time of the EMA call. In other words, when girls had enlisted their parents' help with emotion regulation, they were *less likely* to experience continued negative emotion at the time of the survey. Similarly, we saw a significant within-person effect of peer co-regulation involvement on girls' *decreased* likelihood of experiencing negative affect above zero. When girls involved their peers in co-regulation, they were also *less likely* to experience continued negative affect at the prompt.

Among the covariates, negative affect in response to the social interaction was significantly associated with the decreased likelihood of experiencing any continued negative affect above zero (*OR*=.99, *p*=.003). Contrary to our hypotheses, no other study variables were significantly associated with current negative affect at the time of the EMA call, nor did any between-person effects emerge among study variables. Inconsistent with our predictions, the type of emotion

regulation strategy used was not significantly associated with girls' likelihood of experiencing continued negative affect (*OR*=0.98, *p*=.923). That is, neither the use of generally adaptive nor maladaptive emotion regulation strategies had a significant effect on girls' likelihood of experiencing negative affect. Similarly, no significant interactions emerged between the type of emotion regulation strategy used and the type of socializing agent enlisted in predicting the likelihood of experiencing continued negative affect [for parents (*OR*=.91, *p*=.819); for peers (*OR*=1.76, *p*=.130)].

Table 4. Results from multilevel model of momentary interpersonal emotion regulation use on negative affect (Aim 2)

	Current Negative Affect (Continuous Model)			Current Negative Affect (Zero-Inflated Model)		
Predictors	*OR*	*CI*	*p*	*OR*	*CI*	*p*
(Intercept)	5.81	4.77 – 7.07	**<.001**	0.45	0.29 – 0.70	**<.001**
ER strategy used (BP)	0.90	0.43 – 1.89	.780	1.66	0.31 – 8.96	.554
ER strategy used (WP)	1.00	0.85 – 1.17	.965	0.98	0.70 – 1.38	.923
Parent involved (WP)	1.00	0.82 – 1.21	.965	0.60	0.38 – 0.93	**.022**
Parent involved (BP)	0.51	0.15 – 1.69	.271	1.17	0.08 – 16.76	.908
Peer involved (WP)	1.18	0.99 – 1.41	.062	0.58	0.39 – 0.87	**.008**
Peer involved (BP)	0.83	0.34 – 2.01	.677	2.81	0.40 – 20.02	.302
Time elapsed	0.97	0.95 – 0.99	**.017**	1.04	0.99 – 1.09	.143
Negative reactivity	1.01	1.01 – 1.01	**<.001**	0.99	0.98 – 1.00	**.003**
Pubertal status	1.12	0.94 – 1.33	.206	0.80	0.54 – 1.21	.292
SES	0.99	0.93 – 1.06	.807	0.94	0.82 – 1.08	.399
ER strategy used (WP) * Parent involved (WP)	0.95	0.67 – 1.35	.779	0.91	0.39 – 2.10	.819
ER strategy used (WP) * Peer involved (WP)	0.77	0.56 – 1.07	.115	1.76	0.85 – 3.64	.130

Table 4 (continued)

	Current Negative Affect (Continuous Model)			Current Negative Affect (Zero-Inflated Model)		
Predictors	*OR*	*CI*	*p*	*OR*	*CI*	*p*
Random Effects						
σ^2	1.75					
$\tau_{00\ SubjectID}$	0.69					
ICC	0.28					
$N_{SubjectID}$	106					
Observations	2197					
Marginal R^2 / Conditional R^2	0.039 / 0.312					

Note: Significant effects are bolded. ER = Emotion Regulation; BP = Between-Person effects; WP = Within-Person effects. Time elapsed indicates the time that had elapsed between occurrence of the negative social interaction and the time of the given EMA prompt.

3.4 Aim 3. Frequency of interpersonal emotion regulation predicting depressive symptoms

3.4.1 Concurrent depressive symptoms at baseline

Linear regression results are provided in Tables 5 and 6. Contrary to our hypotheses, neither higher proportions of parental (p=.733) nor peer (p=.386) involvement in maladaptive emotion regulation strategy use were significantly associated with concurrent depressive symptoms at baseline (Time 1). Similarly, neither higher proportions of parental (p=.420) nor peer (p=.891) involvement in adaptive strategy use were significantly associated with baseline reports of concurrent depressive symptoms. No significant associations emerged between pubertal status or SES and baseline depressive symptoms.

Table 5. Regression results of interpersonal strategy use frequency predicting baseline depressive symptoms (Aim 3)

	Maladaptive Strategy Use Predicting Concurrent Depressive Symptoms (Baseline)				**Adaptive Strategy Use Predicting Concurrent Depressive Symptoms (Baseline)**			
Predictors	*ß*	*SE*	*CI*	*p*	*ß*	*SE*	*CI*	*p*
(Intercept)	8.96	0.81	7.35 – 10.57	**<.001**	8.86	1.03	6.83 – 10.90	**<.001**
Pubertal status	-0.00	0.67	-1.32 – 1.32	996	0.02	0.67	-1.30 – 1.35	.973
SES	-0.36	0.23	-0.81 – 0.10	.121	-0.33	0.23	-0.79 – 0.12	.147
Parental involvement:								
Maladaptive strategy use	-2.27	6.63	-15.42 – 10.89	.733				
Adaptive strategy use					4.12	5.09	-5.98 – 14.23	.420
Peer involvement:								
Maladaptive strategy use	5.01	5.76	-6.42 – 16.45	.386				
Adaptive strategy use					-0.56	4.05	-8.59 – 7.48	.891
Observations	104				104			
R^2 / R^2 adjusted	0.032 / -0.007				0.031 / -0.009			

Note: Significant effects are bolded. SES = Socioeconomic Status

3.4.2 Depressive symptoms one year later

Contrary to our predictions, neither higher proportions of parental (p=.086) nor peer (p=.651) involvement in maladaptive emotion regulation strategy use were significantly associated with concurrent depressive symptoms one year later, above and beyond baseline depressive symptoms. Similarly, higher proportions of peer involvement in adaptive strategy use were not significantly associated with future depressive symptoms (p=.286). However, consistent with our predictions, higher proportions of parental involvement in adaptive strategy use were negatively associated with depressive symptoms at the one-year follow-up (β=-11.70, SE=4.99, p=.021). That is, more frequent use of parental co-regulation for adaptive strategies was related to fewer depressive symptoms among adolescent girls one year later—above and beyond girls' baseline depressive symptoms. Further, for both models examining frequencies of adaptive and maladaptive interpersonal strategy use, only baseline depressive symptoms emerged as significant covariates. Specifically, baseline depressive symptoms were positively associated with depressive symptoms one year later in both models [maladaptive model (β=.60, SE=.10, p<.001); adaptive model (β=.63, SE=.10, p<.001)].

Table 6. Regression results of interpersonal strategy use frequency predicting depressive symptoms one year later (Aim 3)

	Maladaptive Strategy Use Predicting Depressive Symptoms (1 Year Follow-Up)				**Adaptive Strategy Use Predicting Depressive Symptoms (1 Year Follow-Up)**			
Predictors	*ß*	*SE*	*CI*	*p*	*ß*	*SE*	*CI*	*p*
(Intercept)	4.05	1.20	1.67 – 6.44	**.001**	5.03	1.33	2.40 – 7.67	**<.001**
Pubertal status	0.74	0.66	-0.57 – 2.04	.267	0.80	0.65	-0.49 – 2.09	.222
SES	0.43	0.23	-0.03 – 0.89	.064	0.45	0.23	-0.00 – 0.89	.051
Baseline depressive symptoms	0.60	0.10	0.41 – 0.80	**<.001**	0.63	0.10	0.44 – 0.83	**<.001**
Parental involvement:								
Maladaptive strategy use	-11.39	6.57	-24.43 – 1.65	.086				
Adaptive strategy use					-11.70	4.99	-21.60 – -1.80	**.021**
Peer involvement:								
Maladaptive strategy use	2.60	5.73	-8.76 – 13.97	.651				
Adaptive strategy use					-4.24	3.95	-12.08 – 3.61	.286
Observations	104				104			
R^2 / R^2 adjusted	0.313 / 0.278				0.331 / 0.297			

Note: Significant effects are bolded. SES = Socioeconomic Status.

4.0 Discussion

Using EMA methods to capture responses to socially-salient, everyday interactions in adolescent girls, this is the one of the first studies to examine differences in interpersonal emotion regulation with parents versus peers. We found that teen girls rely more on peers for adaptive emotion regulation support compared to parents in daily life. Both parents and peers effectively helped teens down regulate daily negative emotions—despite teens engaging in more maladaptive strategies with parents in daily life. Only parental involvement in adaptive emotion regulation strategy use predicted future depressive symptoms, highlighting parents' ongoing critical role in emotion socialization during adolescence. Our findings generally underscore the importance of daily interpersonal influences on teen girls' emotion regulation development.

We found surprising patterns of adolescent girls' frequency of interpersonal emotion regulation strategy use in everyday life. Contrary to our hypotheses, adolescent girls engaged in generally maladaptive emotion regulation strategies (i.e., rumination, cognitive and behavioral avoidance) with parents more often than with peers. Conversely, girls engaged in generally adaptive strategies (i.e., acceptance, problem solving, cognitive reappraisal, support seeking) with peers more frequently than with parents. This is surprising because, relative to their adolescent counterparts, parents were expected to reflect adults' generally advanced emotion regulation capacities (Tottenham et al., 2011; Zimmerman & Iwanski, 2014) through more frequent adaptive co-regulation. Greater adaptive co-regulation among parents was also hypothesized to reflect parents' tendencies to provide support through intentional emotion coaching (Gottman et al., 1996; von Salisch, 2001). Thus, our findings among high-risk adolescent girls' frequent adaptive co-

regulation with peers differed from prior EMA work indicating that youth with MDD problem solve with peers less frequently (Waller et al., 2014).

These findings may be explained by extant literature suggesting that early adolescence is typically characterized by more conflict with parents (Laursen, Coy, & Collins, 1998) and greater lability in negative affect (Larson et al., 1980), which in turn may prompt girls' more frequent use of generally maladaptive strategies with their parents. Recent work found similarly unexpected findings, such that parents co-ruminated with adolescents more than peers during a laboratory-based emotion task (Miller-Slough & Dunsmore, 2020). Indeed, co-rumination shares some commonality with emotion coaching, as they both require attention to and validation of another individual's emotions (Miller-Slough & Dunsmore, 2020). Thus, it is possible that parents express maladaptive co-regulation as an indicator of empathy and support. A recent study also suggested that, across both personal and interpersonal problems, adolescents tend to seek friends as their first choice for help (Sears, 2020). It may be possible that as adolescent girls seek more meaningful interpersonal closeness (Smith & Rose, 2011) through increased self-disclosure and emotion talk (Rose et al., 2012), they may, in turn, seek friends' help (Sears, 2020) and use more adaptive strategies that warrant greater intentionality and cognitive maturity (Crone & Dahl, 2012). Social display rules may also influence how teens disclose emotions to peers. Some evidence shows that, relative to their parents, youth expect more negative feedback from their best friends in response to emotional disclosure (Zeman & Shipman, 1997). Prior work has also linked social competence to peer acceptance or rejection (Brown & Larson, 2009), with teens showing less acceptance towards avoidant emotional responses (Rubin, Bowker, Barstead, & Coplan, 2018). It is possible that teens may not feel secure in disclosing heightened negative affect and less socially desirable emotion regulation responses, like maladaptive avoidant responses, to peers. Given youths'

perceptions that parents are both more supportive of emotional displays (Zeman & Shipman, 1997) and are stable sources of support (Schacter & Margolin, 2019), perhaps girls in our sample felt more comfortable disclosing less socially desirable, maladaptive emotion regulation to their parents. Our EMA prompts also specifically inquired about negative *peer* interactions, which might have influenced their comfort in disclosing sincere negative emotions due to concerns about maintaining friendships. Of note, the effect sizes for this set of findings were small in magnitude and should therefore be interpreted with caution.

Study findings also provide supporting evidence that both parent and peers effectively help adolescent girls down regulate everyday negative emotion. When teen girls enlisted parental help with emotion regulation, they were *less likely* to experience continued negative affect at the time of the EMA prompt. A similar finding emerged for peer influences, such that when girls co-regulated with peers, they were also *less likely* to continue experiencing negative affect at the prompt. These findings build upon prior EMA work showing the simultaneous influence of both parents and peers on youth interpersonal emotion regulation development in daily life (Stone et al., 2018; Waller et al., 2014). Prior EMA research on adolescent co-regulation assessed boys and girls meeting clinical thresholds for anxiety (Stone et al., 2018) and depression (Waller et al., 2014). The current study, however, examined interpersonal emotion regulation in a high-risk sample and focused particularly on teen girls at risk for developing, but not yet meeting, internalizing disorders. Thus, the current study highlights that interpersonal emotion regulation is an effective approach to down regulating negative emotion in high-risk and healthy youth, thereby extending our knowledge of everyday co-regulation beyond clinical samples.

We found partial support for our hypothesized associations between frequencies of co-regulation and concurrent as well as prospective depressive symptoms. Interestingly, neither

higher proportions of parental nor peer involvement in neither adaptive nor maladaptive strategy use predicted concurrent depressive symptoms. However, in partial support of our hypotheses, only adolescent girls' higher proportions of parental involvement in adaptive strategy use significantly reduced depressive symptoms one year later, above and beyond baseline depressive symptoms. Indeed, girls' higher proportions of maladaptive strategy use with parents and peers—as well as higher proportions of adaptive strategy use with peers—were not significantly related to future depressive symptoms. These results seem to suggest that, despite their frequent involvement in maladaptive co-regulation, parents may play a particularly beneficial, longer-term role in girls' emotion regulation development. Thus, although adolescent girls show a greater natural tendency to adaptively co-regulate with peers, working with parents to engage in adaptive emotion regulation strategies, such as problem solving and cognitive reappraisal, seems to have greater potential protective effects for mental health.

This set of findings might suggest that parents are more skilled in implementing emotion regulation strategies. Unlike teens undergoing cognitive maturation, parents are typically equipped with advanced cognitive capacities to regulate emotions more effectively (Tottenham et al., 2011; Zimmerman & Iwanski, 2014). In turn, these parental skills may generalize to co-regulation with greater preparedness. Parents may have also had numerous opportunities to refine their co-regulation skills throughout the natural course of emotion socialization, from infancy (Saarni et al., 2007) to adolescence (Buckholdt et al., 2014; Butterfield et al., 2019; Yap et al., 2008, 2010). Some research suggests that explicit parental emotion coaching, which begins in early childhood (Gottman et al., 1996), may still influence youths' well-being into adolescence (Katz & Hunter, 2007; Stocker et al., 2007). Extant work suggests that parental emotion coaching generally reduces teens' internalizing symptoms (Stocker et al., 2007). Greater maternal emotion coaching, in

particular, has been linked to fewer depressive symptoms among teens (Katz & Hunter, 2007). Indeed, emotion coaching is a form of interpersonal emotion regulation. It is possible that parents equipped with refined co-regulation skills may effectively guide teens' emotion regulation development and long-term mental health. Future longitudinal research should examine how parents actively refine their own co-regulation skills over the course of youths' development. Such work may enhance our understanding of how parents modify the co-regulation skills guiding their children's emotion regulation development.

These findings may also be explained by extant literature on social support and well-being among adolescent girls. A meta-analysis conducted by Chu and colleagues (2010) indicated that adolescents benefitted more from parental social support relative to peer social support. Moreover, girls in particular showed a stronger mean effect size between social support and well-being compared to their male counterparts (Chu et al., 2010). Thus, adolescent girls generally seem to benefit from parental social support—which, in the context of the current study, may consist of parental involvement in adaptive co-regulation. Stability in social support may also be particularly important for adolescent adjustment. A recent daily diary study indicated that adolescents' perceptions of consistent parental support over time helped alleviate the daily negative impact of having low peer support (Schacter & Margolin, 2019). Longitudinal research has also shown that teens experience high turnover rates in their friendships from early to mid-adolescence, with friendship replacements often occurring between academic years (Faris et al., 2018). Taken together, these findings suggest that stability in social support may be a uniquely valuable aspect of parental support, thus distinguishing parents from peers. However, less is known about the stability of co-regulation engagement in particular. To extend our knowledge beyond general

social support, future work should examine how stability in parental and peer co-regulation engagement may differentially unfold throughout adolescence.

Contrary to our hypotheses, neither the use of generally adaptive nor generally maladaptive emotion regulation strategies were significantly more or less effective in down regulating negative emotion in daily life, as current levels of negative affect did not differ based on the type of strategy used. Similarly, there were no significant interactions between the type of strategy used and the type of socializing agent involvement in predicting current levels of negative affect. This differs from extant literature suggesting that generally adaptive and generally maladaptive strategies are differentially related to negative affect (Aldao et al., 2010; Compas et al., 2017; Schäfer et al., 2017), although most of this literature has not used EMA methodology. Nevertheless, several reasons may explain these inconsistent findings. Many researchers highlight the importance of contextual factors and individuals' abilities to flexibly use various strategies within and across situations (Blanke et al., 2020; Brockman, Ciarrochi, Parker, & Kashdan, 2016; Troy, Shallcross, & Mauss, 2013). For example, Troy and colleagues (2013) showed that the contextual consideration of whether or not a stressor was perceived as controllable influenced the utility of cognitive reappraisal on depressive symptoms. Thus, a strategy such as cognitive reappraisal may vary in its effectiveness depending on the individual's context (Troy et al., 2013) and may not always be adaptive. Other work has shown that, relative to individuals using all available strategies to the same extent, individuals who selectively prioritize certain strategies in response to situations in daily life tend to experience less negative affect (Blanke et al., 2020). While such work on strategy flexibility and context has focused primarily on adult samples (Blanke et al., 2020; Brockman et al., 2016; Troy et al., 2013), it raises the possibility that our broader scope of strategy use may not capture how teens effectively select and use strategies in everyday contexts. Indeed,

recent work with this sample found that adolescent girls' selection of emotion regulation strategies varied based on the context (McKone, Edershile, Ladouceur, & Silk, in prep). Future research examining strategy effectiveness with this sample will broaden the scope of contextual factors, such as including adolescents' perceived controllability of a stressful interaction (Troy et al., 2013).

Another potential explanation for these inconsistent findings on strategy use effectiveness may relate to our measure of average negative affect (e.g., averaged values of anger, sadness, worry, and stress) instead of using discrete values of negative affect. Prior EMA work examining anxious and non-anxious youth has shown that effective strategy use differs depending on the discrete emotion observed (Tan et al., 2012). For example, problem solving was linked to lower levels of momentary anger and upset but not to sadness or nervousness, whereas cognitive reappraisal was only linked to reduced momentary upset among youth (Tan et al., 2012). Thus, the current study's use of averaged negative affect may have concealed effects specific to different discrete emotions. Future work with this sample will examine discrete emotions in relation to strategy effectiveness, as prior EMA work has shown differential effectiveness among emotion-specific strategy responses in youth (Tan et al., 2012).

4.1 Limitations

Despite the current study's strengths in using an EMA design to examine the unique parental and peer influences in tandem, there are several limitations to note. When prompted to select the type of emotion regulation employed during any EMA call, participants could only select one strategy among the menu of options. Thus, we were unable to assess other important factors

in determining strategy use effectiveness, such as an individual's ability to flexibly select multiple strategies in any given situation (Blanke et al., 2020; Brockman et al., 2016). Theorists have also raised potential pragmatic limitations when measuring youth emotion regulation, such as participants' reactance to research prompts about strategy use (Zeman, Klimes-Dougan, Cassano, & Adrian, 2007). It is possible that receiving prompts explicitly asking about strategy use may have influenced how youth in this sample engaged with, and reported on, such strategy use. Further, the generalizability of our findings is limited, as our sample is comprised of adolescent girls at risk for developing, but not yet meeting, clinical thresholds of internalizing disorders. Additionally, despite having an adolescent sample enriched for risk for developing internalizing symptoms, girls' reported levels of daily negative affect were generally low. We addressed these lower levels of negative affect with our analytic approach; however, the generalizability of our findings may also be limited among individuals experiencing heightened negative emotion. Two-thirds of participants were also White, and findings may not generalize to more racially and ethnically diverse populations. Further, despite the low frequency of simultaneous co-regulation with both parents and peers, it is possible that the 32 EMA calls excluded may have impacted study findings. We also had limited statistical power to provide more nuanced assessments of parental involvement, as there were few endorsements of fathers' involvement in co-regulation compared to that of mothers. Our co-regulation data collection on peers also did not distinguish between close friends and general peers, thus limiting further nuance among peer relations in analyses. Prior work has suggested that certain sources of social support may have differential effects on teens' emotional well-being (Lyell, Coyle, Malecki, & Santuzzi, 2020; Rueger, Malecki, Pyun, Aycock, & Coyle, 2016). A meta-analysis indicated that, relative to support from close friends, support from general peers showed more robust, inverse links to depression (Rueger et al., 2016). Thus,

future work on adolescent interpersonal regulation may benefit from collecting more nuanced measures of peer social involvement.

4.2 Implications

There are several important implications following the current study's findings. Overall, our findings suggest that social involvement from both parents and peers serve as important protective factors for adolescent girls' emotional development. In light of the COVID-19 pandemic's detrimental effects of social isolation and heightened experiences of anxiety and depression among teens (Hawes et al., 2021; Silk et al., 2021), our findings underscore the crucial socializing roles that both parents and peers may play in alleviating daily negative emotions. While our findings indicate that teen girls generally seem to benefit from parental and peer social support outside the context of global stressors, the protective role of such support during the ongoing COVID-19 pandemic may be particularly important for teens' emotional development as they navigate such times of acute distress. In fact, a recent daily diary study examining a subset of the current study's sample found that during the local area's lockdown months in Spring 2020, teen girls reported experiencing lower levels of daily positive affect when they were unable to connect with friends (Silk et al., 2021). Girls in this study also reported same-day decreases in negative affect and increases in positive affect on days that they spent more time with family (Silk et al., 2021). Taken together, these findings highlight that social involvement and support from key socializing agents, like parents and peers, may help reduce teen girls' daily experiences of negative affect during the COVID-19 pandemic and beyond.

Our surprising findings regarding adolescent girls' differential rates of co-regulation between parents and peers suggest that *how* teens engage with these sources of social support in daily life may look different, depending on the socializing agent. Such differential engagement may lead to different interventions designed to promote peer and parental emotion socialization. Given our findings that teen girls engage in direct adaptive emotion regulation with peers more often than parents in daily life, future interventions should consider capitalizing on teens' naturally-occurring tendency to involve peers in adaptive strategies. Findings suggest that schools should consider investing in peer coaching programs more regularly for students, thereby providing youth with structured opportunities to learn how to engage in adaptive emotion regulation more effectively with peers. Unlike other social-emotional learning programs primarily targeting intrapersonal emotion regulation (Nathanson, Rivers, Flynn, & Brackett, 2016), our suggested peer coaching programs would aim to enhance peers' ability to co-regulate alongside other teens by engaging in adaptive emotional responses. Schools may therefore have key potential to reinforce teens' natural tendencies to support their peers' everyday emotions.

Conversely, our findings indicate that adolescent girls engage in direct maladaptive emotion regulation with parents more frequently than peers in their everyday lives. However, our findings also show that the only protective factor between co-regulation involvement and future depressive symptoms was a higher proportion of parental involvement in adaptive co-regulation. Taken together, our findings suggest that while teens may engage in maladaptive strategies more often with parents on a daily basis, greater parental involvement in adaptive emotion regulation may be a unique, long-term protective mechanism for at-risk girls' susceptibility to develop future depression. This set of findings suggests that communities and clinicians should offer more family-based training programs designed to enhance parents' abilities to engage in adaptive co-regulation

with their adolescent children. Clinicians specializing in adolescent populations may particularly benefit from incorporating such training into semi-regular parent sessions throughout the course of a teen client's treatment plan. Given the possibility that teen clients seeking treatment may be learning adaptive emotion regulation skills for the first time, they may welcome additional parental support as they practice and refine such skills. Preliminary evidence from a parent-child group therapy for families of parents with, and youth at risk for developing, MDD suggests that training families in adaptive coping can help reduce children's depressive symptoms one year later (Compas et al., 2010). Thus, programs designed to enhance parents' preparedness for and involvement in adaptive co-regulation with teens may offer unique benefits to adolescents' emotional well-being—both daily and long-term.

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