# Maternal and Peer Regulation of Adolescent Emotion: Associations with Depressive Symptoms

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**Abstract** Emotion socialization by close relationship partners plays a role in adolescent depression. In the current study, a microsocial approach was used to examine how adolescents' emotions are socialized by their mothers and close friends in real time, and how these interpersonal emotion dynamics are related to adolescent depressive symptoms. Participants were 83 adolescents aged 16 to 17 years who participated in conflict discussions with their mothers and self-nominated close friends. Adolescents' positive and negative emotions, and mothers' and peers' supportive regulation of adolescent emotions, were coded in real time. Two multilevel survival analyses in a 2-level Cox hazard regression framework predicted the hazard rate of (1) mothers' supportive regulation of adolescents' emotions, and (2) peers' supportive regulation of adolescents' emotions. The likelihood of maternal supportiveness, regardless of adolescent emotions, was lower for adolescents with higher depressive symptoms. In addition, peers were less likely to up-regulate adolescent positive emotions at higher levels of adolescent depressive symptoms. The results of the current study support interpersonal models of depression and demonstrate the importance of real-time interpersonal emotion processes in adolescent depressive symptoms.

**Keywords** Dyadic interactions · Depression · Adolescence · Multilevel survival analysis · Emotion regulation

## Introduction

Adolescence is associated with an increased incidence of depression compared to childhood and adulthood (Lewinsohn et al. 1998). Adolescents experience numerous biological, social, and psychological changes (e.g., puberty, changing family and peer relationships, increased emotionality) that all challenge their ability to regulate emotions—that is, their ability to modulate the intensity, form, and duration of emotions (Dahl 2001; Hollenstein and Lougheed 2013; Thompson 1994). Depression has been considered a disorder of emotion regulation (Joormann and Gotlib 2010), as it is associated with difficulties in regulating both positive and negative emotions (Carl et al. 2013; Fussner et al. 2014; Gilbert 2012; Katz et al. 2014; Sheeber et al. 2009). In addition, theoretical perspectives on depression emphasize the role of interpersonal processes in the emergence of depressive symptoms (Allen and Badcock 2003; Joiner et al. 1999). Given the unique co-occurrence of increased challenges to emotion regulation and reorganization of close relationships in adolescence, this period of development is associated with a vulnerability to depression. Emotion socialization, the interpersonal processes involved in the development of emotion regulation, is thus one factor related to adolescent depressive symptoms (Katz et al. 2014; Morris et al. 2007; Sheeber et al. 1998, 2012; Yap et al. 2007, 2008).

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The ability to regulate emotions emerges from interactions with close relationship partners (Granic 2005; Morris et al. 2007). In childhood, primary caregivers socialize children's emotions by helping children down-regulate (resolve) negative emotions and up-regulate (reinforce, enhance) positive emotions (Kopp 1989; Morris et al. 2007). The timing of caregivers' responses to children's emotions is crucial for successful emotion socialization (Granic 2005). Caregivers' responses must be contingently linked in time to children's emotion expressions in order for children to internalize the strategies that parents use in scaffolding children's emotion regulation (Fogel 1993; Granic 2005). Children begin to develop their own self-regulation skills through repeated interactions with their caregivers, but the interpersonal regulation and socialization of emotion continues into adolescence (Morris et al. 2007).

Emotion socialization differs in adolescence from childhood because relationships change during adolescence (Collins and Laursen 2004; Smetana et al. 2006). Specifically, as adolescents gain autonomy and responsibility, adolescents cultivate their own extra-familial relationships (Collins and Laursen 2004; Smetana et al. 2006). Adolescents spend significantly more time with peers than with parents; therefore, peers become another agent of emotion socialization (Klimes-Dougan et al. 2014; Larson and Richards 1991). The objective of the current study was to examine the associations between real-time emotion socialization in two different close relationships contexts—mothers and close friends—and adolescent emotion regulation difficulties (i.e., depressive symptoms). We examined emotion socialization through mothers' and close friends' temporally contingent responding to adolescents' positive and negative emotions with supportive (i.e., validating) regulation, which functions to both down-regulate negative emotions and up-regulate positive emotions (Eisenberg et al. 1996; Fabes et al. 2001; Gottman et al. 1996; Lunkenheimer 2007; Morris et al. 2007).

### Emotion Socialization and Depression

Supportive responses to children's and youths' emotions that function to down-regulate negative emotions and up-regulate positive emotions are associated with the ability to self-regulate emotions and also are a protective factor against the development of psychological difficulties (Eisenberg et al. 1996; Fabes et al. 2001; Gottman et al. 1996). However, when close relationship partners' responses to children's emotions do not promote emotion regulation skills, children are at risk for developing emotion regulation difficulties such as depressive symptoms (Katz et al. 2014; Yap et al. 2008). For example, if a mother does not help her son resolve negative emotions by showing supportiveness, her son will have more difficulty resolving negative emotions in that moment, but he

will also be less likely to effectively self-regulate negative emotions in the future. Emotion dysregulation and related psychopathologies are, in part, shaped by a lack of supportive responses to positive and negative emotions from primary caregivers (Granic 2005; Sheeber et al. 1998; Yap et al. 2007).

**Maternal Emotion Socialization** Although mother-adolescent relationships undergo significant changes, such as becoming less hierarchical as adolescents gain autonomy, mothers continue to play an important role in the socialization of adolescent emotions (Fussner et al. 2014; Katz et al. 2014; Morris et al. 2007; Sheeber et al. 1998). A small body of literature has identified several aspects of mother-adolescent interactions related to adolescent depressive symptoms. Mothers of adolescents with clinical depression are less accepting of adolescents' positive emotions and are more likely to dampen adolescent positive emotions than mothers of non-depressed adolescents (Katz et al. 2014). Maternal dampening of adolescent positive emotions might be one dynamic underlying adolescent difficulties up-regulating and maintaining positive emotions associated with depressive symptoms.

Regarding maternal responses to negative emotions, research points to two different processes associated with adolescent depression (Schwartz et al. 2012). At higher levels of depressive symptoms in typically-developing adolescents, mothers are less likely to follow adolescent negative emotions with supportiveness (Pineda et al. 2007), which is likely related to the difficulties with down-regulating negative emotions associated with depressive symptoms. However, in samples of adolescents with clinical depression, mothers are more likely to respond supportively to adolescent dysphoric behavior, suggesting that maternal responses may reinforce adolescent negative emotions (Sheeber et al. 1998). These discrepant results are likely related to differences between typically-developing and clinical samples (Schwartz et al. 2012). Taken together, research to date on maternal emotion socialization has identified important interpersonal processes related to adolescent depression. However, these studies involved methods that obscure temporal dynamics, such as self-reported maternal responses to adolescent emotions (e.g., Katz et al. 2014) and sequential analysis or analysis of conditional probabilities (e.g., Pineda et al. 2007; Sheeber et al. 1998), which examine the sequence of mother-adolescent emotions and responses but not the timing of maternal responses in relation to adolescent emotions.

**Peer Emotion Socialization** Emotion socialization by same-age peers begins in childhood and continues throughout adolescence (Klimes-Dougan et al. 2014; La Greca et al. 2008; Vernberg 1990). As peer relationships become more autonomous, intimate, and influential in adolescence, emotion socialization by peers becomes more direct (Klimes-Dougan et al. 2014). Adolescents typically disclose more personal

information to peers than parents and consequently peers play a critical role in emotion socialization (Larson and Richards 1991; Rose 2002; Smetana et al. 2006). Peers typically respond supportively to expressed emotions (Cheadle and Goosby 2012; Klimes-Dougan et al. 2014). In addition, adolescents modify the expression of their emotions in accordance with the anticipated responses from their peers, striving to adhere to socially-accepted display rules (Zeman and Shipman 1997).

Emotion socialization by peers is associated with positive and negative outcomes (Rose 2002). Although peers are generally a source of supportive emotion socialization, peer emotion socialization can also play a role in the development of emotion dysregulation and depressive symptoms (Cheadle and Goosby 2012; Rose 2002). For example, friendships tend to form between adolescents with similar characteristics (i.e., selection effects), and those characteristics can become more exaggerated over time in the context of that friendship (i.e., socialization effects; Cheadle and Goosby 2012). In addition, adolescent friends who are both high in depressive symptoms can positively reinforce these depressive symptoms by supporting each others' negative emotions, but also by failing to help each other resolve negative emotions (Rose 2002). One study (Heller and Tanaka-Matsumi 1999) using sequential analysis showed that negative emotions expressed by adolescents with clinical depression were followed by supportive responses from their peers, which suggests a similar reinforcement of depressive symptoms that has been found in clinically-depressed adolescents and their mothers (Schwartz et al. 2012; Sheeber et al. 1998).

### The Current Study

We examined mothers' and peers' supportive responses to adolescents' positive and negative emotion expressions, and their associations with adolescent depressive symptoms. Mothers were selected to examine parental emotion socialization as mothers tend to be more engaged in the emotional lives of their adolescents than fathers (Klimes-Dougan et al. 2007). We examined mothers' and peers' socialization of adolescent emotions in a typically-developing sample of adolescents, in line with a developmental psychopathology approach (Hankin and Abela 2005), as even sub-clinical levels of depression are associated with psychological difficulties and predict future episodes of clinical depression (Sheeber et al. 2007). We also examined sex differences, as females tend to receive more supportive responses to negative emotions from their peers than males (Klimes-Dougan et al. 2014), and emotion socialization between mothers and their daughters versus their sons may differ (Klimes-Dougan et al. 2007).

Previous research on emotion socialization and adolescent depressive symptoms has examined individual characteristics such as maternal meta-emotion philosophy (e.g., Katz et al.

2014), changes in adolescent emotions over time (e.g., Sheeber et al. 2012), and the sequential patterns of emotions and responses (e.g., Heller and Tanaka-Matsumi 1999; Pineda et al. 2007; Sheeber et al. 1998). The current study extends this literature by using a microsocial, systems approach (Granic 2005) to examine the temporal contingencies between maternal and peer supportive (i.e., validating) regulation of adolescents' emotions in real time. Examining close relationship partners' real-time contingent responding directly tests the interpersonal dynamics posited by developmental psychopathology theories (Granic 2005).

Our main research question was whether mothers' and peers' supportive responses to adolescent emotions varied by adolescent depressive symptoms. As a lack of supportive responding to both positive and negative emotions is associated with emotion regulation difficulties such as depressive symptoms (Granic 2005; Pineda et al. 2007), we hypothesized that mothers and peers would be less likely to respond supportively to adolescents' positive and negative emotions for adolescents with higher depressive symptoms. To examine the temporal contingencies between adolescents' emotions and mothers' and peers' supportive responses, multilevel survival analysis (MSA; Mills 2011) was used. MSA estimates the likelihood that repeating events (e.g., maternal supportive regulation) occur, and time-varying influences (e.g., adolescents' expressions of positive and negative emotions) on those events. Compared to event-based sequential analysis and conditional probability analysis, which examine the order of events during parent–child interactions, MSA incorporates the amount of time until an event occurrence in addition to the order of event occurrences (Stoolmiller and Snyder 2006). MSA also differs from sequential approaches in that it is incorporated into a multilevel modeling framework with random effects, and therefore factors in heterogeneity at the level of the dyad rather than making the assumption that all dyads show the same associations between the time-varying predictors and dependent variable (Stoolmiller and Snyder 2006).

## Method

### Participants

The current study used an extant sample from a larger longitudinal study of adolescent relationships with mothers, close friends, and romantic partners (see Connolly et al. 2015; McIsaac et al. 2008). The current study consisted only of adolescents who participated in observation sessions with their mothers and/or close friends. Adolescents were recruited from three high schools in a large city in southern Ontario. The observational portion of the study, the focus of the current study, occurred when participants were in grade 11. Adolescents participated with a self-nominated same-sex best

friend ($n=11$), mother ($n=14$), or both ($n=61$). Three adolescents who participated with both their friend and mother were missing observational data due to technical issues at the recording stage, and these dyads were not included in analyses. The 83 adolescents were aged 16 to 17 years ($M=16.32$, $SD=0.47$), and 37 % of the sample of target adolescents was male. Adolescents identified their ethnicities as: European-Canadian (76 %), Asian-Canadian (7 %), Other (5 %), African/Caribbean-Canadian (4 %), Latin American-Canadian (4 %), South Asian-Canadian (4 %), and Middle Eastern-Canadian (1 %). The participants' families had a high average level of education, with 72 % of fathers and 59 % of mothers having at least a university degree.

## Procedure

Prior to beginning the study, informed consent was obtained from participating mothers. Personal assent was obtained from the target adolescents and their close friends, and informed consent from the friends' parents. Video-recoded observational sessions were conducted either in participants' homes or in a private location at their school. The interaction task consisted of two 7 min conflict discussions. Prior to the interaction task, each dyad member rated the extent to which eight common sources of conflict (e.g., peer pressure, school issues, neglect, trust) were issues in their relationship on a 4-point scale. The dyad's two most highly-rated issues were selected by the researcher as the topics for the conflict discussions. In order to acclimatize participants to the video camera before the conflict discussions, participants had a 5 min warm-up discussion on a positive topic (planning a party together). Only the conflict discussions were of interest in the current study. Target adolescents received $30 for participating.

## Measures

**Adolescent Depressive Symptoms** Adolescent depressive symptoms were measured with the Beck Depression Inventory, second edition (BDI-II; Beck et al. 1996). The BDI-II is a 21-item self-report scale that measures the presence and severity of depressive symptoms in adolescents and adults (Krefetz et al. 2002). Two items from the original scale, pertaining to interest in sex and suicidal thoughts, were omitted at the request of the Research Ethics Board. For the remaining 19 items, participants rated the extent to which they experienced symptoms of depression in the last 2 weeks (e.g., $0=I$ do not feel sad; $3=I$ am so sad or unhappy that I can't stand it). Internal consistency of the mean across all items was good ($\alpha=0.86$). The mean of the scale was used in analyses.

**Adolescent Emotion** All video-taped discussions between adolescents and their mothers and peers were previously coded for emotion with a 10-code version of the Specific Affect observational coding system (SPAFF; Gottman et al. 1995). The 10-code version of SPAFF captures expressions of positive (Joy, Affection, Humor, and Interest), negative (Contempt, Anger, Whine, Sad, and Fear) and Neutral emotion in real time. A team of four undergraduate research assistants used Noldus Observer 5.0 software to code the onset and offset times for all of adolescents' expressions of emotions continuously in real time. Joy, Interest, Humor, and Affection were collapsed into adolescent Positive Emotion. Contempt, Anger, Whine, Sadness, and Fear were collapsed into adolescent Negative Emotion. The Positive Emotion and Negative Emotion categories were used to identify episodes of adolescent Positive Emotion and Negative Emotion (see Derivation of Measures). Reliability was good, with the average percent agreement for frequency-sequence-based analyses of 80 % and $\kappa=0.76$, and an average percent agreement for duration-sequence-based analyses of 93 % for the full sample.

**Supportive Co-Regulation** All video-taped discussions between adolescents and their mothers and peers were coded by a team of four undergraduate research assistants with the Co-Regulation (CORE) observational coding system (Lougheed and Hollenstein 2011). CORE codes are based on verbal content and accompanying verbal tone and body language, and capture interpersonal emotion regulation behaviors. CORE consists of 11 mutually-exclusive code categories: Negative Emotional Directive, Positive Emotional Directive, Invalidation, Validation, Avoidance, Reappraisal, Negative Emotion Talk, Positive Emotion Talk, Problem Definition, Solution-Focused Problem Solving, and No Co-Regulation. The onset and offset times for all codes were applied to mothers and peers and were recorded continuously in real time with Noldus Observer 5.0. Only the supportive regulation codes were of interest in the current study: Positive Emotional Directive (e.g., reassurances that directly target affect, "You should feel proud of yourself"); Validation (e.g., expressions of support, empathy, or approval); and Reappraisal (e.g., attempts to modify the appraised significance of an issue to be more positive). Positive Emotional Directive, Validation, and Reappraisal were collapsed to create variables of maternal and peer Supportive Regulation, as these three behaviors all involve providing acknowledgement, support, and active involvement in helping others to resolve negative emotion or maintain positive emotion (Eisenberg et al. 1996; Fabes et al. 2001; Gottman et al. 1996; Lunkenheimer 2007; Morris et al. 2007). This category was used to identify episodes of maternal and peer Supportive Regulation (see Derivation of Measures).

**Derivation of Measures** To derive measures for MSA (see full description of MSA in Results section), we followed the procedures of Lougheed et al. (2015). GridWare (Lamey et al. 2004), a computer program that can be used to derive

quantitative measures from categorical time series data, was used in the first step of data processing. First, the Supportive Regulation and adolescent emotion coding files from the Observer 5.0 were converted separately by the GridWare File Converter into tab-delimited text files (trajectory files; one per dyad), which contained a column of onset times and separate columns for each variable (Supportive Regulation, Positive Emotion, Negative Emotion). Next, the separate regulation and emotion trajectory files were merged into time-synchronized trajectory files, dyad by dyad, each containing three columns: (a) onset time, (b) supportive regulation events, and (c) emotion events. Rows represented each new regulation/emotion combination in the order of their occurrences. These trajectory files were then processed further for MSA (e.g., one file with all dyads) with a Visual Basic macro available from the corresponding author. The transitions of time-varying predictors and dependent variables were defined from the onset and offset times of adolescent emotion and mother and peer regulation time series data (Mills 2011; Stoolmiller and Snyder 2006). Then, a Time to Event variable was calculated to indicate the time until variables transitioned into their respective dependent variable or time-varying predictor states from the last occurrence of these states. Finally, with MSA, hazard ratios were estimated from these Time to Event variables. For complete details regarding the derivation of MSA measures, readers are referred to the Derivation of Measures section of Lougheed et al. (2015).

## Results

### Descriptive Statistics and Preliminary Analyses

Descriptive statistics and correlations for the frequency of mother and peer Supportive Regulation, adolescent Positive Emotion and Negative Emotion during interactions with mothers and peers, and adolescent depressive symptoms are shown in Table 1. Several variables (the frequency of maternal and peer Supportive Regulation, and the frequency of adolescent Positive Emotion with peers) had outliers greater than 3.5 $SD$ above the sample mean, so these variables were Winsorized. All variables were positively skewed. Preliminary analyses (correlations and $t$-tests) were bootstrapped to overcome the issues of non-normality in the variables (Mooney and Duval 1993). The frequency of adolescent Positive Emotions during interactions with both mothers and peers was positively correlated with adolescent depressive symptoms. Otherwise, the relationships between the variables were not significant. Independent samples $t$-tests were used to test sex differences on all variables. There were no sex differences in adolescent depressive symptoms. For interactions with mothers, there were no sex differences on the frequency of Positive Emotion, but females showed a significantly higher frequency of Negative Emotion ($M=8.60$, $SD=10.43$) than males ($M=3.55$, $SD=3.45$), $t(70)=-2.51$, $p=0.01$, $d=60$. For interactions with peers, there were no sex differences on the frequency of Positive Emotion, but females showed a significantly higher frequency of Negative Emotion ($M=11.78$, $SD=9.47$) than males ($M=6.63$, $SD=8.04$), $t(67)=-2.26$ $p=0.03$, $d=0.57$. There were no sex differences on the frequency of Supportive Regulation for interactions with peers or mothers. Independent samples $t$-tests indicated that there were no differences on the frequency of Supportive Regulation, and adolescent Positive Emotion and Negative Emotion between adolescents who participated only with their mothers and those who participated with both their mothers and peers. Similarly, there were no differences on the frequency of Supportive Regulation, and adolescent Positive Emotion and Negative Emotion between adolescents who participated only with their peers and those who participated with both their mothers and peers.

### Multilevel Survival Analysis

MSA was used to estimate the likelihood of the occurrence of repeating events (maternal and peer Supportive Regulation)

**Table 1** Correlations, means, and standard deviations of the frequency of mother and peer supportive regulation, the frequency of adolescent positive emotion and negative emotion, and the mean of adolescent depressive symptoms

| | Mother Interactions | | | | Peer Interactions | | | |
|---|---|---|---|---|---|---|---|---|
| | 1. | 2. | 3. | 4. | 1. | 2. | 3. | 4. |
| Supportive Regulation | – | | | | – | | | |
| Adolescent Positive Emotion | −0.05 | – | | | 0.05 | – | | |
| Adolescent Negative Emotion | −0.19 | 0.00 | – | | 0.01 | −0.01 | – | |
| Adolescent Depressive Symptoms | −0.21 | 0.29* | 0.20 | – | 0.03 | 0.34** | −0.07 | – |
| Mean (SD) | 4.86 (4.08) | 7.42 (5.64) | 6.57 (8.68) | 1.44 (0.35) | 3.32 (2.24) | 13.20 (7.15) | 9.99 (9.28) | 1.44 (0.35) |

Note: Standard deviations in parentheses. * $p<0.05$, ** $p<0.01$

by estimating their hazard rate (the conditional probability that an event occurs within a given time interval; Mills 2011). Figure 1 shows a hypothetical data structure for our models. Model 1 tested the probability that mothers responded with Supportive Regulation to adolescent Positive Emotion and Negative Emotion. Model 2 tested the probability that peers responded with Supportive Regulation to adolescent Positive Emotion and Negative Emotion. For both Models 1 and 2, adolescent Positive Emotion and Negative Emotion were included as time-varying predictors in order to examine the influence of adolescents' real-time expressions of Positive Emotion and Negative Emotion on the likelihood of maternal and peer Supportive Regulation. Occurrences of maternal and peer Supportive Regulation that are temporally contingent on adolescent Positive Emotion and Negative Emotion (see points A and B in Fig. 1) are associated with increased hazard rates of Supportive Regulation in response to adolescent emotions. In both models, adolescent depressive symptoms and sex were included as time-invariant predictors. At the within level, the hazard rate of the dependent variables on time-varying predictors were estimated as a slope for each dyad. Differences by adolescent depressive symptoms on these slopes were estimated at the between level.

MSA models were run in a two-level Cox hazard regression framework using Mplus (Muthén and Muthén 2012). The hazard ratio, the primary statistic for interpretation, is the exponentiated hazard rate, and is the multiplicative increase in the dependent variable's hazard rate per unit increase in time-varying predictors (Mills 2011; Stoolmiller and Snyder 2006). Similar to an odds ratio, a hazard rate of 1 indicates no relationship between the predictor and the hazard of the dependent variable, a value greater than 1

indicates that the predictor is associated with an increased hazard of the dependent variable, and a value less than 1 indicates that the predictor is associated a decreased hazard of the dependent variable (Mills 2011).

**Maternal Supportive Regulation of Adolescent Positive Emotion and Negative Emotion** Table 2 shows the parameter estimates for Model 1, including the overall hazard rate of maternal Supportive Regulation and the contingent hazard rates of maternal Supportive Regulation on adolescent Positive Emotion and Negative Emotion. Overall, mothers were less likely to show Supportive Regulation to adolescents with higher depressive symptoms, as expected. The hazard ratio for the effect of adolescent depressive symptoms on maternal Supportive Regulation indicated that mothers were about half as likely to show Supportive Regulation to adolescents with higher depressive symptoms. Mothers were less likely to show Supportive Regulation to females than males, with the hazard ratio, when calculated as the percent change in hazard ([hazard ratio − 1]x100; Mills 2011), indicating that mothers had about one-third (34 %) of the hazard for transitioning into Supportive Regulation for females compared to males. Mothers did not up-regulate adolescent Positive Emotion with Supportive Regulation, as indicated by the non-significant intercept for the effect of adolescent Positive Emotion on the hazard rate of Supportive Regulation, and this temporal relationship did not vary by adolescent depressive symptoms or sex. Mothers also did not down-regulate adolescent Negative Emotion with Supportive Regulation, as indicated by the non-significant intercept for the effect of adolescent Negative Emotion on Supportive Regulation, and this temporal relationship did not vary by adolescent depressive symptoms or sex. Thus,
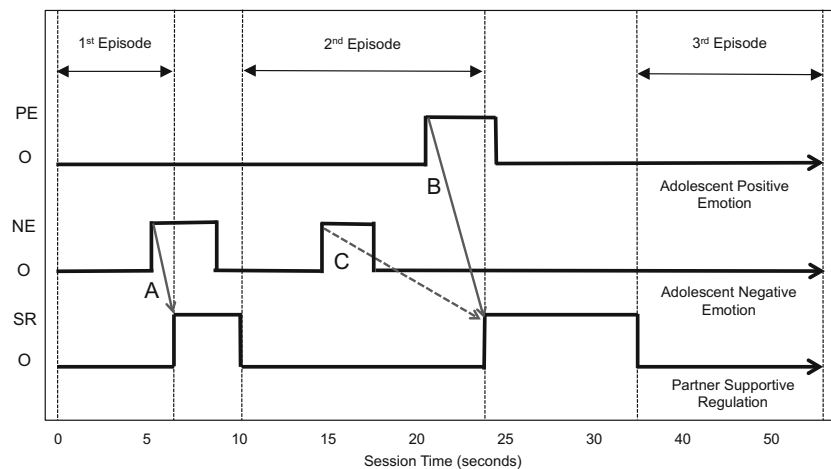


**Fig. 1** Hypothetical data structure of Models 1 and 2. Partner (mother or peer) Supportive Regulation (*SR*), the dependent variable, is predicted by Adolescent Positive Emotion (*PE*) and Negative Emotion (*NE*), the time-varying predictors. At points A and B, the partner transitioned into SR shortly after the adolescent expressed NE and PE, respectively. At point **c**, the partner's transition into SR was not contingent on adolescent NE. We

were interested in the temporal relationship depicted at points **a** and **b**—partners' contingent responding to adolescent NE and PE and the associations between depressive symptoms and that temporal relationship. Note. Partner states include SR and Other (*O*). Adolescent states include PE, NE, and other (*O*). Figure adapted from Stoolmiller and Snyder 2006

**Table 2** Hazard rate estimates for maternal supportive regulation of adolescent positive emotion and negative emotion (Model 1)

| | Estimate | Standard Error | Estimate/ Standard Error | p | Hazard Ratio | 95 % Confidence Interval of Hazard Ratio |
|---|---|---|---|---|---|---|
| Overall Hazard Rate | | | | | | |
| Depressive Symptoms | −0.71 | 0.29 | −2.41 | 0.02 | 0.49 | [0.28, 0.87] |
| Sex | −0.41 | 0.19 | −2.10 | 0.04 | 0.66 | [0.46, 0.96] |
| Effect of Adolescent Positive Emotion on Hazard Rate | | | | | | |
| Intercept | −0.34 | 1.24 | −0.28 | 0.78 | 0.71 | [0.06, 8.09] |
| Depressive Symptoms | 0.17 | 0.61 | 0.28 | 0.78 | 1.19 | [0.36, 3.92] |
| Sex | 0.00 | 0.50 | 0.00 | 0.99 | 1.00 | [0.38, 2.66] |
| Effect of Adolescent Negative Emotion on Hazard Rate | | | | | | |
| Intercept | 1.52 | 1.36 | 1.12 | 0.26 | 4.57 | [0.32, 65.73] |
| Depressive Symptoms | −0.72 | 0.83 | −0.87 | 0.39 | 0.49 | [0.10, 2.48] |
| Sex | −0.04 | 0.57 | −0.06 | 0.95 | 0.96 | [0.31, 2.94] |

Note: Sex 0=male, 1=female

mothers showed less supportiveness to adolescents with higher depressive symptoms and females, regardless of adolescent emotions.

**Peer Supportive Regulation of Adolescent Positive Emotion and Negative Emotion** Table 3 shows the parameter estimates for Model 2. The overall likelihood of peer Supportive Regulation, regardless of adolescent emotions, did not vary by adolescent depressive symptoms or sex. The significant intercept for adolescent Positive Emotion indicated that peers tended to up-regulate adolescent Positive Emotion by responding with Supportive Regulation. The hazard ratio for the intercept of the effect of adolescent Positive Emotion on the hazard of peer Supportive Regulation indicated that, per each additional expression of adolescent Positive Emotion, peers were approximately 13 times more likely to respond with Supportive Regulation. At higher levels of

adolescent depressive symptoms, however, peers were less likely to up-regulate adolescent Positive Emotion with Supportive Regulation, which was in line with expectations. This hazard ratio, when calculated as a percent change in the hazard, indicated that the likelihood of peers' supportive responses to adolescent Positive Emotion went down by 77 % per unit increase of adolescent depressive symptoms. There were no sex differences in the likelihood of peers up-regulating adolescent positive emotions. Peers did not down-regulate adolescent Negative Emotion with Supportive Regulation, as indicated by the non-significant intercept for the effect of adolescent Negative Emotion on Supportive Regulation, and this temporal relationship did not vary by adolescent depressive symptoms or sex. Thus, although peers up-regulate adolescent Positive Emotion in general, at higher levels of adolescent depression, peers were actually less likely to up-regulate adolescent Positive Emotion.

**Table 3** Hazard rate estimates for peer supportive regulation of adolescent positive emotion and negative emotion (Model 2)

| | Estimate | Standard Error | Estimate/ Standard Error | p | Hazard Ratio | 95 % Confidence Interval of Hazard Ratio |
|---|---|---|---|---|---|---|
| Overall Hazard Rate | | | | | | |
| Depressive Symptoms | 0.30 | 0.23 | 1.36 | 0.17 | 1.35 | [0.86, 2.12] |
| Sex | −0.04 | 0.16 | −0.27 | 0.79 | 0.96 | [0.70, 1.31] |
| Effect of Adolescent Positive Emotion on Hazard Rate | | | | | | |
| Intercept | 2.56 | 1.08 | 2.37 | 0.02 | 12.94 | [1.56, 107.43] |
| Depressive Symptoms | −1.45 | 0.55 | −2.63 | 0.01 | 0.23 | [0.08, 0.69] |
| Sex | −0.79 | 0.55 | −1.43 | 0.15 | 0.45 | [0.15, 1.33] |
| Effect of Adolescent Negative Emotion on Hazard Rate | | | | | | |
| Intercept | 0.39 | 1.65 | 0.24 | 0.81 | 1.48 | [0.06, 37.49] |
| Depressive Symptoms | −0.48 | 0.98 | −0.49 | 0.63 | 0.62 | [0.09, 4.22] |
| Sex | 0.57 | 0.80 | 0.71 | 0.48 | 1.77 | [0.37, 8.48] |

Note: Sex 0=male, 1=female

## Discussion

Emotion socialization occurs in close relationships, within and outside of the family (Denham et al. 2007). There is a dearth of research on peer emotion socialization despite widespread acknowledgment of the role of peers in emotion socialization (Denham et al. 2007)—peer relationships have mostly been examined as an outcome of parental emotion socialization (e.g., Eisenberg et al. 1996; Katz and Windecker-Nelson 2004). A small number of studies demonstrate the importance of peer relationships in adolescent depressive symptoms (e.g., Rose 2002; Schwartz-Mette and Rose 2015), but it is necessary to examine how real-time socialization varies in different relationship contexts to best understand the interpersonal processes associated with adolescent depressive symptoms. The current study was a first step toward understanding the microsocial processes in both maternal and peer relationships and their associations with adolescent depressive symptoms. We found that mothers were less likely to show supportiveness to adolescents with higher depressive symptoms, regardless of adolescents' expressed emotions. Peers were less likely to up-regulate adolescent positive emotions for adolescents with higher depressive symptoms. Maternal and peer emotion socialization play a role in late-adolescent depressive symptoms, but in different ways.

### Maternal and Peer Emotion Socialization and Adolescent Depressive Symptoms

Our results suggest that the link between older adolescents' depressive symptoms and maternal emotion socialization does not necessarily involve the reinforcement of negative emotions (i.e., adolescent negative emotions met with increased maternal supportiveness) in typically-developing samples, as found by previous research on clinical samples (Sheeber et al. 1998). Instead, in line with previous research on a typically-developing sample (Pineda et al. 2007), we found that mothers were less likely to show supportiveness at higher levels of adolescent depressive symptoms than at lower levels of depressive symptoms. The degree of maternal supportiveness was not specific to adolescent emotion valence but varied only with respect to adolescent depressive symptoms. In contrast, peers were less likely to up-regulate adolescent positive emotions at higher levels of adolescent depressive symptoms. In late adolescence, peer emotion socialization might be more directly linked than maternal emotion socialization to the positive emotion regulation difficulties associated with adolescent depressive symptoms (Carl et al. 2013; Fussner et al. 2014).

Previous research has shown that emotion regulation difficulties for both positive and negative emotions are associated with depressive symptoms (Fussner et al. 2014; Katz et al. 2014; Sheeber et al. 2009). Consequently, it was surprising that we found no associations between mothers' and peers'

regulation of adolescent negative emotions and adolescent depressive symptoms. This null result may be because we examined these processes in a typically-developing sample. Previous research showing associations between interpersonal emotion processes and adolescent negative emotions has examined these processes in samples of adolescents with clinically-significant levels of depressive symptoms (e.g., Sheeber et al. 2009). The dyads with typically-developing adolescents in this sample may not have expressed as much negative emotion as dyads in clinical samples. Another possibility is that the up-regulation of negative emotions through non-supportive (e.g., invalidating) responses from close relationship partners is more strongly associated with adolescent depressive symptoms than the down-regulation of negative emotions with supportive responses. Non-supportive maternal and peer behaviors were coded in the current study, but their extremely low frequency ($M=0.03$, $SD=0.24$ for mothers; $M=0.06$, $SD=0.24$ for peers) precluded the possibility of testing their associations with depressive symptoms in this sample.

In contrast to the negative emotion results, the results of the current study add to the literature on the importance of examining positive emotions in relation to adolescent depressive symptoms (Gilbert 2012). It was unexpected that adolescent positive emotions and depressive symptoms were positively associated. This positive association may be related to differences between emotional experiences and expressions, as previous research suggests that adolescents with higher depressive symptoms may express more positive emotions, despite feeling less positive, than adolescents with lower depressive symptoms (Chaplin 2006). However, it was not possible for us to examine this possibility in the current study.

Regarding interpersonal processes, previous research and theory suggest that depressive symptoms emerge, and are maintained and exacerbated by, difficulties with regulating positive emotions interpersonally (Allen and Badcock 2003; Joiner et al. 1999). Lewinsohn (1974) proposed that individuals with depression do not receive sufficient positive reinforcement from close relationship partners due to depression-related difficulties in eliciting positive responses from others. Similarly, Coyne (1976) suggested that depression is characterized by a lack of, or disruption to, social support and validation. The social interpretations associated with depression such as negative or hostile attribution biases interact with interpersonal processes (Haines et al. 1999). For example, interpreting close relationship partners' attempts at support in a hostile or negative way might lead to defensiveness, which would in turn push close relationship partners away and thus decrease the likelihood of their supportiveness in the future.

Positive emotions in interpersonal contexts beget positive close relationships, which in turn leads to more positive emotions (Ramsey and Gentzler 2015). This positive upward

spiral is a normative developmental process that functions to socialize emotions and maintain relationships (Ramsey and Gentzler 2015). When the positive upward spiral is disrupted with difficulties regulating positive emotions (e.g., depressive symptoms), psychosocial adjustment problems and interpersonal difficulties are likely to be exacerbated. Adolescents who are high in depressive symptoms, and therefore who are experiencing difficulties regulating positive emotions, might "push" close relationship partners away. Other interpersonal processes associated with adolescent depressive symptoms might also influence how close relationship partners respond to adolescents' positive emotions, such as conversational self-focus, the tendency to re-direct problem-focused discussions towards oneself (Schwartz-Mette and Rose 2015). Conversational self-focus among adolescents with depressive symptoms is associated with decreased peer relationship quality and peer rejection over time (Schwartz-Mette and Rose 2015). Difficulties with interpersonal interactions, such as pushing close relationship partners away and conversational self-focus, might be met with a lowered likelihood of supportiveness from those partners. Without interpersonal scaffolding of positive emotion regulation, adolescents with depressive symptoms may continue to experience difficulties regulating positive emotions and their depressive symptoms may be reinforced. Thus, for individuals with difficulties regulating positive emotions, the "upward spiral" might actually be a downward spiral.

## Adolescent Sex, Depressive Symptoms, and Emotion Socialization

It was surprising that adolescent depressive symptoms did not vary by sex in our sample, as previous research indicates that around 15 years old, females are about twice the likely as males to have experienced depression, and this sex difference is stable through adulthood (Cyranowski et al. 2000). It is possible that the lack of sex differences were related to the relatively low variability on depressive symptoms in our typically-developing sample. However, we did find some sex differences on maternal supportiveness. Females were less likely than males to experience maternal supportiveness. Parental supportiveness decreases in adolescence as adolescents become more adept at self-regulating emotions (Klimes-Dougan and Zeman 2007), and it is possible that these sex differences reflect maturational differences.

## Limitations and Future Directions

In interpreting the results of the study, it is important to note several limitations. There is the possibility of selection effects with respect to the sample. Adolescents with similar characteristics (e.g., depressive symptoms) tend to become friends, and adolescents with depressive symptoms also tend to have

mothers with depressive symptoms (Cheadle and Goosby 2012; Hammen 2009). It is possible that the interpersonal dynamics related to adolescent depressive symptoms observed in the current study also vary as a function of the depressive symptoms of adolescents' close relationship partners. It was not possible to test this hypothesis because we did not have peer or maternal depression measures. Future research should include measures of all interaction partners' depressive symptoms.

Although one strength of the study was examining interactions with both mothers and peers, there are other important socializers of adolescent emotions such as fathers, siblings, and romantic partners (Hammen 2009; Ha et al. 2014; Smetana et al. 2006). Each close relationship type may contribute differently to the socialization of adolescent emotions. Mothers tend to respond supportively to adolescent negative emotions than fathers, who tend to overlook them (Klimes-Dougan et al. 2007). Emotion socialization also varies by the interaction of parent (mother versus father) and adolescent sex. For example, fathers are more likely than mothers to respond punitively to their son's anger, and daughters are more likely to make emotional disclosures to either parent than males (Klimes-Dougan et al. 2007; Papini et al. 1990). In addition, parental emotion socialization likely differs between dyadic interactions (mother-adolescent, father-adolescent) and whole-family interactions (Fosco and Grych 2013), in which mothers and fathers may influence each others' reactions to adolescent emotions. It is important for future research to disentangle the effects of multiple close relationship types and contexts.

With respect to the methods, adolescents' expressed emotions were aggregated into their emotional valence (either positive or negative) due to the relatively low base rates of specific emotions and short observation period. Thus, we were not able to examine mothers' and peers' socialization of specific adolescent emotions related to depression (e.g., sadness), which is an important factor to consider based on previous research (Klimes-Dougan et al. 2007; Sheeber et al. 1998). Longer observational periods to examine real-time interpersonal processes could result in sufficient base rates of specific emotions related to adolescent depressive symptoms.

An important direction for future research will be to incorporate both microsocial and longitudinal designs. In our cross-sectional study, we were not able to examine how microsocial processes with mothers and close friends were related to the emergence and maintenance of adolescent depressive symptoms, but previous research has indicated that adolescent depressive symptoms and negative interpersonal experiences predict each other longitudinally (Vernberg 1990). Incorporating microsocial methods, MSA in particular, into longitudinal designs will shed light on the specific social processes involved in the

etiology of depression, as well as how specific features of depressive symptoms affect real-time social dynamics. Another avenue of investigation for future research is to examine the associations between real-time social cognition and real-time interpersonal dynamics to elucidate the connection between cognitive and emotional processes associated with depression in an interpersonal context. One previous study, in which a novel video-mediated recall procedure of a family observational session was used, showed that adolescents with depression perceived greater parental aggression and less parental positive emotions compared to parents' observed expressions of aggressive and positive emotion (Ehrmantrout et al. 2011). This type of design could be extended to examine the real-time links between interpersonal cognitive biases and emotion dysregulation in interpersonal interactions. Such an approach with a high temporal resolution would yield valuable insights into the cognitive antecedents of emotion dysregulation in depressive symptoms and thus provide specific targets for future intervention efforts.

## Conclusion

Moment-to-moment emotion processes between close relationship partners are the foundation of psychological well-being across the lifespan. In late adolescence, emotion dynamics with close relationship partners such as mothers and peers are related to depressive symptoms. Both dynamic systems and developmental psychopathology approaches (e.g., Granic 2005) posit the functional relations between real-time processes and long-term outcomes. Innovative applications of sophisticated analyses, such as MSA, bring us closer to testing these claims and gaining much-needed insights into the interpersonal mechanisms underlying the development of psychopathology. The current study showed that a lack of support from both mothers and peers is related to adolescents' depressive symptoms. Further investigations of microsocial processes between adolescents and their close relationship partners will clarify the real-time processes through which depressive symptoms emerge and are maintained.

**Compliance with Ethical Standards**

**Conflict of Interest**   The authors declare no conflicts of interest.
    This study was conducted in compliance with the requirements of the Institutional Research Ethics Boards, and informed consent/ assent was obtained from all participants included in the study.

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