Published in final edited form as:
Psychol Assess. 2013 March ; 25(1): 47–60. doi:10.1037/a0030393.

Concurrent and Predictive Associations between Early Adolescent Perceptions of Peer Affiliates and Mood States Collected in Real Time via Ecological Momentary Assessment Methodology

Julie C. Rusby, **Erika Westling**, **Ryann Crowley**, and **John M. Light**
Oregon Research Institute

Abstract

This study uses Ecological Momentary Assessment (EMA) to simultaneously capture youths' perceptions of peer affiliates and social contexts to determine their association with youths' current and future mood states. A sample of 82 seventh grade students (36 at risk for developing or escalating rule-breaking and substance use, and 46 randomly selected) from four schools participated. Utilizing EMA methodology students reported on their peer affiliations, perceptions of peer affiliates, moods, activities, location, and behaviors during their free time. Data from three assessment waves were collected; each wave consisted of 27 randomly prompted assessments during a week. Youth spent a large portion of their free time watching T.V., on the computer, or playing video games. Being "out and about" increased over the school year, whereas adult supervision decreased, showing an increase in potentially risky situations. Happiness was associated with affiliating with peers who were perceived as popular. Negative moods were associated with affiliating with peers by whom they are teased or treated meanly. Multilevel models found that both levels and lability of negative moods (i.e., sadness, anxiety) were predicted by risk status and affiliating with peers who tease them. Compared to boys, girls who affiliated more with peers who teased them and were classified as at-risk had more extreme negative moods and negative mood lability. EMA methodology has demonstrated the ways in which salient intrapersonal and peer processes are associated over time, which can inform efforts to prevent the development and escalation of behavior problems, substance use, and mood disorders in youth.

Keywords

Ecological Momentary Assessment; middle school youth; mood states; peers; behavior

Peer affiliations, friendships, and mood states tend to change rather frequently during early adolescence (Hardy, Bukowski, & Sippola, 2002; Larson, Moneta, Richards, & Wilson, 2002). It also is a time when peers become more salient and their influence increases (Dodge & Sherrill, 2006; Steinberg & Silverberg, 1986). Unfortunately, as the need for peer acceptance increases, the frequency of experiencing overt aggression (Nansel et al., 2001; Rusby, Forrester, Biglan, & Metzler, 2005) and relational aggression (Björkqvist,

Correspondence concerning this article should be addressed to Julie C. Rusby, Oregon Research Institute, 1776 Millrace Dr., Eugene, Oregon 97403-1983. juliecr@ori.org.

Lagerspetz, & Kaukiainen,1992) from peers also increases. Simultaneously, the extent to which adults monitor youth activities and whereabouts tends to decrease (Richards, Miller, O'Donnell, Wasserman, & Colder, 2004; Stoolmiller, 1994). Gathering accurate information from adolescents to assess their intrapersonal and social contexts can be challenging but informative for identifying the relationships between these constructs, predicting risk of onset to mood disorders and problem behaviors, and eventually designing interventions to prevent their development or escalation.

For this study, Ecological Momentary Assessment (EMA) was used to simultaneously examine the relationships among perception of peer affiliates and mood states, as well as the time trends in these relationships and risky contexts (such as lack of adult monitoring) collected over one school year. EMA is a methodology for collecting self-report data in real time in natural settings (for advantages of EMA see Ebner-Priemer & Trull, 2009; Gorin & Stone, 2001; Hufford, Shiffman, Paty, & Stone, 2001; Shiffman, 2000). Assessing the relationships between perception of peer affiliates and mood state is important for understanding the emotional impact of peer relationships, and hence, the potential strength of peer influence on problem or prosocial behavior. Measuring the perception of peer affiliates and youth mood states within potentially risky social contexts (low adult monitoring, rule-breaking peer behavior) during youths' free time and in natural settings provides information about situations in which young adolescents find themselves, along with the feelings and perceptions associated with decisions they make in these specific situations. This can inform efforts to understand and prevent the initiation and escalation of conduct problems and substance use in adolescents.

Peer Influences on Early Adolescent Behavior

Social learning theory (e.g., Bandura, 1971; Rotter, 1945) has provided the primary rationale for how influence processes operate among adolescents. This theory posits that adults and peers provide models and reinforcements that influence adolescents' choices and behaviors. There is extant evidence demonstrating that peers become a salient influence on the behavioral development of adolescents (e.g., Dishion, Patterson, & Griesler, 1994; Dodge et al., 2003; Jaccard, Blanton, & Dodge, 2005; Kiesner, Dishion, & Poulin, 2001; Patterson, Reid, & Dishion, 1992). Findings suggest that certain types of problem behavior, including antisociality and substance use, are modeled and reinforced by friends. Youth tend to select other peers who are like them in risk behaviors, and they further influence each other to engage in problem behaviors (Bagwell, Coie, Terry, & Lochman, 2000; Dishion et al., 1994; Ennett & Bauman, 1994; Espelage, Holt, & Henkel, 2003; Kirke, 2004; Light & Dishion, 2007). Affiliation with peers who engage in aggression, deviant behavior, and tobacco and substance use is a strong predictor of initiation and escalation of that behavior in youth (Biglan & Smolkowski, 2002; Cairns, Cairns, Neckerman, & Gest, 1988; Dishion, Bullock, & Granic, 2002; Dishion et al., 1994; Duncan, Duncan, Biglan, & Ary, 1998; Hawkins, Catalano, & Miller, 1992). The influence and selection processes among adolescent peers are complex. Studies are beginning to shed light on the importance of youth's perception of their peers and their moods on peer influence processes and behavioral patterns.

The Link between Peer Status, Mood, and Peer Influence

There is growing evidence that youth are more likely to be influenced by peers who are considered popular or who have high social standing. In a study of fourth to sixth grade youth, perceived popularity of peers was associated with perceptions that those peers were socially dominant and had influence on others (Lease, Kennedy, & Axelrod, 2002). Ellis and Zarbatany (2007) studied peer influence in the context of social status in the peer network. High status in the peer network predicted greater magnitude of influence on deviant and

prosocial behavior. Moreover, in a recent study of peer networks, perceived peer popularity consistently predicted friendship selection—youth tended to select peers whom they perceived to be popular as their friends (Dijkstra, Berger, & Lindenberg, 2011). The desire to affiliate with popular peers, and perhaps emulate them, appears to be linked with the desire for peer acceptance. Youth reported that the benefits of affiliating with popular peers are to become more popular and more liked (Dijkstra, Cillessen, Lindenberg, & Veenstra, 2010).

The role of mood state on peer influence is shown by the beneficial effects of friendships with prosocial peers. Retrospective ratings of higher quality affective rating when with a friend (i.e., “I feel happy when I am with this friend”) increased the impact a prosocial peer had on their friends’ prosocial behavior (Barry & Wentzel, 2006). Peer affiliates who are well accepted by other peers and who are considered enjoyable friends appear to have a strong influence on prosocial behavior. Conversely, adolescent negative mood was found to be associated with friends’ influence on substance use. Hussong and Hicks (2003) found a significant interaction among negative affect, friends’ substance use, and friendship quality. Substance use was higher for youth with higher self-ratings of depression when their best friends used and the friendship relationship was of high quality.

Predictors of negative mood in adolescents

Although there is evidence that the perception of peers and the mood experienced when with peers impact the strength of influence that those peers have, little is known about the associations between perception of peer affiliates and mood states. There is evidence emerging that a lack of friendships and affiliation with friends with depressed mood predict increases in youth’s depressed mood (Brendgen, Lamarche, Wanner, & Vitaro, 2010), and that having positive relationships with parents and peers predicts lower depressed mood in adolescents and young adults (Costello, Swendsen, Rose, & Dierker, 2008). These longitudinal studies use annual data collection, and thus do not reveal the impact of daily affiliations or events on mood. Using monthly parent and youth interview data, Connell and Dishion (2006) showed that affiliation with deviant peers predicted increases in depressed mood for “high risk” adolescents (those with prior academic and conduct problems, and who have experienced substance use and a number of stressful life events). One study using daily assessment over the course of 5 days has shown that daily stressful events predicted increased anxious, depressed, and irritated mood in adolescents, particularly those who are at high risk for poor mental health outcomes due to conduct and internalizing problems and feelings of loneliness (Schneiders et al., 2006). This study illustrates the impact that daily events can have over time, but the impact that accompanying daily peer affiliations may have on adolescent mood and behavior has not yet been studied.

Adolescent mood state, emotional lability, and problem behavior

The importance of studying the interplay between perception of peers and mood is further illustrated with evidence showing the association between mood state and lability with problem behavior. Child and adolescent mood states are associated with both internalizing and externalizing behaviors. Children who appear sadder, more anxious, and who are prone to anger are more likely to exhibit depressive symptoms as well as externalizing behavior problems, such as aggression, lying, and stealing (Eisenberg et al., 1997, 2001). Studies of emotional intensity and regulation suggest that adolescents with stronger negative emotions or those who cannot effectively regulate their emotions—defined as the ability to initiate, inhibit, or modulate emotional arousal to accomplish one’s goals—are more likely to have internalizing and externalizing problems, and the inability to regulate emotions may in fact be a characteristic of these ongoing problems (Bradley, 2000; Cole, Michel, & Teti, 1994; Dearing et al., 2002). Different mood states are also associated with the urge to smoke and

drink, and with initiation and escalation of tobacco use in adolescents (Kassel, Stroud, & Paronis, 2003; Mermelstein, Hedeker, Flay, & Shiffman, 2002; Turner, Mermelstein, & Flay, 2004; Whalen, Jamner, Henker, & Delfino, 2001).

Furthermore, it appears that rapid fluctuation in emotional states—emotional *variability* or *lability*—may be a risk factor for problems. In a study of fifth to ninth graders, adolescents with more intense and variable emotions were more likely to be depressed, to experience others as less friendly, and to prefer being alone (Larson, Raffaelli, Richards, Ham, & Jewell, 1990). Emotional lability was also associated with depressive symptomatology and externalizing behaviors in adolescents (Silk, Steinberg, & Morris, 2003).

The Importance of Youth Perceptions of Peer Affiliates

EMA can supply context-specific information about perceptions of peers whom adolescents are associating with, such as perceptions of their popularity, whether they consider the peers to be friends, and the extent to which they feel accepted by these peers or teased and treated meanly by them. These perceptions of peers can be linked to simultaneous mood states. We expect that such perceptions have an impact on adolescent mood, the strength of influence those peers have, and the likelihood that adolescents will choose to spend time with those peers in the future. Although the studies summarized above show some evidence that the social status of peers impacts the strength of their influence and friendship selection, and that mood plays a role in the strength of peer influence and behavioral choices, the intrapersonal phenomena of perceptions of peers and mood have not been studied simultaneously in natural contexts. We examine this linkage in the current study, in which perception of peers and mood state are measured simultaneously in specific social situations and longitudinally within one year.

Youth perceptions of mean-spirited teasing by peer affiliates

Teasing among peers during early adolescence is common and it appears that good-natured teasing occurs more often than mean-spirited teasing (Barnett, Burns, Sanborn, Bartel, & Wilds, 2004). What may be more important in youth development is their perception of the extent to which they are a target of mean-spirited teasing by peers, whether it is true or not. In a study in which youth were presented with hypothetical scenarios, those who tended to exhibit “reactive aggression”—who tended to show aggressive or angry responses towards peers—were more likely to perceive hostile intent in the hypothetical actions of others (Crick & Dodge, 1996). There is also evidence that youth reports of high levels of peer teasing is associated with subsequent problems. Middle school youth self-reports of frequent verbal harassment from peers (peers teased or said mean things to them) predicted affiliation with deviant peers, antisocial behavior, and alcohol use in high school (Rusby et al., 2005). In a meta-analysis Hawker and Boulton (2000) found associations between peer victimization and depression, loneliness, and anxiety. Capturing respondents’ perceptions of mean-spirited teasing by peers simultaneously with their mood in a number of specific social situations over time will offer new information about the interplay between these peer-related intrapersonal processes.

Adult Monitoring as a Protective Contextual Influence on Adolescent Development

There is strong evidence that lack of adult monitoring is a key factor in deviant peer association and problem behavior (Mott, Crowe, Richardson, & Flay, 1999; Patterson et al., 1992; Richardson, Radziszewska, Dent, & Flay, 1993). Decreases in adult monitoring and increases in “wandering” were associated with increased delinquent peer affiliations and antisocial behavior of adolescent boys (Stoolmiller, 1994). We measure adult presence and

youth location (i.e., “out and about”) with the EMA, to capture the extent of adult supervision and the social context in which youth behavior occurs.

Purpose

The purpose of this study is to describe the associations among perceptions of peer affiliates, mood states, and social contexts. Collecting these data in real time uniquely provides information on simultaneous and cumulative effect of exposure to these phenomena. Data were collected for 3 one-week long assessments of seventh grade students over a school year. Given the prevention context for this study, youth who are at risk for developing or escalating problem behaviors were included in the sample. We expected to find concurrent and predictive associations between perceptions of peer affiliates and mood states, differences in perception of peers and mood states by risk status, and risky contexts to increase in time.

Specifically, we first investigated the extent to which being with peers who are popular, with whom one wishes to affiliate, and who are considered friends are associated with happy mood. Second, we investigated the extent that feelings of sadness, anxiety, and being left out are associated with spending time with peers by whom one is teased. These associations are expected to hold true across the school year, and to increase in magnitude over time. Third, we tested the extent to which at-risk youth experience greater negative mood compared to nonrisk youth. Fourth, we investigated the extent to which risky contexts for youth increase over time—that adult monitoring decreases and that being “out and about” increases. Confirmation would demonstrate predictive validity of the EMA-based measures of social contexts, while also contributing information about within-school-year trends to already demonstrated between-year change. Last, we tested whether youth who spend time with peers who tend to tease them show increased negative mood lability over the school year. We focused on sad and anxious mood for these analyses given the link between peer teasing and these moods, and the association between these moods and externalizing behavioral problems. Taken together, these aims would demonstrate predictive validity of the EMA-based intrapersonal–contextual measures thought to describe social influence mechanisms, while also offering preliminary understanding of how young adolescents’ perceptions of their peers, mood states, and other social contextual interactions change interdependently.

Method

Study Participants

Students in the seventh grade from four schools that were participating in the control group of a randomized trial of Positive Behavioral Intervention and Support (PBIS) and in the Adolescent Peer Social Network Dynamics and Problem Behavior study were potential participants in this EMA study, to enable the eventual combined analysis of EMA, student survey, and peer network data. One school was in a rural community and had 122 middle school students, and the other three were in suburban communities with 536 to 680 middle school students. One school was in a lower-income neighborhood, with 94% students eligible for free and reduced lunch, and the other three were in middle-income neighborhoods, with 54–61% students eligible for free and reduced lunch.

Using sixth grade data from the PBIS study student survey, a “risk” composite was created from the measures of tobacco, alcohol, and marijuana use, overt aggression, deviant peer association, and antisocial behavior, stratified by gender. These measures were used in the Oregon Healthy Teen Survey as indicators of risk (Boles, Biglan, & Smolkowski, 2006). The substance use questions ask how often the participant used the substance in the last 30 days. The deviant peer affiliation measure is based on 10 questions that ask how often the

participant hung out with friends who did the behaviors (e.g., got in trouble, took something that did not belong to them, used alcohol, dropped out of school) in the last 30 days. The 12 antisocial indicators (e.g., stealing, fighting, been suspended from school, been arrested) ask how frequently each occurred in the last 3 months. The boys and girls with the highest risk scores were selected for participation, and the remaining seventh grade students were stratified by gender and randomly selected. Approximately half of the recruited sample was at-risk according to the composite measure; the remainder of the sample was randomly selected. The students in the at-risk sample were considered to be at risk for initiating and escalating in rule-breaking and substance use in the future compared to their same-age peers, and were not intended to represent a high-risk sample that already engages in high rates of these behaviors.

A total of 162 students were invited by letter to participate in the study (an average of 41 per school; numbers differed by school size). Eligibility for participation included proficiency in English, enrollment in one of the target schools, and entering the seventh grade. Three of the four schools provided parent contact information; for these schools a letter was sent and was followed by a phone call to determine eligibility and answer questions. One participating school refused to provide parent contact information, and sent the invitation letter along with a contact information form to be returned to the research organization; thus, at this school, only families who completed and returned the contact form were contacted via telephone by project staff. Of the 162 letters sent across the four schools, we were able to reach 139 families (86%). Of the families reached, 117 students (84%) were eligible for participation. We received consent to participate for 82 students (from 70% of those eligible). The race and ethnicity distribution of participating students was 59% White, 16% Hispanic/Latino, 5% American Indian, 2% Asian, 1% African American, 1% Hawaiian/Pacific Islander, 9% mixed race and ethnicity, and for 7% race and ethnicity was not reported. A total of 18 at-risk boys and 18 at-risk girls participated, in addition to 22 randomly selected boys and 24 randomly selected girls.

The Ecological Momentary Assessment

Assessment procedures—Handheld digital devices were used for the assessments. These were encased in durable cases for protection and detachable travel chargers were supplied. The devices were preprogrammed with the assessment program, and had limited functionality (i.e., music, internet, e-mail, and device settings were disabled). The assessment equipment was delivered and picked up from students at school. If a student was absent during the assessment week, we attempted to reschedule them or include them during a later assessment week. Using these procedures, no devices were lost or damaged.

Students were trained to use the device by research assistants at the beginning of the assessment week. To protect confidentiality, each student chose their own device password during a training session. All were instructed not to share this password with anyone else, and each was required to enter this password at the beginning of each assessment. Also, during the training students were required to sign a “school contract” stating that they would not use the devices during school hours, and agreeing that if they did so the device could be confiscated by school personnel—this happened only once.

Weekly assessments occurred for each participating student once in the fall (Wave 1), once in the winter (Wave 2), and once in the spring (Wave 3). Each participant was prompted to complete the EMA survey a total of 27 random times each assessment week during times when school was not in session. Thus, over the course of 3 weeks of assessments over their seventh grade year, participants were prompted to complete the survey 81 times. The survey prompts occurred three times Monday through Thursday between 3:30 PM and 9:30 PM, four times on Friday between 3:30 PM and 11 PM, six times on Saturday between 11:30 AM and 11

PM, and five times on Sunday between 11:30 AM and 9:30 PM. Survey prompts were randomized within 90–120 minute blocks, with the criteria that a survey would not occur within 30 minutes of another survey. If a student did not respond to a survey prompt, it repeated two times at one-minute intervals. Students had a total of 8 minutes to respond before the survey was no longer available.

Participating students could choose to skip any question, but could not go back once a question had been answered, to ensure confidentiality. Participants also were able to track how many assessments they had completed, as a percent complete appeared at the end of each day's final assessment. Several students reported this was a motivating factor to do as many surveys as possible each week. Participants were instructed to use the electronic device's *Notes* application to describe any reason they may have missed an assessment. For example, a student would type a note such as "wrestling practice today, 3:30–5:30" and each note was date–time stamped. This helped in linking missed surveys to reasons missed. In addition, at the end of each survey week participants were debriefed in a one-on-one session when the equipment was picked up. During this debrief the student's schedule of completed and missed assessments was examined, they were asked about any missing surveys, and incentives were delivered.

Data were encrypted and secure on the device (i.e., students could not access the data file). Data were sent immediately to the password-protected database if the device was connected to a wireless network at the time of the survey. All data were automatically uploaded as soon as the device was brought to the research institute at the end of the assessment week.

Measures—Time to complete each survey ranged from approximately 2–5 minutes, depending on the activities of the student. Participants were first asked for the number of other youth (in middle school or high school) they are with, the number of adults present (to assess adult monitoring), and the number of younger children present (elementary school age or younger). Next, they were asked to rate how much each of the following words describe how they feel (on a 1–9 scale, from *not at all* to *very*). They were asked to rate seven different mood states: happy, angry, bored, anxious, left out, sad, and stressed. These mood states are similar to those used in prior EMA studies on adolescent tobacco use (Mermelstein et al., 2002; Turner et al., 2004). Ratings of raw mood scores were averaged across the sessions for each wave to arrive at a wave-specific mood summary for individuals.

Mood lability within wave was calculated by taking the mean squared successive difference statistic across each subject's week-long, ordered session observations. For a sequence of N observations, it is given by

$$\mathrm{MSSD}=\frac{\sum_{i=1}^{N-1}(x_{i+1}-x_i)^2}{N-1}. \quad (1)$$

This statistic has become the standard lability measure for EMA and other intensive longitudinal data (Anestis et al., 2010; Jahng, Wood, & Trull, 2008; Miller, Vachon, & Lynam, 2009) because it defines variability between ordered pairs of observations rather than ignoring order. Thus, a higher score reflects greater temporal instability of the mood measured.

Next, participants selected the activities or behaviors in which they or other youth present are engaging, with instructions to "check all that apply": physical activity (sports, hiking, bicycling, etc.); smoking or chewing tobacco; drinking beer, wine, or other alcohol; using

marijuana or other drugs; doing homework; working in the community (paid or volunteer); doing an organized activity (recreation, club, or church activity); doing art (playing musical instrument, drawing, painting, drama, etc.); eating a meal; on the computer, watching TV or a movie, or playing video games; reading; doing something against parent rules; and other activity (which they filled in). At the end of the activities list if substance use or rule breaking was selected, students were asked for the number of youth doing it, if they themselves are doing it, and their attitude about the activity (whether or not they thought the activity was okay to engage in). If substance use or rule breaking was not reported, then the device skipped to the next question. Participants were next asked where they are (choose one): a) at home, b) at someone else's home, c) in a place designed for youth (school, recreation center, church), d) being transported (such as in a car, bus, or train), or e) out and about in the community (a store or business, the park, the sidewalk, the mall).

The next set of questions pertained to participant perceptions of the peers they were with; these questions were asked only if the participant reported that dshe or he is with other youth. Participants were asked to rate the following on a 1–9 scale (*not at all* to *very much*): a) How popular is the group you are with, b) How often these kids tease or say mean things to you, c) Your desire to spend more time with this group in the future. Students are also asked to report on the number of youth present who "are your friends."

Description of incentives—Participants received a variety of incentives for completing assessments. First, they received a baseline payment for participation: $20 the first assessment week, $25 the second week, and $30 the third week. Increasing the payment each time was designed to entice students to remain in the study over the course of the year. Second, if participants returned the device, case, and charger undamaged at the end of each assessment week, they received a raffle ticket to be entered in a drawing at the end of the study, giving them a chance to win one of the devices. Third, they were eligible for a $10 bonus and an additional raffle ticket if they completed at least 90% of the surveys. This was designed to encourage students to complete as many assessments as possible. Fourth, there was a randomly selected prize survey each week—participants did not know the timing of this prize survey. If a participant completed the randomly selected prize survey they received an extra $5 and an additional raffle ticket. The random prize incentive was designed to encourage participants to continue to complete as many surveys as possible even if they realized they would not complete enough assessments to obtain the 90% bonus, which was often the case for students involved in after-school sports. To encourage students to keep the device with them, several games were included on the device. At each assessment wave the games and the device background graphics were changed to maintain interest. Students reported that they enjoyed the new games and that the ability to play these games helped them to remember to keep the device with them.

Analytical Procedures

First, we examined descriptive statistics of the EMA data on affiliations, activities and behaviors, locations, moods, and perceptions of peers and Pearson bivariate correlations among mood states and perceptions about affiliate peers. Then, to obtain associations in a multivariate context and uncontaminated by the nonindependence of observations within individuals, conditional and unconditional changes of these measures over time were examined using mixed-effect models, specified as latent growth models (LGMs) with EMA wave nested within individual (Snijders & Bosker, 2012).

For all multilevel models, fixed effects at the individual level included gender, risk status, and affiliation with peers who tease and say mean things at Wave 1; the latter two predictors were centered at their means. Wave number (i.e., time) was the only fixed wave-level

predictor. Random effects included the outcome variances and covariances across individuals (Level 2, L2) and within individuals across waves (Level 1, L1). Consistent with our objective of identifying trends in outcomes over the school year, the relationship between wave number and outcome was assumed to be linear.

Missing data was dealt with by using maximum likelihood estimation under the assumption that the data were missing at random (MAR; Rubin, 1976). This procedure uses all data for individual and wave combinations for which all measured variables in the model are available. It is necessary that, conditional on the predictors in the model, missingness is entirely random. A reasonable level of confidence regarding this assumption is provided by selecting important individual level predictors of model outcomes. Models were estimated using MLwIN 2.23 (Rasbash, Steele, Browne, & Goldstein, 2009). The general formulation for these models can be written as follows (Snijders & Bosker, 2012):

$$Y_{ij}=\gamma_{00}+\sum_{h=1}^{p}\gamma_{h0}x_{hij}+\sum_{k=1}^{q}\gamma_{k0}z_{hj}+\sum_{k=1}^{q}\sum_{h=1}^{p}\gamma_{hk}z_{hj}x_{hij}+U_{0j}+\sum_{h=1}^{p}U_{hj}x_{hij}+R_{ij} \quad (2)$$

where Y is the outcome for individual i and wave j, the γ_{hk} are regression parameters to be estimated, the x_{hij} are $h = 1 \ldots p$ level 1 predictors (here, $p = 1$ and the predictor modeled is wave number), and the z_{hj} are $h = 1 \ldots q$ level 2 predictors, which may also include within-level interactions. We have three level 2 predictors—gender, affiliating with peers who tease, and risk level. We also want to treat all within-level interactions as z's, hence $q = 3 \times 2 \times 1 = 6$. The $z_{hj}x_{hij}$ are cross-level interactions, and the other terms are error (random) components.

We adopted a fully multivariate modeling specification (Snijders & Bosker, 2012), where variance–covariance matrices at both wave and individual levels were unconstrained. Nonsignificant elements of these matrices were set to zero post hoc. In no case did this materially affect estimates of fixed or cross-level effects, or their standard errors. Outliers that were not well predicted were eliminated and the models were reestimated. Post hoc examination of normal probability plots of residuals revealed no material departure from normality at either level 1 or 2 for the analyses. For interactions in the model we used the backward-elimination strategy with up to four levels of interaction (Wave × Teasing Wave 1 × Risk × Gender) plus all lower-level interactions, eliminating nonsignificant highest-order effects first, and proceeding until all remaining effects were significant. In the case that a higher-order interaction was significant, all lower-order interactions nested within the higher-order interaction were kept whether they were statistically significant or not, following the standard for properly interpreting relevant interactions (Gelman & Hill, 2008).

Results

Participation Rates

The percentage of students participating in each assessment wave was 95% at Wave 1, 98% at Wave 2, and 95% at Wave 3. The average rates of survey completion were 75% at Wave 1, and 69% at Waves 2 and 3. Almost half (49%) of participants completed 80% or more of the surveys and 21% of participants completed fewer than 50% of the surveys. The proportion of completed surveys did not violate the assumptions of normality. Survey completion rates did not differ by gender or risk status.

When the devices were collected from participants, they were asked for reasons they missed a survey and the reasons for missed surveys were documented. For Wave 1, 18% of missing sessions were explained, 16% were explained for Wave 2, and 25% were explained in Wave 3. The most common reason participants missed a survey was because of an athletic practice

or game (47%). Other reasons a survey was missed included not being with the device (temporarily misplaced or forgot it, 20%), being at church or synagogue (6%), working (for pay or volunteering, 4%), being in a noisy environment so did not hear the signal (4%), or doing a family activity (4%). A small number of missed surveys were explained by the participant being asleep, engaging in an activity where the participant could not have the device (e.g., at a movie), doing chores, the device battery being uncharged, and the participant being ill.

Descriptive Statistics

Descriptive statistics for measures in Waves 1–3 are reported in Table 1. Presence of peers and adults, activities, behaviors, and locations are reported in terms of percent of surveys in which the response was provided. Perceptions about peers and moods are the mean on a 1–9 point scale from *not at all* to *very much.*

Presence of peers and adults—Participants reported that they were not with other peers on 38–45% of the surveys. They reported being with other middle school students for about 1/4 of the surveys, being with younger children for more than 1/4 of the surveys, and being with older youth (high school age) for about 1/5 of the surveys. Adults were present for about 75% of the surveys in Wave 1, which decreased to 66% by Wave 3.

Activities and behaviors—The predominate activity reported was watching T.V., using computer, or playing video games, reported for 43% of the Wave 1 surveys. The next frequent activities were physical activity (14%), eating a meal (13%), doing homework (11%), and doing chores (9%). Tobacco, alcohol, and marijuana use and rule-breaking were reported infrequently, with each occurring during 1% of the prompts. Participants could select “other” and provide an open response for activity; for the “other” category participants reported doing “nothing” for 3% of the surveys.

Location—Participants were most likely to report being at home or at someone else’s home. Less frequently they reported being at a school, recreation center, church, or similar place; “out and about” (at a store or business, at a park, hanging out on the sidewalk, at a mall); or in transit (in a car, bus, train, or bike). Being “out and about” increased from 5% of the surveys at Wave 1 to 9% at Wave 3.

Perception of peers—On average, participants reported that the peers they were with were somewhat popular and that they did want to spend time with them in the future. Participants reported that they were friends with more than half of the peers present. Participants also reported that peers they were with on average did not tend to tease them or say mean things to them. However, some participants reported that the peers they were with frequently teased or said mean things to them (a rating of 7 or higher); 13% reported being with peers who teased them frequently in Wave 1, 17% in Wave 2, and 13% in Wave 3.

Mood states—On average, participants reported being fairly happy and not very angry, sad, anxious, or left out. On average, medium-to-low levels of boredom and stress were reported.

Mood lability—The mean and standard deviation statistics for mood lability show that sad and anxious mood states tended to fluctuate somewhat between time points within a given week. The levels of skew for the mood lability measures were within the bounds of normality.

Analyses of Associations

Within-person correlations among moods and of moods with perceptions about peers are summarized in Table 2.

Associations among moods—Low to moderate negative associations were found between happiness and sadness in all waves (Wave 1 $r = -.40$; Wave 2 $r = -.23$; Wave 3 $r = -.29$), and between happiness and anxiety ($r = -.26$) in Wave 1 only. Strong associations were found among the negative moods in all waves.

Associations of mood with perceptions about peers—Happiness was moderately associated with being with peers perceived to be popular in all waves. Being with peers who teased or said mean things to them was associated with sadness, anxiety, and feelings of being left out in all waves. The desire to spend more time with the peers who were present was positively associated with happiness and negatively associated with negative moods in Waves 1 and 2. The percent of time spent with friends was associated with happiness ($r = .36$) in Wave 3 and was negatively associated with feelings of anxiety ($r = -.28$) and being left out ($r = -.29$) in Wave 2.

Multilevel Models

Table 3 shows results for the multilevel models of the risky context measures (adult monitoring and being “out and about”), of sad and anxious mood state lability, and of happy mood state. These models were specified as LGMs, examining both mean differences (over all waves) and change over waves (linear slope) by gender, risk status, and extent of time spent with peers who tease and say mean things to them at Wave 1. Slope-related differences involve the wave variable as a main or interaction component of one or more model terms; all other terms measure differences in means at Wave 1. Since up to 4-way interactions were possible given the four predictors, we used a backward-stepwise procedure to arrive at a final model, eliminating the highest-order nonsignificant interaction terms first, then lower-order nonsignificant terms not required by inclusion of a significant higher-order term. Table 3 shows the final models trimmed in this way.

Growth models for risky contexts—Adult monitoring decreased significantly over time ($\beta = -4.7$, $p < .001$) across the three waves for all participants (see Table 3). Individuals who reported spending more time with peers who teased them also reported being in more situations that lacked adult monitoring ($\beta = -2.62$, $p < .01$). Being “out and about” increased significantly and unconditionally over all three waves ($\beta = 1.67$, $p < .01$).

Growth models of sad mood and sad mood lability—Results of multilevel models describing conditional and unconditional means and trajectories for negative moods (sad and anxious mood) and negative mood labilities across all three waves are shown in Table 3. Main effects and within-level and cross-level interactions were examined for each model and for the predictors: Wave (L1), being with peers who tease them (L2), risk status (L2), and gender (L2). In the models for mood, we control for mood lability, and in the models for mood lability we control for mood level (e.g., when modeling sadness, sadness lability is included as a control variable, and when modeling sadness lability, sadness is included as a control variable). In the models involving mood lability, we found that the means and MSSDs of these measures were strongly correlated—the between-subjects correlation was 0.50 for sad mood and sad mood lability, and 0.63 for anxious mood and its associated lability—reinforcing the importance of having controlled for MSSDs in models of means, and vice versa, in order to accurately estimate unique effects of all predictors on each such outcome.

Generally, all substantive predictors are seen to have significant main or interaction-contingent effects, but these vary from one outcome to another. Most of the effects involve interactions, i.e., are contingent. Significant main effects were found for risk status and sad mood, for affiliating with peers who tease and anxious mood, and for gender and sad mood lability and happy mood. These effects, however, need to be interpreted in terms of the significant interactions found.

As it can be difficult to substantively interpret interaction effects of individual predictors when they appear in multiple terms in a model, we provide illustration and description of these effects with Figures 1 and 2. Figure 1 shows that sadness was highest overall for at-risk girls. This group reported less sadness later in the school year regardless of the level of Wave 1 time spent with peers who tease. However, the model predicts that at higher levels of time with peers who tease, boys (regardless of risk) reported increased sadness over the school year, while at-risk girls reported sharp declines in sadness across the year. As shown in Figure 1a, nonrisk girls were the only group whose sadness was not affected in some way by the extent of time spent with peers by whom one is teased.

Figure 1b shows little difference by gender or risk status in sadness lability when there is little time spent with peers who tease (top panel), but an interesting gender difference is shown in the lower panel; girls who spend time with peers who tease them had lower sadness lability than boys at Wave 1, but this lability increased over the school year. In contrast, boys' sadness lability was substantially higher than for girls at Wave 1, but declined quite dramatically, and by Wave 3, it was lower than for girls. Since the models of sadness and sadness lability each control for the other, the predicted decline in sadness lability for more teased-boys assumes that sadness *level* is fixed (at the sample mean, since it is centered around the sample grand mean in the model). Thus Figure 1b implies that at a particular level of overall sadness, boys' moods became relatively more stable over the course of the school year. Since boys became, on average, sadder over the school year (bottom panel, Figure 1a), we conclude that they became more uniformly sad in reaction to teasing. Girls, in contrast, became more variable in their sadness in reaction to teasing; at-risk girls, specifically, became less sad overall, but had increased sadness lability.

Confirmation for trends in happiness—As a corroborative measure, we also estimated an LGM for happiness (also in Table 3). At-risk youth of both genders showed sharper declines in happiness over the three waves than nonrisk schoolmates if they spent more time with peers who teased them at Wave 1 (Wave × At-risk × Teasing Wave 1 $\beta = -0.20$, $p < .01$), suggesting more vulnerability to teasing. Regardless of risk status, boys who spent more time with peers who tease at Wave 1 showed slightly stronger declines in happiness over the school year, compared to girls ($\beta = -0.26$, $p < .001$). This effect needs to be interpreted along with the positive coefficient for the Wave × Teasing Wave 1 term ($\beta = 0.17$, $p < .05$), which applies to both boys and girls. Together, these effects indicate that happiness increases modestly for girls who spend more time with peers who tease them and declines modestly for boys who spend more time with peers who tease them. The results showing that boys' happiness ratings declined more over the school year in relation to teasing compared to girls essentially mirrors the findings for sadness.

Growth models of anxious mood and anxious mood lability—Figure 2a shows that anxious mood was unrelated to risk status and did not change significantly across the school year, yet girls had significantly higher levels of anxious mood than boys in response to spending more time with peers who tease them ($\beta = -0.23$, $p < .05$). On the other hand, anxiety lability declined in relationship to teasing for at-risk boys and girls, while modestly increasing for the nonrisk group (Figure 2b, lower panel). Boys who spent more time with

peers who teased them tended to have higher anxiety lability than girls, within risk groups, a difference that did not change across the school year.

Discussion

This study details the free-time activities that youth were engaged in during nonschool hours. Participants were at home over two thirds of the time when they were prompted to complete a survey, and there was an adult present two thirds or more of the time. Thus, the adolescents were generally not in a risky environment, although their environmental context became riskier over time. Adult supervision declined during the year, which coincided with increased reports of spending more time “out and about” in the community. Previous research has shown that such risky contexts are associated with deviant peer affiliation and with rule-breaking behavior (Stoolmiller, 1994).

Our substantive findings regarding mood states largely confirmed our expectations, although our analyses did reveal a number of interesting nuances. As expected, happy mood was correlated with time spent with popular peers, peers one wants to be with, and peers considered to be friends. Additionally, although positive and negative moods are considered orthogonal and are not expected to be highly negatively correlated (Watson, Clark, & Tellegen, 1988), we found low to moderate negative correlations between positive mood (happiness) and negative moods (sadness and anxiety). As expected, we found strong correlations among negative moods and with feeling left out.

We expected risk status to predict greater negative mood; this held true for Wave 1 predictions of sadness but not for anxiety. Further, girls’ level of sadness declined over the school year but their sadness lability increased, while the opposite was true for boys.

We also expected that more negative mood lability would be observed among those who spent more time with peers who teased and said mean things to them, compared to those who spent less time with peers who teased them. Our findings suggest that the association of teasing with mood and mood lability is not so simple; in particular, sadness lability declined for boys, but increased for girls who spent time with peers who teased them. One implication of these findings is that boys became relatively more sad, and more stably so, in response to affiliating with peers who tease them, whereas girls became more situationally reactive to teasing, as indicated by increased lability of sadness for girls. A possible explanation is that girls have a stronger orientation towards relationships, and thus perceptions of low acceptance or criticism from peers may have a greater negative impact on girls’ moods than on boys’ moods (Cyranowski, Frank, Young, & Shear, 2000; Rudolph & Hammen, 1999). In addition, adolescent girls are more likely to seek social support as a way to cope with social difficulties than boys, who are more likely to use avoidance as a coping strategy (Eschenbeck, Kohlmann, & Lohaus, 2007). Girls’ sad mood may change from moment-to-moment—they may be sad when they are with peers who tease or say mean things to them, and then happy when they seek out and find peers who offer them social support. Boys, on the other hand, are less likely to seek out social support; therefore, the peer influence on mood maybe more consistently negative for boys. The higher salience of peer acceptance for girls may also explain why anxiety was higher for girls who affiliate with peers who tease and say mean things to them than for boys in this situation.

We also found that anxiety lability increased over time among nonrisk boys and girls, but decreased for at-risk adolescents who spend more time with peers who tease them. Since teasing is more predominate for at-risk adolescents, it is possible that they expect it and therefore affiliating with peers who tend to tease them is not anxiety provoking for them.

Overall, these findings highlight the need for social acceptance, which has important implications for understanding the strength of peer influence on the development of early adolescents. As peer influence is thought to be driven by a need for social acceptance (e.g., Dodge et al., 2003; Ellis & Zarbatany, 2007; Urberg, Luo, Pilgrim, & Degirmencioglu, 2003), spending time with peers may reinforce either negative or positive mood states, depending on one's perceptions of those peers. When young adolescents feel accepted by popular and liked peers, they are happier while with those peers. Conversely, when youth are teased and do not feel accepted by their peers, they feel sad, anxious, and left out while with these peers, which for some youth may lead to pervasive negative moods, even when not in the company of those peers. These findings align with studies showing the negative impact of peer harassment on middle school youth (Hawker & Boulton, 2000; Juvonen, Nishina, & Graham, 2000; Natvig, Albrektsen, & Qvarnstrom, 2001; Rusby et al., 2005). Such experiences also may motivate youth—particularly girls—to find social niches where they are less harassed; yet, for less popular youth, this motivation may require them to forgo the potential social status associated with being part of a popular peer group. A better understanding of how these conflicting motivations are managed may help explain the differing social experiences of adolescents, especially the less popular youth (e.g., Vaillancourt & Hymel, 2006).

As we noted previously, understanding how day-to-day experience predicts later, relatively stable individual differences continues to be a major challenge for adolescent developmental theory. Our results provide concrete evidence that early adolescent social experiences occurring across a time frame of days may, over time, produce changes in emotional functioning. It is precisely the sort of micro–macro linkage that EMA is capable of providing.

Limitations of the Study

This is a descriptive study regarding the use of EMA to simultaneously measure peer affiliations, moods, perceptions of peers, activities, and behaviors in early adolescents during free time. As such, the sample size was relatively small (although not atypically so for this type of study), which in turn provided limited statistical power for estimating complex models. The nature of EMA data necessitates complex models to fully exploit them (e.g., Walls & Schaefer, 2006). Suggestions for designing an affordable larger-scale study are outlined in the next section.

The study also was not intended to generalize to youth who are already highly involved in delinquent behaviors and substance use, or to clinical samples. It was designed from the perspective of a prevention framework; therefore, the sample consisted of typically developing youth and youth who showed indications of being at risk for developing multiple problems. Results also apply to middle school youth in rural and suburban communities, and thus may not generalize to youth who live in urban areas. Given the limitations of location, the ethnic and racial composition of the sample is typical of youth who live in rural and suburban Northwest communities. The sample, therefore, is limited in the representation of African American and Asian youth.

Additionally, rule breaking and substance use were reported at a very low frequency in this study, although initiation of deviant behaviors often occurs around these ages. It is possible that this sample was too young to capture initiation of these behaviors or that frequencies of deviant behaviors were so low that we were not capturing them with the random EMA prompts. It is important to begin EMA assessments prior to initiation and escalation of these behaviors to measure the environments and processes that are associated with later initiation and escalation. A longitudinal EMA design covering a broader age range would allow for

the measurement of the environments and processes that predict escalation or de-escalation of rule breaking and substance use.

Finally, although typical for EMA studies, about 20–26% of missed assessments were unexplained. It is possible that youth who were engaged in rule-breaking behaviors or substance use responded to the EMA assessment prompts less often than when engaged in other activities. Although we found that missingness was not higher for at-risk youth than for nonrisk youth, it is nevertheless possible that these behaviors were underreported.

Suggestions for an Efficient Larger-Scale EMA Study Design

Given that EMA devices are not inexpensive to purchase, program, or utilize, an EMA assessment schedule may not be feasible with a large number of participants. In this case a planned missing design is possible, in which EMA assessments are carried out on a subsample of study participants or time points, or both. In short, unplanned missingness is to be expected with EMA, while planned missingness may be pragmatically necessary. Fortunately, both of these issues can be efficiently addressed using multiple imputation (MI) methods (Enders, 2010; Gelman & Hill, 2008; Schafer, 1999). Multiple imputation relies on the MAR assumption also required by frequently used missing-data estimation methods like maximum likelihood (Rubin, 1976). We suggest that EMA is a particularly attractive technique to embed in a larger study, especially if that study utilizes other data collection methodologies such as yearly surveys or observation methods.

While researchers typically provide participants with incentives to participate in an EMA study, the additional incentives used in this present study are recommended based on meeting response rate goals. We found that using a popular electronic handheld device for collecting EMAs was an incentive in itself—participating youth reported that they enjoyed being a part of the study and regretted when the study was over. In addition, it may be possible to install an EMA application or program onto cell phones or music devices that participants already own, bypassing the costs of purchasing electronic devices altogether.

Implications for Future Research and Practice

The current study provides additional evidence for the validity of the EMA measurement approach in an early adolescent population. Further validation would entail direct comparisons of each measure with other measures obtained with different procedures. Concurrent and predictive associations of the EMA data with student reports on longer questionnaires of peer associations (particularly associations with deviant peers), the development of both prosocial and antisocial behaviors, and substance use would provide additional evidence. Although ordinary survey data may suffer from recency and saliency bias, such data may still yield useful information about easier-to-recall or relatively stable behaviors and feelings concerning self and peers. Thus, the ideal approach would combine EMA methodology with multimethod assessment. An additional and valuable test of validity would be to compare the EMA reports to youth reports from a peer network study. If both measures are obtained across the same time frame, characteristics of network nominees should be related to EMA-reported peer activities.

It is too early in the investigation of EMA measures of early adolescent processes (mood states and perceptions of peers), environments (peers, adult monitoring, and locations), activities, and behaviors to make strong statements about implications for practice. The rates of problem behaviors were too low in the present study to definitively identify correlates of such behaviors; however, our findings suggest the promise that this type of detailed information about adolescent moods, perceptions about peers, and the environments that they are exposed to may identify specific processes involved in peer influence and the

initiation and escalation of problem behaviors, and inform intervention and prevention efforts. Perhaps even more valuable may be the use of such data to understand the peer influence processes that predict the de-escalation of such behaviors.

Acknowledgments

This research was supported by Grants 1R21DA023618 and 1-P30-DA018760 from the National Institute on Drug Abuse. Authors wish to acknowledge Brooke Parrill and Joey Blum for their contribution to the research and Susan Long for editorial assistance with this manuscript.

References

Anestis MD, Selby EA, Crosby RD, Wonderlich SA, Engel SG, Joiner TE. A comparison of retrospective self-report versus ecological momentary assessment measures of affective lability in the examination of its relationship with bulimic symptomatology. Behaviour Research and Therapy. 2010; 48:607–613. doi:10.1016/j.brat.2010.03.012. [PubMed: 20392437]

Bandura, A. Social learning theory. General Learning Press; New York, NY: 1971.

Bagwell CL, Coie JD, Terry RA, Lochman JE. Peer clique participation and social status in preadolescence. Merrill-Palmer Quarterly. 2000; 46:280–305.

Barnett MA, Burns SR, Sanborn FW, Bartel JS, Wilds SJ. Antisocial and prosocial teasing among children: Perceptions and individual differences. Social Development. 2004; 13:292–310. doi: 10.1111/j.1467-9507.2004.000268.x.

Barry CM, Wentzel KR. Friend influence on prosocial behavior: The role of motivational factors and friendship characteristics. Developmental Psychology. 2006; 42:153–163. doi: 10.1037/0012-1649.42.1.153. [PubMed: 16420125]

Biglan, A.; Smolkowski, K. Intervention effects on adolescent drug use and critical influences on the development of problem behavior. In: Kandel, DB., editor. Stages and pathways of drug involvement: Examining the Gateway Hypothesis. Cambridge University Press; New York, NY: 2002. p. 158-183.doi:10.1017/CBO9780511499777.010

Björkqvist K, Lagerspetz KMJ, Kaukiainen A. Do girls manipulate and boys fight? Developmental trends in regard to direct and indirect aggression. Aggressive Behavior. 1992; 18:117–127. doi: 10.1002/1098-2337(1992)18:2<117::AID-AB2480180205>3.0.CO;2-3.

Boles S, Biglan A, Smolkowki K. Relationships among negative and positive behaviours in adolescence. Journal of Adolescence. 2006; 29:33–52. doi:10.1016/j.adolescence.2005.01.007. [PubMed: 15979137]

Bradley, SJ. Affect regulation and the development of psychopathology. Guilford; New York, NY: 2000.

Brendgen M, Lamarche V, Wanner B, Vitaro F. Links between friendship relations and early adolescents' trajectories of depressed mood. Developmental Psychology. 2010; 46:491–501. doi: 10.1037/a0017413. [PubMed: 20210508]

Cairns RB, Cairns BD, Neckerman HJ, Gest SD. Social networks and aggressive behavior: Peer support or peer rejection? Developmental Psychology. 1988; 24:815–823. doi: 10.1037/0012-1649.24.6.815.

Cole PM, Michel MK, Teti LO. The development of emotion regulation and dysregulation: A clinical perspective. Monographs of the Society for Research in Child Development. 1994; 59 (2-3, Serial No. 240). doi:10.2307/1166139.

Connell AM, Dishion TJ. The contribution of peers to monthly variation in adolescent depressed mood: A short-term longitudinal study with time-varying predictors. Development and Psychopathology. 2006; 18:139–154. doi:10.1017/S0954579406060081. [PubMed: 16478556]

Costello DM, Swendsen J, Rose JS, Dierker LC. Risk and protective factors associated with trajectories of depressed mood from adolescence to early adulthood. Journal of Consulting and Clinical Psychology. 2008; 76:173–183. doi:10.1037/0022-006X.76.2.173. [PubMed: 18377115]

Crick NR, Dodge KA. Social information-processing mechanisms in reactive and proactive aggression. Child Development. 1996; 67:993–1002. doi:10.2307/1131875. [PubMed: 8706540]

Cyranowski JM, Frank E, Young E, Shear K. Adolescent onset of the gender difference in lifetime rates of major depression: A theoretical model. Archives of General Psychiatry. 2000; 57:21–27. doi:10.1001/archpsyc.57.1.21. [PubMed: 10632229]

Dearing KF, Hubbard JA, Ramsden SR, Parker EH, Relyea N, Smithmyer CM, Flanagan KD. Children's self-reports about anger regulation: Direct and indirect links to social preference and aggression. Merrill-Palmer Quarterly. 2002; 48:308–336. doi:10.1353/mpq.2002.0011.

Dishion TJ, Bullock BM, Granic I. Pragmatism in modeling peer influence: Dynamics, outcomes, and change processes. Development and Psychopathology. 2002; 14:969–981. doi:10.1017/S0954579402004169. [PubMed: 12549712]

Dishion, TJ.; Patterson, GR.; Griesler, PC. Peer adaptation in the development of antisocial behavior: A confluence model. In: Huesmann, LR., editor. Aggressive behavior: Current perspectives. Plenum; New York, NY: 1994. p. 61-95.

Dijkstra JK, Berger C, Lindenberg S. Do physical and relational aggression explain adolescents' friendship selection? The competing roles of network characteristics, gender, and social status. Aggressive Behavior. 2011; 37:417–429. doi:10.1002/ab.20402. [PubMed: 21688275]

Dijkstra JK, Cillessen AHN, Lindenberg S, Veenstra R. Basking in reflected glory and its limits: Why adolescents hang out with popular peers. Journal of Research on Adolescence. 2010; 20:942–958. doi:10.1111/j.1532-7795.2010.00671.x.

Dodge KA, Lansford JE, Burks VS, Bates JE, Pettit GS, Fontaine R, Price JM. Peer rejection and social information-processing factors in the development of aggressive behavior problems in children. Child Development. 2003; 74:374–393. doi:10.1111/1467-8624.7402004. [PubMed: 12705561]

Dodge, KA.; Sherrill, MR. Deviant peer group effects in youth mental health interventions. In: Dodge, KA.; Dishion, TJ.; Lansford, JE., editors. Deviant peer influences in programs for youth: Problems and solutions. Guilford Press; New York, NY: 2006. p. 97-121.

Duncan SC, Duncan TE, Biglan A, Ary D. Contributions of the social context to the development of adolescent substance use: A multivariate latent growth modeling approach. Drug & Alcohol Dependence. 1998; 50:57–71. doi:10.1016/S0376-8716(98)00006-4. [PubMed: 9589273]

Ebner-Priemer UW, Trull TJ. Ambulatory assessment—An innovative and promising approach for clinical psychology. European Psychologist. 2009; 14:109–119. doi:10.1027/1016-9040.14.2.109.

Eisenberg N, Cumberland A, Spinrad TL, Fabes RA, Shepard SA, Reiser M, Guthrie IK. The relations of regulation and emotionality to children's externalizing and internalizing problem behavior. Child Development. 2001; 72:1112–1134. doi:10.1111/1467-8624.00337. [PubMed: 11480937]

Eisenberg N, Fabes RA, Shepard SA, Murphey BC, Guthrie IK, Jones S, Maszak P. Contemporaneous and longitudinal prediction of children's social functioning from regulation and emotionality. Child Development. 1997; 68:642–664. doi:10.2307/1132116. [PubMed: 9306644]

Ellis WE, Zarbatany L. Peer group status as a moderator of group influence on children's deviant, aggressive, and prosocial behavior. Child Development. 2007; 78:1240–1254. doi:10.1111/j.1467-8624.2007.01063.x. [PubMed: 17650136]

Enders, CK. Applied missing data analysis. Guilford Press; New York, NY: 2010.

Ennett ST, Bauman KE. The contribution of influence and selection to adolescent peer group homogeneity: The case of adolescent cigarette smoking. Journal of Personality and Social Psychology. 1994; 67:652–663. doi:10.1037//0022-3514.67.4.653.

Eschenbeck H, Kohlmann CW, Lohaus A. Gender differences in coping strategies in children and adolescents. Journal of Individual Differences. 2007; 28:18–26. doi:10.1027/1614-0001.28.1.18.

Espelage DL, Holt MK, Henkel RR. Examination of peer-group contextual effects on aggression during early adolescence. Child Development. 2003; 74:205–220. doi:10.1111/1467-8624.00531. [PubMed: 12625446]

Gelman, A.; Hill, J. Data analysis using regression and multilevel/hierarchical models. Cambridge University Press; New York, NY: 2008.

Gorin, AA.; Stone, AA. Recall biases and cognitive errors in retrospective self-reports: A call for momentary assessments. In: Baum, A.; Revenson, T.; Singer, J., editors. Handbook of health psychology. Erlbaum; Mahwah, NJ: 2001. p. 405-413.

Hardy CL, Bukowski WM, Sippola LK. Stability and change in peer relationships during the transition to middle-level school. Journal of Early Adolescence. 2002; 22:117–142. doi: 10.1177/0272431602022002001.

Hawker DSJ, Boulton MJ. Twenty years' research on peer victimization and psychosocial maladjustment: A meta-analytic review of cross-sectional studies. Journal of Child Psychology and Psychiatry and Allied Disciplines. 2000; 41:441–455. doi:10.1111/1469-7610.00629.

Hawkins JD, Catalano RF, Miller JY. Risk and protective factors for alcohol and other drug problems in adolescence and early adulthood: Implications for substance abuse prevention. Psychological Bulletin. 1992; 112:64–105. doi:10.1037//0033-2909.112.1.64. [PubMed: 1529040]

Hufford, MR.; Shiffman, S.; Paty, J.; Stone, AA. Ecological Momentary Assessment: Real-world, real-time measurement of patient experience. In: Fahrenberg, J.; Myrtek, M., editors. Progress in ambulatory assessment. Hogrefe & Huber Publishers; Kirkland, WA: 2001. p. 69-91.

Hussong AM, Hicks RE. Affect and peer context interactively impact adolescent substance use. Journal of Abnormal Child Psychology. 2003; 31:413–426. doi:10.1023/A:1023843618887. [PubMed: 12831230]

Jaccard J, Blanton H, Dodge T. Peer influences on risk behavior: An analysis of the effects of a close friend. Developmental Psychology. 2005; 41:135–147. doi:10.1037/0012-1649.41.1.135. [PubMed: 15656744]

Jahng S, Wood PK, Trull TJ. Analysis of affective instability in ecological momentary assessment: Indices using successive difference and group comparison via multilevel modeling. Psychological Methods. 2008; 13:354–375. doi:10.1037/a0014173. [PubMed: 19071999]

Juvonen J, Nishina A, Graham S. Peer harassment, psychological adjustment, and school functioning in early adolescence. Journal of Educational Psychology. 2000; 92:349–359. doi: 10.1037//0022-0663.92.2.349.

Kassel JD, Stroud LR, Paronis CA. Smoking, stress, and negative affect: correlation, causation, and context across stages of smoking. Psychological Bulletin. 2003; 129:270–304. doi: 10.1037/0033-2909.129.2.270. [PubMed: 12696841]

Kiesner, J.; Dishion, TJ.; Poulin, F. A reinforcement model of conduct problems in children and adolescents: Advances in theory and intervention. In: Hill, J.; Maughan, B., editors. Cambridge monographs in child and adolescent psychiatry. Cambridge University Press; Cambridge, UK: 2001. p. 264-291.

Kirke DM. Chain reactions in adolescents' cigarette, alcohol, and drug use: Similarity through peer influence or the patterning of ties in peer networks? Social Networks. 2004; 26(1):3–28. doi: 10.1016/j.socnet.2003.12.001.

Larson R, Moneta G, Richards MH, Wilson S. Continuity, stability, and change in daily emotional experience across adolescence. Child Development. 2002; 73:1151–1165. doi: 10.1111/1467-8624.00464. [PubMed: 12146740]

Larson R, Raffaelli M, Richards MH, Ham M, Jewell L. Ecology of depression in late childhood and early adolescence: A profile of daily states and activities. Journal of Abnormal Psychology. 1990; 99:92–102. doi:10.1037//0021-843X.99.1.92. [PubMed: 2307772]

Lease AM, Kennedy CA, Axelrod JL. Children's social constructions of popularity. Social Development. 2002; 11:87–109. doi:10.1111/1467-9507.00188.

Light JM, Dishion TJ. Early adolescent antisocial behavior and peer rejection: A dynamic test of a developmental process. New Directions for Child and Adolescent Development. 2007; 118:77–89. doi:10.1002/cd.202. [PubMed: 18157876]

Mermelstein, R.; Hedeker, D.; Flay, B.; Shiffman, S. Situational versus intra-individual contributions to adolescents' subjective mood experiences of smoking. Poster session presented at the annual meeting of the Society for Research on Nicotine and Tobacco; Savannah, GA. Feb. 2002

Miller DJ, Vachon DD, Lynam DR. Neuroticism, negative affect, and negative affect instability: Establishing convergent and discriminant validity using ecological momentary assessment. Personality and Individual Differences. 2009; 47:873–877. doi:10.1016/j.paid.2009.07.007. [PubMed: 20160976]

Mott JA, Crowe PA, Richardson JL, Flay BR. After-school supervision and adolescent cigarette smoking: Contributions of the setting and intensity of after-school self-care. Journal of Behavioral Medicine. 1999; 22:35–58. doi:10.1023/A:1018747602026. [PubMed: 10196728]

Nansel TR, Overpeck M, Pilla RS, Ruan WJ, Simons-Morton B, Scheidt P. Bullying behaviors among US youth. Journal of the American Medical Association. 2001; 16:2094–2100. doi: 10.1001/jama.285.16.2094. [PubMed: 11311098]

Natvig GK, Albrektsen G, Qvarnstrom U. Psychosomatic symptoms among victims of school bullying. Journal of Health Psychology. 2001; 6:365–377. doi:10.1177/135910530100600401. [PubMed: 22049386]

Patterson, GR.; Reid, JB.; Dishion, TJ. Antisocial boys: A social interactional approach. Vol. Vol. 4. Castalia; Eugene, OR: 1992.

Rasbash, J.; Steele, F.; Browne, WJ.; Goldstein, H. A user's guide to MLwiN. v2.10. Centre for Multilevel Modelling, University of Bristol; Bristol, UK: 2009.

Richards MH, Miller BV, O'Donnell PC, Wasserman MS, Colder C. Parental monitoring mediates the effects of age and sex on problem behaviors among African American urban young adolescents. Journal of Youth and Adolescence. 2004; 33:221–233. doi:10.1023/B:JOYO.0000025321.27416.f6.

Richardson JL, Radziszewska B, Dent CW, Flay BR. Relationship between after-school care of adolescents and substance use, risk taking, depressed mood, and academic achievement. Pediatrics. 1993; 92:32–38. [PubMed: 8516082]

Rotter, JB. Social learning and clinical psychology. Prentice-Hall; Englewood Cliffs, NJ: 1945.

Rubin DB. Inference and missing data. Biometrika. 1976; 63:581–592. doi:10.1093/biomet/63.3.581.

Rudolph KD, Hammen C. Age and gender as determinants of stress exposure, generation, and reactions in youngsters: A transactional perspective. Child Development. 1999; 70:660–677. doi: 10.1111/1467-8624.00048. [PubMed: 10368914]

Rusby JC, Forrester KK, Biglan A, Metzler CW. Relationships between peer harassment and adolescent problem behaviors. Journal of Early Adolescence. 2005; 25:453–477.

Schafer JL. Multiple imputation: A primer. Statistical Methods in Medical Research. 1999; 8(1):3–15. doi:10.1191/096228099671525676. [PubMed: 10347857]

Schneiders J, Nicolson NA, Berkhof J, Feron FJ, van Os J, deVries MW. Mood reactivity to daily negative events in early adolescence: Relationship to risk for psychopathology. Developmental Psychology. 2006; 42:543–554. doi:10.1037/0012-1649.42.3.543. [PubMed: 16756444]

Shiffman, S. Real-time self-report of momentary states in the natural environment: Computerized ecological momentary assessment. In: Stone, AA.; Turkkan, JS.; Bachrach, CA.; Jobe, JB.; Kurtzman, HS., editors. The science of self-report: Implications for research and practice. Erlbaum; Mahway, NJ: 2000. p. 277-296.

Silk JS, Steinberg L, Morris AS. Adolescents' emotion regulation in daily life: Links to depressive symptoms and problem behavior. Child Development. 2003; 74:1869–1880. doi:10.1046/j.1467-8624.2003.00643.x. [PubMed: 14669901]

Snijders, TAB.; Bosker, RJ. Multilevel analysis: An introduction to basic and advanced multilevel modeling. 2nd ed. Sage; Thousand Oaks, CA: 2012.

Steinberg LD, Silverberg SB. The vicissitudes of autonomy on early adolescents. Child Development. 1986; 57:841–851. doi:10.2307/1130361. [PubMed: 3757604]

Stoolmiller M. Antisocial behavior, delinquent peer association and unsupervised wandering for boys: Growth and change from childhood to early adolescence. Multivariate Behavioral Research. 1994; 29:263–288. doi:10.1207/s15327906mbr2903_4.

Turner L, Mermelstein R, Flay BR. Individual and contextual influences on adolescent smoking. Annals of the New York Academy of Science. 2004; 1021:175–197. doi:10.1196/annals.1308.023.

Urberg KA, Luo Q, Pilgrim C, Degirmencioglu SM. A two-stage model of peer influence in adolescent substance use: Individual and relationship-specific differences in susceptibility to influence. Addictive Behaviors. 2003; 28:1243–1256. doi:10.1016/S0306-4603(02)00256-3. [PubMed: 12915166]

Vaillancourt T, Hymel S. Aggression and social status: The moderating roles of sex and peer-valued characteristics. Aggressive Behavior. 2006; 32:396–408. doi:10.1002/ab.20138.

Walls, TA.; Schafer, JL., editors. Models for Intensive Longitudinal Data. Oxford University Press; Oxford, U.K.: 2006.

Watson D, Clark LA, Tellegen A. Development and validation of brief measures of positive and negative affect: The PANAS scales. Journal of Personality and Social Psychology. 1988; 54:1063–1070. doi:10.1037//0022-3514.54.6.1063. [PubMed: 3397865]

Whalen CK, Jamner LD, Henker B, Delfino RJ. Smoking and moods in adolescents with depressive and aggressive dispositions: Evidence from surveys and electronic diaries. Health Psychology. 2001; 20:99–111. doi:10.1037//0278-6133.20.2.99. [PubMed: 11315734]

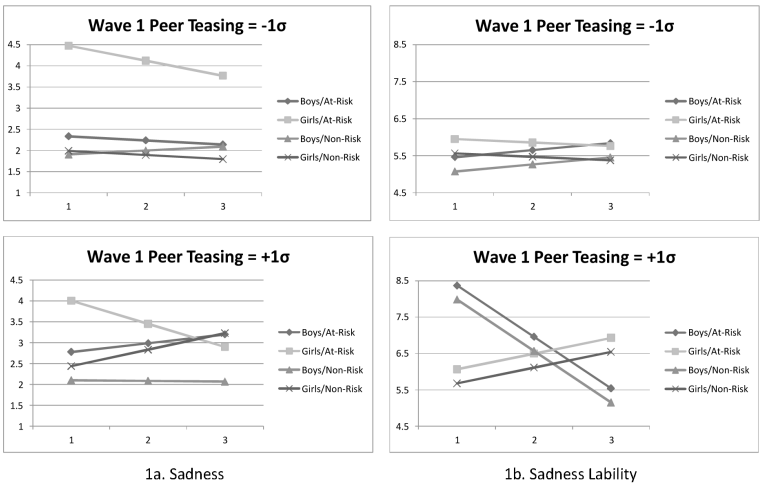

Figure 1.
Predicted Sadness and Sad Lability by Gender, Risk Status, Wave, and Affiliating with Peers who Tease.

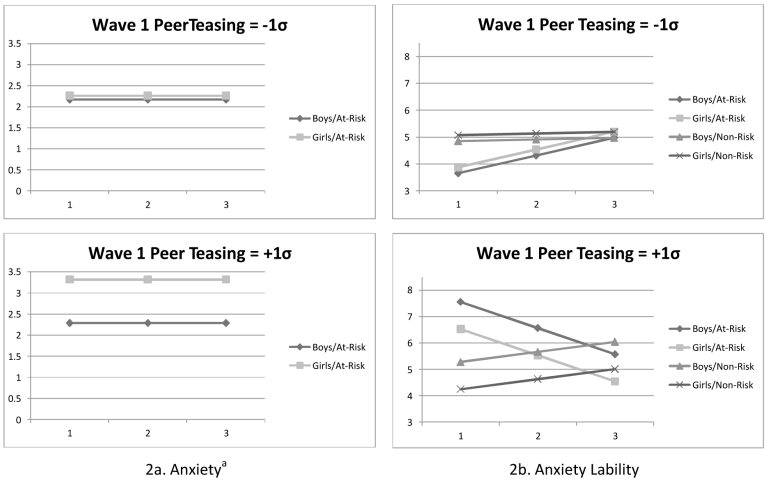

Figure 2.

Predicted Anxiety and Anxiety Lability by Gender, Risk Status, Wave, and Affiliating with Peers who Tease. [a]There is no significant difference between At-Risk and Nonrisk students for this outcome, so results are shown for At-Risk only.

Table 1

Descriptive Statistics by Assessment Wave

Measure	Wave 1	Wave 2	Wave 3
Percent of times youth were with:			
Same-age peers (Middle school students)	27%(.45)	27%(.44)	25%(.43)
Older peers (High school students)	21%(.41)	19%(.39)	17%(.38)
Younger peers(Children under 12)	34%(.48)	26%(.44)	27%(.44)
No peers	38%(.49)	44%(.50)	45%(.50)
Adults (Monitoring)	75%(.43)	71%(.45)	66%(.47)
Percent of times youth were engaged in[a]:			
TV, computer, or video games	41%(.49)	39%(.49)	40%(.49)
Physical activity	13%(.34)	13%(.34)	18%(.38)
Eating a meal	11%(.32)	10%(.30)	11%(.31)
Homework	11%(.31)	12%(.33)	13%(.34)
Chores	8%(.27)	7%(.25)	6%(.24)
Smoking cigarettes	1%(.10)	0%(.04)	0%(.05)
Drinking alcohol	1%(.10)	0%(.04)	0%(.06)
Smoking marijuana	1%(.08)	1%(.07)	0%(.05)
Breaking parents' rules	1%(.10)	0%(.06)	1%(.08)
Percent of times youth were:			
At home	72%(.45)	67%(.47)	70%(.46)
At someone else's house	13%(.34)	13%(.34)	12%(.33)
School/REC Center/Church	5%(.22)	6%(.24)	5%(.22)
In transit	4%(.20)	6%(.23)	4%(.20)
Out and about	5%(.23)	8%(.27)	9%(.29)
Perception of peers present			
Peers are popular[b]	5.33(2.95)	5.72.84	5.53(3.03)
Peers tease and say mean things to me[b]	3.03(2.55)	3.4 (2.76)	3.17(2.60)
Want to spent more time with peers[b]	6.48(3.01)	6.67 (2.82)	6.70(2.87)
Percent of peers present who are my friends	65%(.77)	59%(.72)	57%(.59)
Moods			
Happy[b]	6.71(2.45)	6.37(2.66)	6.26(2.72)
Angry[b]	2.49(2.28)	2.59(2.40)	2.42(2.23)
Sad[b]	2.54(2.36)	2.61(2.49)	2.38(2.39)
Anxious[b]	2.50(2.24)	2.53(2.33)	2.19(2.01)
Bored[b]	3.92(2.85)	3.89(2.95)	3.57(2.92)
Stressed[b]	2.98(2.46)	3.00(2.53)	2.66(2.47)
Left out[b]	2.04(1.94)	2.23(2.24)	1.97(1.95)
Lability of sad mood	5.55(6.89)	5.20(6.06)	4.80(5.81)
Lability of anxious mood	5.21(5.81)	4.84(5.75)	4.17(5.50)

Note. *SD*s are in parenthesis following each percentage or mean.

[a]The more frequent activities and the substance use and rule-breaking behaviors are presented.

[b]Numbers are the mean rating on a 1–9 scale (*not at all to very much*).

Table 2

Within-Person Correlations among Moods and of Mood with Perceptions of Peers

	Happy			Sad			Anxious			Left Out		
Sad	**−.40***,	−.23*,	−.29*		--							
Anxious	−.26*,	−19,	−.16	**.64***,	**.80***,	**.66***		--				
Left Out	−.14,	−.10,	−.14	**.52***,	**.74***,	**.60***	**.70***,	**.85***,	**.82***		--	
Popular peers	.23*,	.31*,	.31*	−05,	−.13,	−.20	−.04,	−22,	−.01	−.16,	−.24*,	−.05
Peers tease	−.08,	.01, -	−.28*	.28*,	**.40***,	.28*	**.46***,	**.54***,	.26*	**.51***,	**.58***,	.34*
Want future time w/peers	**.38***,	.32*,	.31*	−.23*,	−.28*,	−21	−.24*,	−.27*,	−.13	−.23*,	−.29*,	−.21
% who are friends	02,	.16,	.36*	−07,	−14,	−12	.09,	−.28*,	−.12	−.16,	−.29*,	−.17

Note. Bolded correlations are significant with *p*-value ≤ .001. Bolded values are a conservative indicator of significance and less likely to have occurred by chance due to the increased Type I error ratio of multiple comparisons. Correlations are shown in order of wave: Wave 1, Wave 2, and Wave 3.

* $p < .05$.

Table 3

Multilevel Models of Mood, Mood Lability and Risky Contexts

	Moods					Risky Contexts	
Model Term	**Sad Mood**	**Sad Lability**	**Anxious Mood**	**Anxious Lability**	**Happy Mood**	**Adult Monitoring**	**Out and About**
			Fixed Effects				
Constant	2.21 (0.29)***	5.47 (0.62)***	2.67 (0.16)***	4.66 (0.48)***	6.62 (0.33)***	81.6 (3.8)***	5.38 (0.79)***
Wave	0.15 (0.11)	0.17 (0.36)	---	0.22 (0.29)	−0.21 (0.13)	−4.7 (1.4)***	1.67 (0.66)**
At-risk	2.03 (0.45)***	0.39 (0.28)	0.12 (0.10)	0.54 (0.52)	−0.60 (0.40)	−5.0 (4.5)	
Teasing W1	0.11 (0.19)	0.03 (0.26)	0.26 (0.08)**	−0.21 (0.21)	−0.33 (0.20)	−2.62(1.1)**	
Male	−0.21 (0.41)	0.91 (0.60)	−0.56 (0.15)***	0.41 (0.25)	0.42 (0.39)	−8.0 (4.45)	
Wave × At-risk	−0.60 (0.17)**	---	---	−0.39 (0.45)	−0.01 (0.16)		
Wave × Teasing W1	0.12 (0.07)	0.13 (0.20)	---	0.08 (0.15)	0.17 (0.08)*		
Wave × Male	−0.11 (0.15)	−0.78 (0.50)	---	---	−0.13 (0.15)		
At-risk × Teasing W1	−0.23 (0.25)	---	---	0.87 (0.28)**	0.28 (0.20)		
At-risk × Male	−1.47 (0.62)*	---	---	---	---		
Teasing W1 × Male	−0.06 (0.23)	0.70 (0.33)*	−0.23 (0.09)**	0.31 (0.15)*	0.26 (0.21)		
Wave × At-risk × Teasing W1	−0.17 (0.09)	---	---	−0.49 (0.22)*	−0.20 (0.08)**		
Wave × At-risk × Male	0.62 (0.23)**	---	---	---	---		
Wave × Teasing W1 × Male	−0.15 (0.08)	−0.53 (0.26)*	---	---	−0.26 (0.08)***		
At-risk × Teasing W1 × Male	0.29(0.32)	---	---	---	---		
Wave × At-risk × Teasing W1 × Male	0.28 (0.12)	---	---	---	---		
Covariate[a]	0.12 (0.01)***	3.19 (0.33)***	0.21 (0.02)***	3.19 (0.30)***	---		
			Random Effects				
Level 2 (students)							
Var(students)	1.36 (0.25)***	11.35 (2.72)***	0.89 (0.19)***	5.94 (1.59)***	2.28 (0.42)***	308 (66)***	5.9 (5.5)
Var(Wave)	--	--	---	---		63 (24)*	7.9 (3.6)*
Var(Covariate[a])	--	4.63 (1.25)***	0.008 (0.003)**	4.75 (1.11)***			
Cov(Const × Wave)	--	---	--	--			
Cov(Const × Covariate[a])	--	8.18 (1.78)***	0.09 (0.02)	6.18 (1.30)***			
Cov(Const × Male)	--	--	−0.21 (0.08)				
Cov(Covariate[a]× Male)	---	--	--				
R^2	0.46	0.55	0.52	0.52	0.14	0.30	0.16
Level 1- (waves)							
Var(waves)	0.48 (0.06)***	9.45 (1.08)***	0.59 (0.07)***	6.94 (0.81)***	0.88 (0.10)***	180 (26)***	51.9 (6.6)***
R^2	0.37	0.60	0.46	0.46	0.02	0.25	0.20

Note. Numbers presented are Beta coefficients and numbers in parentheses are standard errors unless otherwise specified. “Teasing W1” means affiliating with peers who tease and say mean things to them at Wave 1.

[a] In models of anxiety, anxiety liability was used as a covariate and in models of anxiety liability, anxiety was used as a covariate. The same is true for sadness and sadness liability.

* $p < .05$.

** $p < .01$.

*** $p < .001$.