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# Peer Contagion and Adolescent Depression: The Role of Failure Anticipation

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The current study investigated the mechanisms underlying peer contagion of depressive symptoms in adolescence. Five annual measurements of data were gathered from a large ( $N = 842$ ) community-based network of adolescents ( $M = 14.3$  years at first measurement). Results showed that, after controlling for selection and deselection of friends on the basis of depressive symptoms, peers' depressive symptoms predicted increases in adolescents' depressive symptoms over time. Failure anticipation mediated effects of peers' depressive symptoms on adolescents' depressive symptoms, particularly for girls. Thus, results suggest that peers' depressive symptoms place adolescents at risk of developing depressive symptoms through increasing in failure anticipation.

Adolescence has been characterized as a vulnerable period for developing depressive symptoms. Several studies have focused on peer relationships in adolescence in order to explain why certain individuals are prone to develop depressive symptoms (e.g., Kiesner, 2002; Kovacs, 1992; Rudolph, Hammen, & Burge, 1994; Selfhout, Branje, & Meeus, 2009). Peers may influence each other to become more similar in depressive symptoms over time (Prinstein, 2007; Stevens & Prinstein, 2005), a process labeled *peer contagion* (Stevens & Prinstein, 2005). It has been suggested that peers' depressive symptoms increase adolescents' negative cognitions, and these, in turn, increase adolescents' depressive symptoms (e.g., Prinstein, 2007; Stevens & Prinstein, 2005). In the current study, we examined

whether peer contagion was mediated by negative cognitions. Furthermore, as girls are particularly prone to develop depressive symptoms in adolescence (e.g., Lansford et al., 2006; Rudolph, 2002; Selfhout et al., 2009), we examined whether girls were more affected by their peers' depressive symptoms than boys.

## PEER CONTAGION AND DEPRESSIVE SYMPTOMS

One specific type of peer influence is peer contagion, or the tendency for peers to influence each other to become similar in depressive symptoms. Friends may directly mimic each other's depressive behaviors to increase perceptions of belongingness and relationship closeness (Prinstein, Cheah, & Guyer, 2005). Further, depressive friends tend to *co-ruminate* (Rose, 2002; Rose, Carlson, & Waller, 2007); that is, they mutually encourage

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problem talk, rehash problems, speculate about problems, and dwell on negative affect. Through co-rumination, depressive friends tend to reinforce negative thoughts and feelings, thereby increasing each others' depressive symptoms (Rose, 2002; Rose et al., 2007). Thus, through peer contagion, peers become increasingly similar over time in depressive symptoms.

Few studies have examined the extent to which peer contagion occurs within adolescent friendships. Two studies examined youths and their best friends over a period of 11 months (Stevens & Prinstein, 2005) and 18 months (Prinstein, 2007) in middle adolescence. In both studies, higher scores of friends' own reported depressive symptoms predicted higher adolescents' depressive symptoms, even after controlling for adolescents' depressive symptoms at the first measurement. In sum, prior research has supported peer contagion within best friendships.

#### MECHANISMS UNDERLYING PEER CONTAGION

One explanation for peer contagion of depressive symptoms is that it is mediated by *failure anticipation*, or consistent expectations of failing on future tasks (Määttä, Nurmi, & Stattin, 2007; Nurmi, 1993, 1997). The basic premise of this theory is that adolescents' cognitive schemata, constructed in earlier similar types of situations, provide a basis for various anticipations about the outcomes of and success in difficult situations. When handling these situations, adolescents with high failure expectations tend to dwell on unrelated, "off-task" behavior. By dwelling on these off-task behaviors, the likelihood of actual failure increases over time, thereby enhancing self-deprecating thoughts and pessimism about one's personal future (Määttä et al., 2007; Nurmi, 1993). Youths with high failure anticipation, thus, get trapped in a vicious cycle of self-handicapping behaviors, which increase depressive feelings and thoughts over time (Nurmi, 1997; Overbeek et al., 2006). In sum, adolescents' failure anticipation may lead to depressive symptoms because it increases the risk of becoming trapped in a cycle of self-handicapping behaviors.

Several studies have confirmed the role of failure anticipation in the development of depressive symptoms. In one study, failure anticipation among early adolescents predicted increased depressive symptoms over a 2-year period (Overbeek et al., 2006). In another, failure anticipation and depressive symptoms were shown to be bidirectionally positively associated in middle adolescence across 18 months while controlling for pessimistic cognitions and depressogenic attributions (Määttä et al., 2007). In a third study, late adolescents'

failure anticipation predicted increases in their depressive symptoms over a period of 10 years (Salmela-Aro, Aunola, & Nurmi, 2008). Thus, failure anticipation has been shown to predict depressive symptoms, over and above other negative cognitions.

Failure anticipation has also been shown to be highly shared between friends with emotional problems (Määttä et al., 2007). One explanation for this is the previously described co-rumination process: As depressive friends tend to rehash and dwell on negative attributions and interpretations, they tend to focus on personal failures as well (Rose, 2002; Rose et al., 2007). Failure anticipation may, therefore, be transferred within these friendships as well. Thus, friends' depressive symptoms may increase adolescents' failure anticipation, and this in turn may increase adolescents' depressive symptoms. Nevertheless, the mediating role of failure anticipation in the effects of friends' depressive symptoms on adolescents' depressive symptoms has not yet been examined.

#### GENDER DIFFERENCES IN THE ROLE OF FAILURE ANTICIPATION IN PEER CONTAGION

Several studies have shown that peer contagion regarding depressive symptoms is stronger for girls than for boys (Prinstein et al., 2005; Rudolph, 2002; Stevens & Prinstein, 2005). For example, friends' depressive symptoms were found to predict girls' depressive symptoms more strongly than boys' depressive symptoms (Stevens & Prinstein, 2005). Why would girls be more affected than boys by their friends' depressive symptoms? One explanation may be that girls' failure anticipation is more strongly affected by their friends' depressive symptoms than boys' failure anticipation is. Girls may be socialized to react with more co-rumination when facing emotional problems (Rose, Schwartz, & Carlson, 2005). When co-ruminating, negative attributions and pessimistic future expectations are rehashed and shared (Rose, 2002), which may increase sharing of failure anticipation as well. Consistent with this possibility, one study demonstrated that girls within friendships are more similar in failure anticipation than boys within friendships (Määttä, Stattin, & Nurmi, 2006). In addition, girls seem to experience higher levels of stress than boys when discussing negative attributions and expectations within friendships, which in turn reinforces their own negative thoughts, feelings, and expectations (Rose, 2002; Rose et al., 2007). Consistent with this possibility, an experimental study on communication within friendships among girls showed that stress-related hormones increased more when talk about emotional problems was elicited than when it was not (Byrd-Craven, Geary, Rose, & Ponzi, 2008). This

increase in stress hormones seems to make girls more likely to memorize problematic aspects and expect more future problems (Rose et al., 2005). Thus, depressive girls may transfer negative cognitions, such as failure anticipation, more than depressive boys. In sum, girls' failure anticipation may be more affected than boys' by peers' depressive symptoms. On the other hand, gender differences may also exist in the way failure anticipation directly affects depressive symptoms. However, gender differences in the mediating role of failure anticipation for peer contagion have not been studied.

### ALTERNATIVE PROCESSES

Although empirical support has been provided for influence processes regarding depressive symptoms, several alternative processes must be addressed to clarify the unique role of influence. First, influence processes may be confounded with *selection* processes (Kandel, 1978a; Stevens & Prinstein, 2005), or the tendency to select peers with similar depressive symptoms. Selection is based on the theory of homophily (Lazarsfeld & Merton, 1954) and the similarity-attraction theory (Berger & Calabrese, 1975; Byrne & Nelson, 1965), which state that similarity in values, traits, and behaviors increases predictability, making individuals communicate with less effort and with shared feelings of understanding and belongingness. This increased predictability and these positive feelings are suggested to enhance selection of friends. In sum, similarity in depressive symptoms between adolescents and their friends may alternatively be explained by the tendency of adolescents to select friends with similar levels of depressive symptoms.

On the other hand, *de-selection* processes may provide yet another alternative explanation why adolescents have relationships with peers who show similarity in depressive symptoms. According to the theory of social corrosion (Coyne, 1976), individuals prone to depressive symptoms lack the necessary social skills to provide support and closeness. Depressive individuals' failures to provide support and closeness are, in turn, suggested to trigger dissatisfaction and even deselection by the less depressive dyadic partner in the relationship. In contrast, mutual feelings of understanding and high self-disclosure may characterize communication between two similarly depressive friends, which seem to increase closeness and intimacy between depressed friends (Rose, 2002; Rose et al., 2007). This, in turn, is suggested to contribute to the continuity of these relationships. In sum, selection and deselection must be controlled to understand the unique importance of peer influence processes on depressive symptoms.

### THE CURRENT STUDY

In this study, we aimed to gain more understanding of mechanisms underlying peer contagion processes in depressive symptoms. To do so, we adopted a social network approach, which is currently the only approach available that can control for the confounding processes selection and de-selection (Snijders, 2001). Another advantage of the social network approach over other dyadic approaches is that peer contagion is studied in adolescents' entire social networks. In other dyadic approaches, peer contagion is studied within relationships with one friend at a time. Nevertheless, adolescents tend to have multiple friendships, even those with relatively high depressive symptoms (Kiesner, Poulin, & Nicotra, 2003). In a social network approach, peer contagion is studied across *multiple* friendships simultaneously, thus using information of all peer relationships adolescents have. In sum, using a social network approach may provide more accurate estimation of peer contagion than other dyadic approaches.

We hypothesized that peer contagion would be stronger for girls than for boys. Next, we examined whether adolescents' failure anticipation mediated effects of peers' depressive symptoms on adolescents' depressive symptoms. In addition, we tested gender differences in the mediating role of failure anticipation in peer contagion. Finally, when estimating peer contagion concerning depressive symptoms, we controlled all aforementioned analyses for peer selection and deselection based on depressive symptoms. In this way, we were able to examine the importance of peer contagion, apart from these other processes.

### METHOD

#### Participants

Participants came from a community-based, cohort-sequential study in a medium-sized city in Sweden (total population of about 26,000). All the schools in the city participated at each measurement. The major advantage of using this community approach is that peers both outside of school and inside of school participated. Annual assessments were conducted over five measurements. To form the network that would be included in these analyses, we began with all eighth graders who participated in at least three measurements ( $N = 329$ ; 148 girls, 181 boys;  $M_{age} = 14.28$ ). We focused on eighth graders because depressive symptoms tend to change particularly during middle adolescence (Selfhout et al., 2009). Therefore, to capture these changes, we followed eighth graders over 4 years. After inclusion of the friends the eighth graders nominated at each of five

measurements, the final network consisted of 847 students (355 girls, 492 boys;  $M = 14.29$ ). Approximately 10% of all participants were ethnic minorities. Adolescents who participated at all five measurements (91%) did not differ significantly from those who did not (9%) on a multivariate test including depressive symptoms and number of nominated friends at Measurement 1,  $F(2, 839) = .73, p > .05$ .

### Procedure

Data collections took place during school hours. Adolescents were recruited by first contacting administrators of the local municipality, who in turn contacted the principals of the schools. The principals organized the subsequent data collections at the schools. Trained research assistants visited the adolescents in their classrooms during school time. Students were told about the types of questions they would answer and the time it would take to finish the questionnaires. They were also informed that their participation was voluntary and that if they chose not to participate, they could do something else instead. They were guaranteed that if they did participate in the study, their answers would never be shown to their parents, their teachers, or anyone else. Data collections at each wave lasted about 1 hr. Before the study took place, parents were informed about the study through community-based meetings and via letters. Before each wave, parents received new information and a prepaid card to return to us if they did not want their child/children to participate in the study. Only 1% of the parents did so. The parents were told that they could withdraw their child from the study at any time.

Adolescents filled out the questionnaires during regular school hours in sessions administered by trained research assistants. The teachers were not present. No participant was paid for taking part in the study; however, in each of the classes in Grades 7 through 12, we held a drawing for movie tickets. Whether or not youths chose to participate, they were eligible for the drawing. The procedures and measures used were all approved by the university's Ethics Review Board.

### Measures

**Peer nominations.** Adolescents were asked to identify up to three important peers, which we defined as "someone you talk with, hang out with, and do things with." In addition, up to 10 peers with whom they spent time in school and up to 10 peers with whom they spent time outside of school were also identified. When participants nominated siblings or romantic partners as important peers, these siblings and romantic partners were excluded from the analyses. We combined the three

different nominations by identifying the unique peers who were nominated at each measurement. Thus, up to 23 nominations of friends each participant spent time with in school and in free time were collected annually. The mean number of nominated friends ranged between 3.6 and 4.2 across the measurements. Of all friendship relationships in the network, between 34% and 39% were formed from one measurement to the next, between 24% and 29% were ended from one measurement to the next, and between 31% and 34% remained stable from one measurement to the next.

**Depressive symptoms.** Depressive symptoms were measured using the Child Depression Scale from the Center for Epidemiological Studies (Radloff, 1977). The scale consists of 20 items, rated on 4-point scales ranging 1 (*not at all*), 2 (*seldom*), 3 (*now and then*), and 4 (*often*). Participants were instructed to think about the past week. Examples of items are, "I have 'Worried about things I don't usually worry about,'" "Felt scared," and "Felt down and unhappy." We calculated depressive symptoms by summing all scores for each participant, creating a total score with a range from 0 to 60 (Radloff, 1977). In follow-up analyses, we used the clinical cut-off score indicating depressive symptoms within the clinical range (i.e., scores higher than 30; Radloff, 1977). The Center for Epidemiologic Studies Depression Scale has been shown to have adequate specificity, constructive validity, and predictive validity among adolescents (Aebi, Metzke, & Steinhäusen, 2009; Olsson & Von Knorring, 1999; Perreira, Deeb-Sossa, Harris, & Bollen, 2005). The Cronbach's alphas in the current sample ranged between .83 and .88 across the five measurements. The cross-year correlations ranged from .44 to .58. Note that in the social network analyses, changes in the total score were treated as ordinal categorical changes (see Results section).

**Failure anticipation.** We used three items pertaining to failure anticipation from the revised Strategy-Attribution Questionnaire (Nurmi, 1993). Items were "I don't really have faith in my ability to cope with hard tasks," "I easily become uncertain when I face new tasks," and "Often I don't even think there is a point in trying when I face demanding tasks." Respondents answered each item on a 4-point Likert scale ranging from 1 (*not at all true*) to 4 (*very true*). A series of studies has demonstrated that this scale has adequate construct validity (Nurmi, 1993, 1997; Nurmi, Salmela-Aro, & Haavisto, 1995). Predictive validity was supported in terms of educational outcomes and depressive symptoms (Määttä, Nurmi, & Stattin, 2007; Salmelo-Aro, Anora, & Nurmi, 2008). The Cronbach's alphas ranged

between .85 and .88 across the five measurements. The cross-year correlations ranged from .40 to .59.

### Data Analysis

To examine selection, influence, and deselection processes simultaneously, we used the software program Simulation Investigation for Empirical Network Analyses (SIENA; Snijders, 2001; Snijders, Steglich, & Schweinberger, 2007). This method has been successfully applied in adolescence to assess selection effects for personality (Selfhout et al., in press), and selection, deselection, and influence processes regarding delinquency (Snijders & Baerveldt, 2003). SIENA is currently the only program available that can be used to study influence processes while controlling for selection and deselection within adolescents' networks of multiple peer relationships. Further, with SIENA we controlled in all analyses for the total amount of changes in adolescents' relationships as well as effects of mean levels of depressive symptoms on selection and deselection.

If information about nominations, depressive symptoms, or failure anticipation were missing (>10% across measurements), scores were imputed according to the procedure developed by Huisman and Steglich (2008). To examine the pattern of missingness, dummy-coded variables were used to indicate which persons had missing values at a specific variable on a specific measurement (i.e., 15 dummy-coded variables). Next, we performed a series of regression analyses where these indicators for missings were used to predict scores of depressive symptoms and failure anticipation at each measurement. None of the regression coefficients were significant ( $p > .05$ ). Taken together, findings indicate that the pattern of missingness approaches "missing at random" (Kline, 1998). The Results section provides more details about the modelling and specific effects regarding this approach.

## RESULTS

### Descriptive Statistics

Table 1 shows the summed scores and standard deviations on depressive symptoms and failure anticipation by gender. The summed scores of depressive symptoms in the current sample are similar to summed scores found in previous community samples among adolescents (Aebi et al., 2009). Furthermore, the proportion of adolescents within the clinical range in the current sample (11.9–12.8% across waves) is highly similar to that found in prior studies (12.1–13.2%; Aebi et al., 2009; Olson & Von Knorring, 1999). A repeated measures analysis was used to examine changes in

development in depression and failure anticipation, as well differences according to gender, for all adolescents. The overall effect of gender was significant for both depression,  $F(1, 846) = 15.7, p < .01$ , and failure anticipation,  $F(1, 846) = 17.8, p < .01$ ; girls consistently had higher levels of depressive symptoms and failure anticipation than boys. Only one significant change was found: Failure anticipation,  $F(4, 838) = 97.3, p < .01$ , declined significantly over time.

In addition, we examined a repeated measures analysis to examine differences in the depressed group (participants scoring >30 on the summed score of the CES-D) versus the nondepressed group (participants scoring ≤30 on the summed score of the CES-D) in mean levels and changes in depressive symptoms and failure anticipation. Findings showed that the depressed group scored significantly,  $F(1, 841) = 65.8, p < .01$ , higher on failure anticipation than the nondepressed group. No other significant differences were found. Thus, more depressed adolescents seem to have more failure anticipation across the five measurements than less depressed adolescents.

### Peer Contagion and Depressive Symptoms

For influence processes, the dependent variable was represented by changes in adolescents' depressive symptoms. SIENA treats changes in depressive symptoms as ordinal categorical values (Snijders et al., 2007) and models changes in friendships and changes in depression as two interdependent processes, thereby controlling each for the other. This means that positive significant effects of the variables of interest on these change scores of depressive symptoms indicated that higher scores on the variable in question predicted a higher increase in adolescents' depressive symptoms than expected by chance, holding all other effects of independent variables (including those in selection and deselection) constant. When examining these effects, individuals are assumed to be mutually dependent because each individual figures simultaneously as an adolescent who is being influenced, and as a friend who influences others. This mutual dependence is mediated by effects of the network structure (such as *reciprocated relationships* and *triadic relationships*). These effects respectively pertain to the tendency to form reciprocated relationships (John selects Mark, and Mark selects John) and the tendency to form triadic relationships (John selects Mark, Mark selects Sue, and John selects Sue). This way, all selection, influence, and deselection effects were adjusted for overlap in the network (for full details, see Snijders, 2001). We also controlled for the trend in depressive symptoms by including both the linear tendency of change and quadratic tendency of change in the

TABLE 1  
Depressive Symptoms and Failure Anticipation Across Five Annual Measurements

	Measurement 1		Measurement 2		Measurement 3		Measurement 4		Measurement 5	
	Boys	Girls								
Depression										
All	8.43 <sub>a</sub> (6.72)	12.82 <sub>b</sub> (12.06)	8.52 <sub>a</sub> (6.80)	14.22 <sub>b</sub> (12.08)	8.42 <sub>a</sub> (6.70)	15.87 <sub>b</sub> (12.02)	8.23 <sub>a</sub> (6.21)	16.33 <sub>b</sub> (13.02)	8.50 <sub>a</sub> (6.44)	18.73 <sub>b</sub> (12.10)
Nondepressed	8.41 <sub>a</sub> (6.73)	12.80 <sub>b</sub> (12.02)	8.51 <sub>a</sub> (6.76)	14.47 <sub>b</sub> (12.02)	8.41 <sub>a</sub> (6.60)	15.92 <sub>b</sub> (11.80)	8.24 <sub>a</sub> (6.07)	16.82 <sub>b</sub> (12.19)	8.52 <sub>a</sub> (6.45)	18.70 <sub>b</sub> (11.87)
Depressed	32.46 <sub>a</sub> (2.03)	33.76 <sub>b</sub> (3.04)	32.43 <sub>a</sub> (2.05)	34.50 <sub>b</sub> (2.05)	32.46 <sub>a</sub> (1.58)	33.87 <sub>b</sub> (1.81)	31.20 <sub>a</sub> (2.10)	32.80 <sub>b</sub> (2.17)	32.48 <sub>a</sub> (2.40)	33.69 <sub>b</sub> (1.81)
Failure Anticipation										
All	2.11 <sub>a</sub> (.08)	2.24 <sub>b</sub> (.06)	2.09 <sub>a</sub> (.08)	2.22 <sub>b</sub> (.08)	2.06 <sub>a</sub> (.08)	2.18 <sub>b</sub> (.09)	2.01 <sub>a</sub> (.12)	2.16 <sub>b</sub> (.11)	2.00 <sub>a</sub> (.12)	2.13 <sub>b</sub> (.11)
Nondepressed	2.11 <sub>a</sub> (.08)	2.23 <sub>b</sub> (.06)	2.09 <sub>a</sub> (.08)	2.22 <sub>b</sub> (.08)	2.07 <sub>a</sub> (.08)	2.18 <sub>b</sub> (.09)	2.01 <sub>a</sub> (.12)	2.16 <sub>b</sub> (.11)	2.00 <sub>a</sub> (.12)	2.13 <sub>b</sub> (.11)
Depressed	3.05 <sub>b</sub> (.02)	3.11 <sub>b</sub> (.03)	2.99 <sub>b</sub> (.02)	3.08 <sub>b</sub> (.02)	2.93 <sub>b</sub> (.02)	3.03 <sub>b</sub> (.03)	2.88 <sub>b</sub> (.04)	3.00 <sub>b</sub> (.02)	2.83 <sub>b</sub> (.02)	2.93 <sub>b</sub> (.03)

Note. Different subscripts show differences between groups for depression separately. Numbers between parentheses pertain to standard deviations. ND = nondepressed, participants scoring 30 or less on the CED; D = depressed, participants scoring more than 30 on the CED.

<sup>a,b</sup>Different subscripts show differences between groups for depression separately.

categorical scores of depressive symptoms (Snijders, Steglich, & Van de Bunt, 2010).

We examined whether the effect of *peers' depressive symptoms* was significant; that is, whether adolescents become more similar to their peers in depressive symptoms over time (Step 1 in Table 2). As expected, adolescents' depressive symptoms became more similar to their peers' depressive symptoms over time ( $\hat{\beta}_k = .72$ ,  $SE = .07$ ,  $p < .01$ ; odds ratio [OR] = 2.05). This effect indicates that adolescents were 2.05 times more likely to become similar to their peers' average depressive symptoms than to not become similar to their peers' average depressive symptoms over time. Thus, support was found for influence processes as an explanation why adolescents tend to be similar to their peers in depressive symptoms.

In addition to these analyses for the whole sample, we additionally examined whether girls became more similar to their peers in depressive symptoms than boys did. We examined whether the interaction between peers' depressive symptoms and gender predicted changes in adolescents' depressive symptoms. As expected, the interaction effect was positive and significant. Finally, findings showed that gender, age, and the interaction between age and peer depression did not significantly predict changes in adolescents' depressive symptoms.

To further explore gender differences in the peer depression effect, we created two networks from our original data: One where the target adolescents were all girls ( $n = 148$  target girls, and  $n = 271$  friends), and one where the target adolescents were all boys ( $n = 181$  target boys, and  $n = 247$  friends). Next, we examined to what extent peers' depressive symptoms predicted girls' depressive symptoms and boys' depressive symptoms. Findings showed that both boys ( $\hat{\beta}_k = .55$ ,  $SE = .05$ ,  $p < .01$ ; OR = 1.73) and girls ( $\hat{\beta}_k = 1.66$ ,  $SE = .07$ ,  $p < .01$ ; OR = 5.26) tended to become significantly more similar to their peers in depressive symptoms over time. We tested differences between these two effects using a multiple group test developed by Snijders (2010). This test showed that the effect was significantly ( $p < .01$ ) larger for girls than for boys. Thus, although both boys and girls tended to become similar to their peers in depressive symptoms over time, girls became significantly more similar than boys did.

### Alternative Processes

Both selection and deselection provide alternative explanations for why adolescents tend to be similar to their peers in depressive symptoms. Therefore, in the next two steps we examined the role of similarity in depressive symptoms for selection and deselection, respectively,

TABLE 2  
Peer Contagion Processes Regarding Changes in Adolescent Depressive Symptoms and Changes in Adolescent Failure Anticipation

	Adolescent Depressive Symptoms				Adolescent Failure Anticipation			
	$\beta_k$ at Step	SE	$\beta_k$ Final Model	SE	$\beta_k$ at Step	SE	$\beta_k$ Final Model	SE
Step 1								
Baseline Depressive Symptoms	-.12	.11	-.12	.12				
Gender	.03	.05	.02	.03				
Age	.04	.03	.02	.05				
Peers' Depressive Symptoms	.72***	.07	.05	.03				
Peers' Depressive Symptoms $\times$ Gender (0 = boy, 1 = girl)	.31***	.10	.02	.04				
Peers' Depressive Symptoms $\times$ Age	.05	.06	.02	.05				
Step 2								
Depression: Selection Similarity	1.56***	.60	1.61***	.70				
Depression: Adolescents Select	.02	.06	.01	.06				
Depression: Peers Select	-.23***	.06	-.20***	.06				
Step 3								
Depression: Deselection Similarity	-1.82***	.56	-1.71***	.46				
Depression: Adolescents Deselect	2.14***	.17	2.13***	.17				
Depression: Peers Deselect	.51***	.12	.49***	.12				
Step 4								
Baseline Adolescent Failure Anticipation					-.07	.14	-.06	.14
Peers' Depressive Symptoms					.55***	.09	.54***	.07
Peers' Depressive Symptoms $\times$ Gender					.45***	.13	.49***	.12
Step 5								
Adolescent Failure Anticipation	1.21***	.23	1.20***	.23				
Adolescent Failure Anticipation $\times$ Gender	.00	.02	.00	.03				

\*\* $p < .01$ . \*\*\* $p < .001$ .

over and above the prior discussed influence processes. The dependent variable was changes in friendship nominations. To distinguish between different types of changes in friendships for the 847 participants, one matrix was created for each measurement consisting of  $847 \times 847$  cells. Each participant was represented with one row, showing whether the participant nominated another participant as a friend (i.e., up to 23 nominations per participant). Each participant was also represented with one column, which showed whether the participant was selected as a friend. Thus, each cell showed whether a participant nominated the other participant (a value of  $x_a = 1$ ; a *friend dyad*) or did not nominate the other participant (a value of  $x_b = 0$ ; a *nonfriend dyad*). Self-nominations were excluded.

**Selection processes.** For selection processes, we examined to what extent variables predicted that a non-friend dyad at one measurement would change to a friend dyad at the next. For selection, higher positive significant values of  $\beta_k$  indicated that higher scores on a variable predicted a higher likelihood of selecting a friend versus not selecting a friend. We examined whether mean levels of depressive symptoms and similarity in depressive symptoms between adolescents and peers predicted relationship formation between adolescents and peers more than expected by chance (Step 2 in Table 2). Table 2 showed that higher *depression: selection similarity* predicted a higher probability of adolescents and peers selecting each other ( $\hat{\beta}_k = 1.56$ ,  $SE = .60$ ,  $p < .01$ ;  $OR = 5.00$ ). This effect indicates that adolescents were 5 times more likely to select peers with similar levels of depressive symptoms than to not select peers with similar levels of depressive symptoms. In addition, one significant effect of mean-levels of depressive symptoms on peer selection was found: *depression: peers select*. This effect indicates that adolescents with higher levels of depressive symptoms had lower probabilities of being selected by peers. The effect of *depression: adolescents select* was not significant. This indicates that depressive symptoms did not significantly predict how frequently adolescents select peers. After inclusion of these significant selection processes, higher scores of peers' depressive symptoms still predicted increases in adolescents' depressive symptoms over time ( $\hat{\beta}_k = .66$ ,  $SE = .05$ ,  $p < .01$ ;  $OR = 1.93$ ).

**Deselection processes.** For deselection processes, we examined to what extent variables predicted that a friend dyad at one measurement would change into a nonfriend dyad at the next. For each independent variable, higher positive significant values of  $\beta_k$  indicated that higher scores on an independent variable predicted a higher likelihood of deselecting a friend versus not

deselecting a friend. Findings in Table 2 show that the *depression: deselection similarity* effect was negative and significant ( $\hat{\beta}_k = -1.82$ ,  $SE = .56$ ,  $p < .01$ ;  $OR = .16$ ), indicating that similarity between adolescents and peers predicted *less* deselection between them. This means that adolescents are left with peers who are relatively similar to them in depressive symptoms. Therefore, peer deselection provides an alternative explanation why adolescents tend to be similar to their peers in depressive symptoms. In addition, two significant effects of mean-levels of depressive symptoms on peer selection were found. The significant, positive effect of *depression: peers deselect* indicates that adolescents with higher levels of depressive symptoms had higher probabilities of being deselected by peers. The effect of *depression: adolescents deselect* was significant and negative, indicating that adolescents' depressive symptoms significantly predicted their deselecting peers more frequently. After including these deselection processes, higher scores of peers' depressive symptoms still predicted increases in adolescents' depressive symptoms over time ( $\hat{\beta}_k = .66$ ,  $SE = .08$ ,  $p < .01$ ;  $OR = 1.93$ ).

#### Peer Contagion and Depressive Symptoms within the Clinical Range

To explore the role of peers in developing depressive symptoms within the clinical range, we additionally examined whether having a peer who scored within the clinical range of depressive symptoms predicted adolescent's own depressive symptoms to increase to the clinical range. To test this, we replaced participants' average scores of depressive symptoms in the prior discussed model with the dichotomous variable *clinical depressive symptoms* (0 = scoring  $\leq 30$  on the summed score on the CED, 1 = scoring  $> 30$  on the summed score of the CED). We controlled for both selection and deselection processes as discussed in the previous model.

Findings showed that adolescents tended to become more similar to their peers in clinical depressive symptoms over time ( $\hat{\beta}_k = .43$ ,  $SE = .08$ ,  $p < .01$ ;  $OR = 1.54$ ). This effect shows that adolescents were 1.54 times more likely to become similar to their peers in depressive symptoms within the clinical range than not to become similar to their peers in depressive symptoms within the clinical range. Thus, support was also found for peer contagion of depressive symptoms within the clinical range. Findings further showed that similarity in clinical depressive symptoms predicted a higher probability of adolescents and peers selecting each other ( $\hat{\beta}_k = .23$ ,  $SE = .08$ ,  $p < .01$ ;  $OR = 1.26$ ). Finally, results showed that similarity in clinical depressive symptoms did not predict adolescents de-selecting peers ( $\hat{\beta}_k = .01$ ,  $SE = .06$ ,  $p > .01$ ;  $OR = 1.01$ ). Thus, findings indicated that

peer contagion processes do occur for depressive symptoms within the clinical range, even after controlling for significant selection processes.

### Peer Contagion: Mediation of Failure Anticipation

According to the approach suggested by Baron and Kenny (1986), four conditions have to be met for demonstrating a mediation model. First, the predictor variable, peers' depressive symptoms, should predict the outcome variable, adolescents' depressive symptoms, in the assumed direction. Findings of the prior model show that this condition was met. The second condition is that the predictor, peers' depressive symptoms, must significantly predict the mediator, adolescents' failure anticipation, in the assumed direction. This condition was supported; peers' depressive symptoms significantly predicted increases in adolescents' failure anticipation (Step 4 in Table 2). The third condition is that the mediator variable, adolescents' failure anticipation, must significantly predict the outcome variable, adolescents' depressive symptoms. Results showed that adolescents' failure anticipation significantly predicted increases in adolescents' depressive symptoms. Thus, this condition was met. The fourth condition holds that the impact of the predictor, peers depressive symptoms, on the outcome, adolescents' depressive symptoms, is significantly reduced when controlling for the effect of the mediator, adolescents' failure anticipation (Step 5 in Table 2). This condition was also supported; after including effects of adolescents' failure anticipation on adolescents' depressive symptoms, effects of peers' depressive symptoms on adolescents' depressive symptoms became non-significant (see Table 2;  $\beta_k = .05$ ,  $SE = .03$ ,  $p > .10$ ;  $OR = 1.00$ ). In addition, we tested the strength of the indirect effects by multiplying effects of peers' depression on adolescents' failure anticipation with effects of adolescents' failure anticipation on adolescents' depression and dividing this effect by its standard deviation (MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002; Sobel, 1982). This effect was positive and highly significant:  $.90$  ( $p < .001$ ). In sum, findings suggest that adolescents' failure anticipation mediates peer contagion effects in depressive symptoms.

We explored gender differences in this mediation effect by using the previously mentioned subsamples of boys and girls. We did this in two steps. First, we examined whether there were gender differences in the way peers' depressive symptoms predicted adolescents' failure anticipation. Results in Table 2, under Step 4, showed that the interaction effect between gender and peers' depressive symptoms on adolescents' failure anticipation was positive and significant, indicating that failure anticipation was more strongly affected by peers' depressive symptoms for girls than for boys. Next, we

explored this interaction by examining to what extent peers' depressive symptoms predicted girls' failure anticipation and boys' failure anticipation. Findings showed that for both boys ( $\hat{\beta}_k = .22$ ,  $SE = .05$ ,  $p < .01$ ;  $OR = 1.25$ ) and girls ( $\hat{\beta}_k = .64$ ,  $SE = .07$ ,  $p < .01$ ;  $OR = 1.90$ ), peers' depressive symptoms predicted changes in adolescents' failure anticipation. We tested differences between these two effects using a multiple group test developed by Snijders (2010). This test showed that the effect for girls was significantly ( $p < .01$ ) larger than for boys.

Second, we explored gender differences in the way adolescents' failure anticipation subsequently predicted adolescents' depressive symptoms. Results (Table 2, Step 5) showed that the interaction effect between gender and adolescents' failure anticipation on adolescents' depressive symptoms was not significant, indicating no significant gender differences in how failure anticipation affected depressive symptoms. In sum, support was found for gender differences in the way adolescents' failure anticipation mediated effects of peers' depressive symptoms on adolescents' depressive symptoms. Effects of peers' depressive symptoms on adolescents' failure anticipation were stronger for girls than for boys. In turn, higher adolescents' failure anticipation seemed to increase adolescents' depression similarly for boys and girls.

## DISCUSSION

The current study investigated the mechanisms underlying peer contagion of depressive symptoms in adolescence. Findings support peer contagion processes for depressive symptoms; adolescents tend to become more similar to their peers in depressive symptoms over time. Moreover, additional analyses demonstrated that peer contagion might also occur for depressive symptoms within the clinical range. This indicates that having a peer with a depressive disorder may increase the risk for adolescents themselves to develop a depressive disorder. Alternatively, this indicates a protective factor of having a nondepressed peer. For adolescents who show clinically relevant depressive symptoms, symptoms might decrease if they have a nondepressed peer. Taken together, findings underline the importance of understanding the role of peers' depressive symptoms in how adolescents develop their own depressive symptoms.

Findings provided insight into mechanisms underlying peer contagion of depressive symptoms. Peers' depressive symptoms may increase adolescents' failure anticipation, which in turn may increase adolescents' depressive symptoms. These findings can be explained when integrated with two other results in the current study: selection and deselection processes. These

processes refer to the tendency of adolescents to form relationships with peers who have similar depressive symptoms at the same time as adolescents end relationships with peers who have dissimilar depressive symptoms. Both these processes indicate that adolescents with high depressive symptoms may seek out and tend to stay with peers who have similar depressive symptoms. Prior research has shown that similarly depressive peers talk excessively about their negative attributions and future expectations (Rose, 2002; Rose & Asher, 1999; Rose et al., 2007; Rudolph, 2002; Rudolph et al., 1994). This sharing of negative cognitive styles between friends has been shown to lead to internalization of negative cognitions (Burwell & Shirk, 2007). More specifically, peers with emotional problems are particularly likely to share failure anticipation with adolescents (Määttä et al., 2006), perhaps because of the same type of communication. Thus, depressive peers may increase adolescents' failure anticipation. This increase in adolescents' failure anticipation, in turn, may lead to a vicious cycle of self-handicapping behaviors (Nurmi, 1993, 1997), in which adolescents with relatively high failure anticipation focus on off-task behavior, which increases their chances of actual failure. Failing increases pessimistic self-views and evaluation, as well as future failure anticipation (Nurmi, 1993, 1997). This cycle of self-handicapping behaviors may, over time, increase depressive feelings and thoughts because it may enhance feelings of helplessness and hopelessness (Määttä et al., 2007; Oster, 2006). In sum, findings indicate that highly depressive adolescents may seek out and tend to stay with similarly depressive peers. Their depressive feelings and thoughts may lead them to excessively talk about failure anticipation, possibly increasing each dyadic partner's own failure anticipation. This, in turn, seems to increase the risk of developing depressive symptoms.

Current results offer a refinement of previously found gender differences in the way peers' depressive symptoms may affect adolescents' depressive symptoms. That is, the current study, as well as prior studies (Prinstein, 2007; Stevens & Prinstein, 2005) indicated that girls' depressive symptoms were more affected by their peers' depressive symptoms than boys' were. These gender differences were explained, however, when estimating the mediation model; peers' depressive symptoms predicted girls' failure anticipation more than boys'. In turn, boys' and girls' failure anticipation seem to equally affect their depressive symptoms. Particularly depressive girls may have a predisposition to increase in stress-related hormones when co-ruminating (Byrd-Craven et al., 2008), making them more likely to increase in negative self-evaluations and negative expectations, and eventually depressive symptoms (Rose et al., 2005). Thus, girls may be more predisposed to increase in depressive

symptoms because of a higher sensitivity to corumination. In sum, the current study demonstrated that stronger increases in failure anticipation offer one explanation why girls are more affected by peers' depressive symptoms than boys are.

Several limitations of the current study should be noted. First, negative cognitive styles other than failure anticipation, such as depressogenic attributions (Stevens & Prinstein, 2005), may have mediated peer contagion. Nevertheless, failure anticipation was shown to predict depressive symptoms irrespective of pessimistic cognitions and depressogenic attributions (Määttä et al., 2007). Therefore, failure anticipation may have a unique role in the development of depressive symptoms, over and above other negative cognitive styles. Second, although we proposed that communication between depressive friends provides the explanation why peers' depressive symptoms may increase adolescents' failure anticipation, communication differences between depressive friends and less depressive friends were not studied. Future studies should examine how characteristics of communication explain the mediational role of failure anticipation in peer contagion. Although the current study did not examine the quality of these relationships, one prior study showed that peers' depressive symptoms predicted adolescents' depressive symptoms in low and high quality relationships (Prinstein, 2007). Therefore, current results for peer contagion may hold for both lower and higher quality peer relationships. Finally, future studies should explore developmental differences in peer contagion across adolescence.

Despite these limitations, this study has several strengths. The current study followed a large network of adolescents' peer relationships over 4 years, which allowed us to control peer contagion for both selection and de-selection processes occurring within this network of relationships. Further, the current study provides insight into what mechanisms underlie peer contagion, indicating that increases in adolescents' failure anticipation forms one of these mechanisms. Finally, gender differences in the mediational role of failure anticipation in peer contagion were shown, stressing that gender differences need to be taken into account to understand how peers may affect adolescents' depressive symptoms.

### Implications for Research, Policy, and Practice

Based on these findings, it appears that peer relationships seem to have an important function for the development of depressive symptoms in adolescence, as depressive adolescents not only seek out and stay with similarly depressive peers but risk increasing in depressive symptoms through peer contagion of depressive symptoms within the relationship. Moreover, selection and deselection each make it more likely that depressed

friends become even more isolated from their less depressive peers, which in turn may increase risks for peer contagion. Thus, to intervene in peer contagion, simultaneous selection and deselection seems to additionally need to be considered and altered to prevent depressive friends from becoming more isolated over time. In addition, communication between friends, and specifically shared failure anticipation, seems to be one mechanism through which peer contagion may occur. Girls may be particularly vulnerable to increases in depressive symptoms through failure anticipation. The current study therefore provides support for clinical prevention (Gladstone & Beardslee, 2009) and intervention (Castle, Berk, Lauder, Berk, & Murray, 2009) programs aimed at addressing how adolescents interact with their interpersonal contexts. Furthermore, these findings stress that interpersonal therapy (Driessen et al., 2010; Gunlicks-Stoessel & Mufson, 2010) should specifically aim at changing transmission of adolescents' failure anticipation within peer relationships. To be able to truly intervene in this dyadic process, both friends should be targeted instead of focusing on one single individual. Further, future research and intervention should focus on *how* the cycle of shared failure anticipation between friends can be changed, specifically among girls. As this cycle revolves primarily around expecting failure in tasks and therefore actually failing at these tasks, perhaps letting friends perform a variety of joint tasks and teaching them to provide positive and constructive feedback on each other may reduce feelings of anxiety and negative thoughts. This, in turn, may break the cycle of sharing failure anticipation within peer relationships.

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