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Máire B. Ford <sup>a</sup> & Nancy L. Collins <sup>b</sup>

<sup>a</sup> Psychology Department , Loyola Marymount University , Los  
Angeles , CA , USA

<sup>b</sup> Department of Psychological and Brain Sciences , University of  
California , Santa Barbara , CA , USA

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# Self-esteem Moderates the Effects of Daily Rejection on Health and Well-being

Máire B. Ford<sup>1</sup> and Nancy L. Collins<sup>2</sup>

<sup>1</sup>Psychology Department, Loyola Marymount University, Los Angeles, CA, USA

<sup>2</sup>Department of Psychological and Brain Sciences, University of California, Santa Barbara, CA, USA

A daily diary methodology was used to investigate the effects of rejection on daily health and well-being as well as the moderating role of self-esteem. Participants completed an online diary for two weeks, reporting on rejection, mental well-being/resources, risky health behaviors, and health-related outcomes. Overall, daily rejection was associated with decreases in mental well-being/resources but not with health behaviors or health-related outcomes. Additionally, self-esteem played an important moderating role. On high rejection days low self-esteem individuals were more likely to engage in risky health behaviors, and on the day following a high rejection day they reported decrements in health and well-being. Discussion centers on possible self-regulatory explanations for these findings and implications for the health of individuals with low self-esteem.

**Keywords:** Daily diary; Health; Interpersonal rejection; Self-esteem; Self-regulation.

People of all ages are most likely to thrive when they feel valued and accepted by others; but social acceptance is not always attainable. Even the most socially skilled people have experienced times when they felt socially excluded or rejected by others. These feelings of rejection are a common human experience that can lead to negative *psychological* consequences (Blackhart, Eckel, & Tice, 2007; Leary, Tambor, Terdal, & Downs, 1995; Stroud, Tanofsky-Kraff, Wilfley, & Salovey, 2000; Zadro, Williams, & Richardson, 2004). There is growing evidence that rejection and social exclusion are also harmful to *physical* health. People who are chronically lonely or who lack strong social ties are at increased risk for disease and early mortality (Hawkley & Cacioppo, 2010). Likewise, laboratory work shows that acute social rejection and other threats to social acceptance can lead to a variety of adverse physiological responses including increases in physiological stress reactivity (Blackhart et al., 2007; Dickerson, Gruenewald, & Kemeny, 2004; Stroud, Salovey, & Epel, 2002; Stroud et al., 2000) and inflammatory responses (Dickerson, Gable, Irwin, Aziz, & Kemeny, 2009; Slavich, Way, Eisenberger, & Taylor, 2010) that, if chronically activated, can have long-term implications for health. But social rejection may also have important implications for health through a number of pathways that have not yet been explored (e.g., risky health behaviors and restorative behaviors such as sleep). Although laboratory studies are useful for examining acute threats to social acceptance and for investigating immediate emotional and physiological outcomes, they are not well suited for examining a broader range of health-relevant outcomes

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Correspondence should be addressed to: Máire B. Ford, Loyola Marymount University, Psychology Department, One LMU Drive, Los Angeles, CA 90045, USA. E-mail: mford9@lmu.edu

that can impact the quality of daily life. How people cope with feelings of rejection in their daily lives, and how they recover in the hours and days following rejection, can play an important role in shaping both emotional well-being and physical health.

Despite the fact that rejection is normatively distressing, individuals differ in their responses to rejection, with some individuals displaying relative resilience following rejection and others displaying vulnerability to the poor outcomes associated with rejection. One factor that has been associated with resilience/vulnerability in the face of rejection is an individual's self-view. There is growing evidence that individuals with negative self-views (such as those with low self-esteem) respond to rejection in ways that are harmful to their *psychological* well-being (e.g., Downey & Feldman, 1996; Ford & Collins, 2010; Murray, Bellavia, Rose, & Griffin, 2003; Nezlek, Kowalski, Leary, Blevins, & Holgate, 1997; Sommer & Baumeister, 2002). However, little work has been done to investigate whether they also respond to rejection in ways that are harmful to their physical well-being (Ford & Collins, 2010; Gunnar, Sebanc, Tout, Donzella, & Van Dulmen, 2003; Sommer, Kirkland, Newman, Estrella, & Andreassi, 2009). Additionally, the work that has been done has solely focused on immediate physiological responses to rejection. The goal of the current study was to extend this area of research by investigating additional pathways whereby self-esteem and rejection may interact to impact everyday health and well-being. The current investigation examined the impact of naturally occurring rejection on daily health and emotional well-being as well as the moderating role of self-esteem (SE) in shaping reactivity to daily rejection, as well as recovery. The current study is the first that we know of to investigate the association between *rejection and health* outside of a laboratory context and to investigate health behaviors as a mediator of the link between self-esteem and health outcomes. As such, it allowed us to examine research questions that could not be examined during a short laboratory session. In the current study, we used daily diary methods to examine the effects of feeling rejected on psychological well-being and health-related behaviors in daily life. We examined reactivity as well as recovery from rejection and we examined self-esteem as a critical moderator variable. Thus, we begin by reviewing the research on the association between social rejection and health/well-being. Next we discuss several mechanisms by which rejection may impact health/well-being. Finally we consider the role of SE as an important moderator of these pathways.

### *Responses to Rejection*

A number of theories assert that humans have a fundamental need to belong and that rejection is aversive because it threatens the fulfillment of this need (Baumeister & Leary, 1995; Bowlby, 1982; Dickerson & Kemeny, 2004; MacDonald & Leary, 2005; Williams, 2001). Consistent with this assumption, rejection (and related social threats) are reliably associated with negative *psychological* consequences including negative mood (Blackhart, Nelson, Knowles, & Baumeister, 2009; Gerber & Wheeler, 2009) and impaired self-regulatory abilities (Baumeister, DeWall, Ciarocco, & Twenge, 2005). Studies have also revealed an association between rejection (and related social threats) and *physiological* responses including increased cardiovascular reactivity (Sommer et al., 2009; Stroud et al., 2000), increased levels of stress hormones (Blackhart et al., 2007; Dickerson et al., 2004; Dickerson & Kemeny, 2004; Dickerson, Mycek, & Zaldivar, 2008; Gunnar et al., 2003; Stroud et al., 2000, 2002), and activation of components of the immune system related to inflammation (Dickerson et al., 2009; Slavich et al., 2010). These findings suggest that rejection

elicits immediate physiological responses that may, over time, be detrimental to health and well-being. However, it is likely that rejection impacts health and well-being through additional pathways.

### *Potential Pathways Linking Rejection and Health*

What are the mechanisms through which rejection might impact health and well-being? Rejection may impact health and well-being in at least three ways: (1) by triggering adverse cognitive, emotional, and physiological responses; (2) by shaping health-related behaviors; and (3) by interfering with restorative behaviors. Of these three possible mechanisms only the first one has received research attention. Thus, the goal of the current study was to extend research in two ways. First, we investigated the effects of rejection on health-related behaviors (pathway 2) and restorative behaviors (pathway 3). Second, we investigated the role of self-esteem in shaping health-related behaviors and restorative behaviors following rejection.

Why might rejection influence health-related *behaviors*? A small number of laboratory studies have shown that rejection reduces self-regulatory ability (Baumeister et al., 2005; DeWall, Baumeister, & Vohs, 2008; Oaten, Williams, Jones, & Zadro, 2008). Because self-regulatory resources play an important role in shaping health behaviors, such as eating behaviors and substance use (e.g., Herman & Polivy, 2004; Hull & Slone, 2004; Sayette, 2004), it is likely that rejection may interfere with the optimal regulation of health behaviors. Evidence suggests a link between social exclusion and eating behaviors (Baumeister et al., 2005; Stroud et al., 2000) but other health-related behaviors have not yet been investigated. It is important to apply a self-regulatory perspective to rejection in order to understand whether rejection is associated with other potentially harmful health-related behaviors (such as drug use and unsafe sex), and therefore may have even greater consequences for health than we currently realize.

Rejection may also impact health by affecting restorative behaviors, such as sleep. Although the association between rejection and sleep quality has not been explored there is evidence that other experiences that signify social devaluation, such as perceptions of social isolation and loneliness, are associated with poor sleep quality (Cacioppo et al., 2002; Steptoe, Owen, Kunz-Ebrecht, & Brydon, 2004). One reason posited for this association is an evolutionary one. Specifically, throughout evolutionary history co-sleeping was safer than sleeping alone. Thus, feelings of loneliness, isolation or rejection may trigger a sense of vulnerability and increased vigilance, disrupting restful sleep. Additionally, because rejected individuals have an increased tendency to experience mood states that are associated with poor sleep, such as depression (Baglioni, Spiegelhalder, Lombardo, & Riemann, 2010), this may increase the likelihood that they will experience poor sleep. Given that sleep disruption is associated with poor health outcomes including poor appetite regulation, obesity, diabetes, lower glucose tolerance and increased evening cortisol levels (Knutson & Van Cauter, 2008; Van Cauter, Spiegel, Tasali, & Leproult, 2008) it is important to understand the relationship between rejection and sleep quality.

### *Self-esteem as a Moderator of Responses to Rejection*

Although rejection is normatively distressing, not everyone responds to it in the same way. There are important individual differences in sensitivity to subtle or ambiguous rejection cues, which are prevalent in everyday life. Some individuals have a lower

threshold for appraising rejection cues as threatening to the self and are therefore more reactive to rejection. One variable that seems to play an important role in shaping reactivity to rejection is self-esteem. Specifically, individuals with low self-esteem (LSE) are more likely to see rejection as evidence of a flawed self (Ford & Collins, 2010). In contrast, for individuals with high self-esteem (HSE), positive self-views and general expectations of acceptance should lead to external attributions for rejection and should buffer the impact of specific rejection experiences on their broader self-concept and well-being.

Research findings are beginning to suggest that the response patterns exhibited by LSE individuals following rejection may make them vulnerable to both decrements in emotional well-being and poor health. For example, a recent longitudinal study of college students revealed that LSE was associated with poor health outcomes and that the association between LSE and poor health was mediated by interpersonal stressors (Stinson et al., 2008). However, it is not yet clear how interpersonal stress is converted into poor health outcomes for LSE individuals. Laboratory research suggests that LSE individuals are more likely to exhibit maladaptive physiological responses (increased cortisol reactivity) following even mild rejection cues (Ford & Collins, 2010), suggesting that physiological reactivity may be one important mechanism linking interpersonal stress to long-term health. However, it is likely that other mechanisms also exist. With respect to psychological well-being, LSE individuals, who process rejecting information in a more threatening way, may need to utilize more mental resources to cope with rejection, leaving them with fewer resources to self-regulate their behavior, including health-related behavior. LSE individuals may also engage in unhealthy lifestyle behaviors—such as substance use—to escape from aversive thoughts and feelings following rejection; and their desire for social approval and acceptance may motivate them to engage in behaviors—such as casual or unsafe sex—that allow them to regain a temporary sense of approval and acceptance, even if these behaviors compromise their health. Also, given the link between LSE and physiological stress reactivity following rejection (Ford & Collins, 2010), it is possible that in the hours and days following rejection LSE individuals may also be more vulnerable to adverse stress-related health consequences such as poor sleep, stress-related physical symptoms, and general feelings of malaise.

### *The Present Study*

The current investigation had two main goals: (1) to examine the relationship between daily rejection and health and well-being; and (2) to examine the moderating role of SE on this relationship. To accomplish these goals we utilized a daily diary methodology in which participants answered questions about daily rejection, psychological well-being/resources (depressed mood, perceived stress, perceived ability to self-regulate behaviors), daily health-related responses (overeating, unsafe sex, substance use), and daily health outcomes (sleep quality, physical symptoms, and general feelings of health) each evening for two weeks. This methodology enabled us to conduct both within-person and between-person analyses. At the within-person level, we examined the normative effects of rejection on health by comparing participant's levels of health and well-being on their high rejection days versus their low rejection days. We predicted that rejection would be associated with decrements in psychological well-being, health behaviors, and health outcomes. At the between-person level, we examined SE differences in reactivity to rejection. We

predicted that LSE individuals would be more reactive to rejection, as indicated by greater relative decrements in health and well-being on high rejection days.

Diary methodology also allowed us to investigate lagged effects (effects of today's rejection on tomorrow's health and well-being) in order to assess patterns of recovery from rejection. Studying recovery is important because the ability to bounce back from rejection experiences may be an important marker of resilience. However, previous studies have focused solely on reactivity and neglected to investigate recovery. In the current study, we predicted that LSE individuals would have greater difficulty recovering from rejection (as compared to HSE individuals) and that this delayed recovery would be reflected in sustained negative psychological and health-related outcomes on the day *following* a high rejection day (when compared to the day following a low rejection day). Finally, because SE is correlated with dispositional neuroticism (Schmitt, Allik, McCrae, & Benet-Martinez, 2007), and neuroticism is a known risk factor for poor psychological well-being and poor health (Hampson & Friedman, 2008; Smith, 2006), we controlled for neuroticism in all analyses in order to ensure that the moderating role of SE was independent of neuroticism.

## Method

### *Participants*

A total of 101 undergraduate participants were recruited for the study and 100 completed a minimum of 5 daily assessments.<sup>1</sup> Participants completed an average of 12.40 diaries (out of 14). Eleven diaries were dropped from analyses because they were not completed on time. Additionally, one participant did not provide data for an important control variable (neuroticism) and was dropped from the current analyses. Thus, all analyses are based on the remaining 99 participants (23 males and 76 females) who ranged in age from 17 to 22 ( $M = 18.7$ ,  $SD = 1.04$ ). Participants received either course credit or \$50.

### *Procedure*

Participants were recruited for a daily diary study and reported to the laboratory in groups of six for an initial session, during which they completed background questionnaires assessing demographic variables as well as SE and neuroticism. During this session the experimenter described the procedure for accessing the online daily diary questionnaire and instructed participants to complete their questionnaire for the next 14 days, each night immediately before going to sleep. Lastly, they were told that at the end of the 14 days they would return to the lab for a final session, during which they would be fully debriefed.

### *Background Measures*

*Trait self-esteem (SE).* SE was measured with the 10-item Rosenberg Self-esteem Scale (Rosenberg, 1965;  $\alpha = .89$ ), which assesses the degree to which individuals feel good about themselves (e.g., "On the whole, I am satisfied with myself"). Items were rated on a scale from 1 (*strongly disagree*) to 7 (*strongly agree*). The mean SE score was 5.85 ( $SD = 0.78$ ).

*Neuroticism.* Neuroticism was measured with the 12-item neuroticism subscale from the Short-scale EPQ-R (Eysenck, Eysenck, & Barrett, 1985;  $\alpha = .70$ ). This scale measures emotional instability and general negative affectivity (e.g., “Are you an irritable person?”; “Would you call yourself tense or high-strung?”). Items were rated as *yes* (1) or *no* (0), and the number of “yes” answers was summed for each participant ( $M = 4.31$ ,  $SD = 2.66$ ).

#### *Daily Diary Measures*

*Daily feelings of rejection.* Daily feelings of rejection were measured with two items. Participants rated the extent to which they felt “rejected” and “excluded or left out” that day, using a scale that ranged from 1 (*not at all*) to 5 (*extremely*). The two items were averaged to form a daily index of rejection-related feelings ( $\alpha = .79$ ,  $M = 1.33$ ,  $SD = 0.67$ ).

#### *Measures of General Mental Well-being/Resources*

*Perceived stress.* Daily perceptions of stress were measured using four items from the long form of the Perceived Stress Scale (Cohen, Kamarck, & Mermelstein, 1983). These four items were chosen because they represented a concise measure of perceived stress that could be completed quickly each evening. The shortened scale included items such as: “Today, how often have you felt that you were coping well or effectively handling events that were occurring in your life?” (reversed); and “Today, how often have you felt confident about your ability to handle your personal problems?” (reversed). Items were rated on a scale from 1 (*never*) to 5 (*almost all the time*) and were averaged to form an index of daily stress ( $\alpha = .92$ ,  $M = 2.64$ ,  $SD = 0.88$ ).

*Depressed mood.* Depressed mood was measured with four items from a larger emotion adjective checklist. Participants rated the extent to which they experienced each emotion that day (“Today I felt ...”) on a scale from 1 (*very slightly*) to 5 (*extremely*). Guided by factor analysis we computed a four-item index of depressed mood. Items included, *depressed*, *emotionally drained*, *hopeless*, and *downcast* ( $\alpha = .79$ ,  $M = 1.54$ ,  $SD = 0.70$ ).

*Self-regulation.* Daily self-regulation was measured with four items designed to measure how well participants were able to regulate their behavior that day. Items included: “Overall I felt like I had a lot of willpower today”; “I had difficulty controlling my behavior today” (reversed); “I found it difficult to focus or concentrate today” (reversed); and “I found it easy to work toward meeting my goals today.” Items were rated on a scale from 1 (*strongly disagree*) to 5 (*strongly agree*), and were averaged to form a daily self-regulation index ( $\alpha = .68$ ,  $M = 3.41$ ,  $SD = .76$ ).

#### *Daily Health Behaviors*

*Risky health behaviors.* To assess risky health behaviors we included measures of drug use, tobacco use, alcohol use, binge eating, purging, and risky sex (risk of pregnancy, risk of STD, hook-up/one night stand). Participants indicated whether they engaged in a given risky health behavior that day by checking a box indicating an answer of *yes* (1) or *no* (0) to the following questions: “Did you use any

non-prescription or recreational drugs today?"; "Did you use any prescription drugs today?"<sup>2</sup>; "Did you use any tobacco products today?"; "Did you have any alcoholic drinks today?"; "Did you binge today?"; "Did you purge today?". Participants who indicated that they had sexual intercourse or oral sex also indicated whether they engaged in behavior that would put them at risk for pregnancy or for contracting a sexually transmitted disease and they indicated the nature of their relationship with the sexual partner (e.g., hook-up/one night stand, dating casually, dating exclusively). Base rates for each risky health behavior are reported in Table 1. Because the base rates of individual risky behaviors were low, we created a daily index of risky health behaviors by assigning participants a score of 1 for each risky behavior that they engaged in on a given day. Over the 14 days, 25% of the daily responses indicated that participants had engaged in at least one risky health behavior (with 8% of these responses indicating 2 or more risky health behaviors in a given day).

### Health-related Outcomes

*Daily sleep quality.* Daily sleep quality was measured with a single item that read: "Please rate the quality of your sleep in the past 24 hours." Participants responded on a scale from 1 (*not at all good*) to 5 (*extremely good*). The mean score was 3.25 ( $SD = 1.03$ ).

*General daily feelings of poor health.* Participants were presented with four statements that measured their daily feelings of poor health. Items included: "I felt ill today"; "I felt like my health interfered with my activities today"; "I felt fatigued today"; "I felt unhealthy today." Items were rated on a scale from 1 (*strongly disagree*) to 5 (*strongly agree*). An index of general feelings of poor health was created by averaging responses to these four items ( $\alpha = .88$ ,  $M = 1.70$ ,  $SD = 0.95$ ).

*Daily physical symptoms.* Daily stress-related physical symptoms were measured using six items from the somatic symptoms subscale of the Brief Symptom Inventory (Derogatis & Melisaratos, 1983). Participants were presented with a list of physical symptoms (e.g., headache, nausea or upset stomach) and asked to indicate how

**TABLE 1** Percentage of Daily Diaries in which Individual Risky Health Behaviors were Reported

Risky health behavior	Percent reported
Non-prescription drug use	6
Prescription drug use	2
Tobacco use	2
Alcohol use	12
Binging	4
Purging	2
Risky sex (pregnancy risk)	1
Risky sex (STD risk)	5
Hook-up/one night stand	1

*Notes:* Values represent the % of daily diaries in which the respondent reported engaging in that specific risky health behavior. These are the base rates for the individual risky health behaviors.

much they were bothered by each symptom that day, using a scale from 1 (*not at all*) to 5 (*extremely*). An index of physical symptoms was created by averaging responses to the six items ( $\alpha = .60$ ,  $M = 1.28$ ,  $SD = 0.43$ ).

## Results

### *Data Analytic Strategy*

To investigate reactivity to (and recovery from) daily rejection we used software designed to analyze hierarchically nested data (with days nested within person). We conducted multilevel analyses using HLM software Version 6.04 (Raudenbush, Bryk, Cheong, & Congdon, 2004), which provides independent estimates of the associations among constructs at Level 1 (within persons) and models them at Level 2 (between persons) using maximum likelihood estimation. In the current set of analyses all significance tests were based on robust standard errors. In the Level 1 model, daily well-being/health variables were predicted by daily feelings of rejection and an error term, allowing us to estimate the normative (within person) effects of rejection on daily health and well-being. Daily rejection was group centered (centered around an individual's mean) so that the effects could be interpreted as changes in the outcome variable associated with changes from an individual's average feeling of rejection over the 14 days. At Level 2, SE (the primary Level 2 predictor) and neuroticism (a Level 2 control variable) were grand mean centered and entered simultaneously to predict the Level 1 intercepts and slopes, allowing us to investigate SE as a moderator of the relationship between rejection and daily health/well-being (controlling for neuroticism).<sup>3</sup> Additionally, because the daily rejection variable was person centered at Level 1, we computed a mean rejection score for each person (averaged over the 14 diary days) and entered this variable (grand mean centered) at Level 2 predicting the Level 1 intercepts, as recommended by Raudenbush and Bryk (2002). The HLM model is specified below.

### *Within-person Effects (Level 1 Model)*

$$\text{Today's health/well-being} = b_{0j} + b_{1j}(\text{Today's feelings of rejection}) + e_{ij}$$

### *Between-person Effects (Level 2 Model)*

$$b_0 = \gamma_{00} + \gamma_{01}(\text{self-esteem}) + \gamma_{02}(\text{neuroticism}) + \gamma_{03}(\text{mean rejection}) + v_{0j},$$

$$b_1 = \gamma_{10} + \gamma_{11}(\text{self-esteem}) + \gamma_{12}(\text{neuroticism}) + v_{1j}.$$

In addition to the same-day model shown above, we ran a series of lagged models to investigate the relationship between today's rejection and the next day's outcomes, in order to investigate recovery processes. To create the lagged model we modified the Level 1 equation such that the dependent variable reflected *the next day's* health/well-being. The Level 1 equation included *the same day's rejection* and *the previous day's rejection* as predictor variables, which allowed us to test the lingering effects of the prior day's rejection on the next day's outcomes while controlling for the same day's rejection. The next day (lagged) HLM model is specified below.

***Within-person Effects (Level 1 Model)***

$$\text{Next day's outcomes} = b_{0j} + b_{1j} (\text{Same day's rejection}) + b_{2j} (\text{Previous day's rejection}) + e_{ij}$$

***Between-person Effects (Level 2 Model)***

$$b_0 = \gamma_{00} + \gamma_{01} (\text{self-esteem}) + \gamma_{02} (\text{neuroticism}) + \gamma_{03} (\text{mean rejection}) + v_{0j},$$

$$b_1 = \gamma_{10} + \gamma_{11} (\text{self-esteem}) + \gamma_{12} (\text{neuroticism}) + v_{1j}.$$

$$b_2 = \gamma_{20} + \gamma_{21} (\text{self-esteem}) + \gamma_{22} (\text{neuroticism}) + v_{2j}.$$

***Relationship between Self-esteem and Feelings of Rejection***

Before exploring daily reactivity to rejection, we investigated the relationship between SE and feelings of rejection across the 14 day diary period. We used a simplified version of the same-day equations presented above to predict mean levels of daily rejection (Level 1 intercepts only) from self-esteem and neuroticism (see equations below).

***Within-person Effects (Level 1 Model)***

$$\text{Daily rejection} = b_{0j} + e_{ij}$$

***Between-person Effects (Level 2 Model)***

$$b_0 = \gamma_{00} + \gamma_{01} (\text{self-esteem}) + \gamma_{02} (\text{neuroticism}) + v_{0j}.$$

This analysis revealed no significant effect of SE ( $\gamma = -0.12$ ,  $p = .235$ ) and no significant effect of neuroticism ( $\gamma = 0.02$ ,  $p = .333$ ) on mean rejection across the 14 days.

***Effects of Today's Rejection on Today's Outcomes***

We began our analysis of *daily reactions* to rejection by using the same-day multilevel model specified earlier. Next we ran the *lagged* models to investigate lingering effects of rejection on the next day's outcomes. Results are summarized in Tables 2 and 3. For each outcome variable, the first column shows the same-day model and the second column shows the next-day model. We begin by reporting the same day models.

***Mental Health Outcomes/Resources***

*Perceived stress.* As shown in Table 2, there was a significant main effect of rejection ( $\gamma = 0.28$ ,  $p < .001$ ), a significant main effect of SE ( $\gamma = -0.32$ ,  $p < .001$ ), and a significant SE  $\times$  rejection interaction ( $\gamma = 0.16$ ,  $p = .004$ ). As illustrated in Figure 1, a simple slopes analysis indicated that both LSE ( $-1SD$ ) and HSE ( $+1SD$ ) individuals reported a significant increase in perceived stress on their high rejection days compared to their low rejection days. However, contrary to predictions, the slope was significantly steeper for HSE individuals (compared to LSE individuals),

TABLE 2 Estimated Gamma Coefficients Predicting Daily Mental Well-being/Resources

Coefficient	Dependent variable					
	Perceived stress		Depressed mood		Self-regulation	
	Same day	Next day	Same day	Next day	Same day	Next day
Intercept ( $\gamma_{00}$ )	2.64***	2.65***	1.55***	1.53***	3.40***	3.41***
Self-esteem ( $\gamma_{01}$ )	-0.32***	-0.30***	-0.12**	-0.11**	0.12*	0.12*
Neuroticism ( $\gamma_{02}$ )	0.38	0.04 <sup>†</sup>	-0.01	-0.01	-0.04*	-0.04*
Mean daily rejection ( $\gamma_{03}$ )	0.34*	0.30*	0.87***	0.90***	-0.35***	-0.40***
Same day rejection ( $\gamma_{10}$ )	0.28***	0.27***	0.47***	0.45***	-0.19***	-0.14**
Previous day rejection ( $\gamma_{20}$ )	—	0.06	—	0.07**	—	-0.09*
Self-esteem × Same day rejection ( $\gamma_{11}$ )	0.16**	0.14**	0.08	0.06	0.08	0.06
Self-esteem × Previous day rejection ( $\gamma_{21}$ )	—	-0.11*	—	-0.12**	—	-0.01
Neuroticism × Same day rejection ( $\gamma_{12}$ )	0.02	0.02	-0.01	-0.02	0.01	0.03
Neuroticism × Previous day rejection ( $\gamma_{22}$ )	—	-0.03*	—	-0.04***	—	0.00

Notes: All coefficients are unstandardized multilevel regression coefficients. <sup>†</sup>  $p \leq .10$ ; \*  $p \leq .05$ ; \*\*  $p \leq .01$ ; \*\*\*  $p \leq .001$ .

TABLE 3 Estimated Gamma Coefficients Predicting Daily Physical Health Behaviors/Outcomes

Coefficient	Dependent variable											
	Risky health behaviors			Sleep quality			General feelings of poor health			Physical symptoms		
	Same day	Next day	Next day	Same day	Next day	Next day	Same day	Next day	Next day	Same day	Next day	Next day
Intercept ( $\gamma_{00}$ )	0.28***	0.27***	0.27***	3.26***	3.25***	3.25***	1.69***	1.67***	1.67***	0.35***	0.35***	0.35***
Self-esteem ( $\gamma_{01}$ )	0.01	0.02	0.02	0.20*	0.21*	0.21*	-0.03	-0.05	-0.05	0.00	0.00	0.00
Neuroticism ( $\gamma_{02}$ )	0.01	0.01	0.01	-0.02	-0.01	-0.01	0.02	0.02	0.02	0.00	0.00	0.00
Mean daily rejection ( $\gamma_{03}$ )	0.06	0.05	0.05	-0.26	-0.29	-0.29	0.55***	0.54**	0.54**	0.06***	0.06***	0.06***
Same day rejection ( $\gamma_{10}$ )	0.02	0.04	0.04	-0.03	-0.09	-0.09	0.06	0.01	0.01	0.00	0.00	0.00
Previous day rejection ( $\gamma_{20}$ )	—	0.03	0.03	—	0.04	0.04	—	0.02	0.02	—	—	0.00
Self-esteem $\times$ Same day rejection ( $\gamma_{11}$ )	-0.05*	-0.05	-0.05	0.11*	0.13*	0.13*	0.02	0.02	0.02	0.00	0.00	0.00
Self-esteem $\times$ Previous day rejection ( $\gamma_{21}$ )	—	0.03	0.03	—	-0.10	-0.10	—	-0.19***	-0.19***	—	—	-0.02***
Neuroticism $\times$ Same day rejection ( $\gamma_{12}$ )	-0.01	-0.02 <sup>†</sup>	-0.02 <sup>†</sup>	0.02	0.04	0.04	0.01	0.00	0.00	0.00	0.00	0.00
Neuroticism $\times$ Previous day rejection ( $\gamma_{22}$ )	—	0.01	0.01	—	-0.03	-0.03	—	-0.04*	-0.04*	—	—	-0.002*

Notes: All coefficients are unstandardized multilevel regression coefficients. The Risky Health Behavior variable is square root transformed and the physical symptoms variable is log transformed. <sup>†</sup>  $p \leq .10$ ; \*  $p \leq .05$ ; \*\*  $p \leq .01$ ; \*\*\*  $p \leq .001$ .

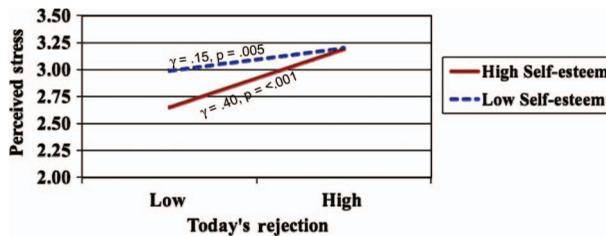
suggesting that they experienced a greater relative increase in perceived stress on days when they felt more rejected.

*Depressed mood.* Analyses revealed a significant main effect of rejection ( $\gamma = 0.47, p < .001$ ), a significant main effect of SE ( $\gamma = -0.12, p = .005$ ), and no SE  $\times$  rejection interaction ( $\gamma = 0.08, p = .282$ ). Participants reported higher levels of depressed mood on their high rejection days compared to their low rejection days. Additionally, individuals with LSE reported higher levels of depressed mood than those with HSE.<sup>4</sup>

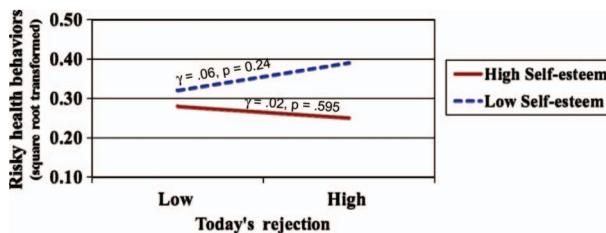
*Self-regulation.* Analyses revealed a significant main effect of rejection ( $\gamma = -0.19, p < .001$ ), a significant main effect of SE ( $\gamma = 0.12, p = .035$ ), and no SE  $\times$  rejection interaction ( $\gamma = 0.08, p = .220$ ). Participants reported less self-regulatory ability on their high rejection days compared to their low rejection days. In addition, individuals with LSE reported less self-regulatory ability than those with HSE.

### Daily Health Behaviors and Health-related Outcomes

*Risky health behavior.* Because the distribution for the risky health behavior index was moderately positively skewed we performed a square root transformation on this variable. As shown in Table 3, analyses revealed no main effect of rejection ( $\gamma = 0.02, p = .533$ ), no main effect of SE ( $\gamma = 0.01, p = .845$ ), and a significant SE  $\times$  rejection interaction ( $\gamma = -0.05, p = .039$ ). As illustrated in Figure 2, LSE individuals (but not HSE individuals) were more likely to engage in risky health behavior on days when they felt more rejected.<sup>5</sup>



**FIGURE 1** The association between today's feelings of rejection and *today's* perceived stress.



**FIGURE 2** The association between today's feelings of rejection and *today's* risky health behaviors.

### Daily Health-related Outcomes

*Sleep quality.* Analyses revealed no main effect of rejection ( $\gamma = -0.03, p = .486$ ) but a significant main effect of SE ( $\gamma = 0.20, p = .054$ ) and a significant SE  $\times$  rejection interaction ( $\gamma = 0.11, p = .014$ ). As illustrated in Figure 3, LSE individuals (but not HSE individuals) reported poorer sleep quality on evenings when they felt more rejected.<sup>6</sup>

*General feelings of poor health.* Analyses revealed no main effect of rejection ( $\gamma = 0.06, p = .292$ ), no main effect of SE ( $\gamma = -0.03, p = .761$ ), and no SE  $\times$  rejection interaction ( $\gamma = 0.02, p = .817$ ).

*Physical symptoms.* Because the distribution for the physical symptoms variable was strongly positively skewed we performed a logarithmic transformation on this variable (first we added one point to each score to remove zero values). Results revealed no main effect of rejection ( $\gamma = 0.00, p = .984$ ), no main effect of SE ( $\gamma = 0.00, p = .592$ ), and no SE  $\times$  rejection interaction ( $\gamma = 0.00, p = .602$ ).

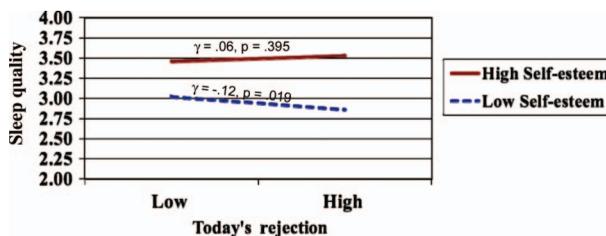
### Effects of Today's Rejection on the Next Day's Outcomes

Main effects of SE will not be discussed as these have already been reported above. The descriptions below will focus on the lagged association between the *previous day's* rejection and the *next day's* outcomes, as well as the moderating role of SE on this association (recall that these analyses controlled for same day rejection). Results for these analyses are presented in the second column (for each outcome) in Tables 2 and 3.

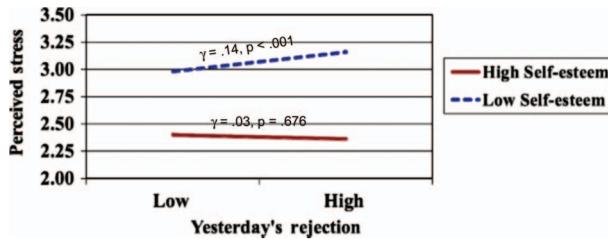
### Mental Health Outcomes/Resources

*Perceived stress.* As shown in Table 2, there was no main effect of the previous day's rejection ( $\gamma = 0.06, p = .179$ ) but a significant SE  $\times$  rejection interaction ( $\gamma = -0.11, p = .011$ ). As illustrated in Figure 4, LSE individuals (but not HSE individuals) reported higher levels of perceived stress on days following their high rejection days (relative to their low rejection days).

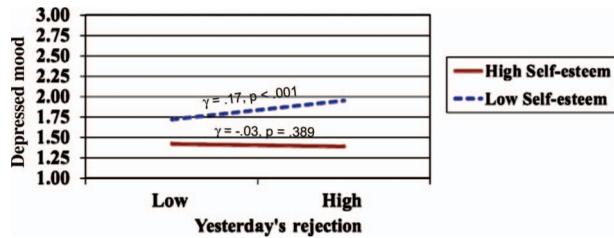
*Depressed mood.* Analyses revealed a significant main effect of the previous day's rejection ( $\gamma = 0.07, p = .007$ ) and a significant SE  $\times$  rejection interaction ( $\gamma = -0.12, p = .002$ ). As illustrated in Figure 5, LSE individuals (but not HSE individuals) reported higher levels of depressed mood on days following their high rejection days (relative to their low rejection days).



**FIGURE 3** The association between today's feelings of rejection and *tonight's* sleep quality.



**FIGURE 4** The lagged association between *yesterday's* feelings of rejection and *today's* perceived stress.



**FIGURE 5** The lagged association between *yesterday's* feelings of rejection and *today's* depressed mood.

*Self-regulation.* Analyses revealed a significant main effect of the previous day's rejection ( $\gamma = -0.09, p = .040$ ) but no SE  $\times$  rejection interaction ( $\gamma = -0.01, p = .782$ ). Both HSE and LSE individuals reported less self-regulatory ability on days following their high rejection days (relative to their low rejection days).

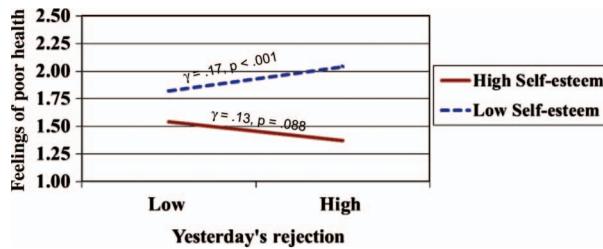
#### **Daily Health Behaviors and Health-related Outcomes**

*Risky health behaviors.* As shown in Table 3, there was no main effect of the previous day's rejection ( $\gamma = 0.03, p = .248$ ) and no SE  $\times$  rejection interaction ( $\gamma = 0.03, p = .186$ ). Thus rejection was no longer related to risky health behavior on the day following a high rejection day.

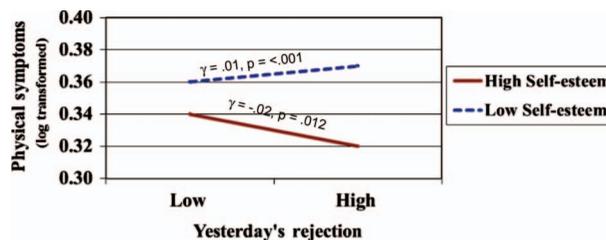
*Sleep quality.* Analyses revealed no main effect of the previous day's rejection ( $\gamma = 0.04, p = .574$ ) and no SE  $\times$  rejection interaction ( $\gamma = -0.10, p = .274$ ). Thus rejection was no longer related to sleep quality on the day following a high rejection day.

*General feelings of poor health.* Analyses revealed no main effect of the previous day's rejection ( $\gamma = 0.02, p = .726$ ) but a significant SE  $\times$  rejection interaction ( $\gamma = -0.19, p < .001$ ). As illustrated in Figure 6, LSE individuals (but not HSE individuals) reported feeling less healthy following their high rejection days (relative to their low rejection days).

*Physical symptoms.* Analyses revealed no main effect of the previous day's rejection ( $\gamma = 0.00, p = .712$ ), and a significant SE  $\times$  rejection interaction ( $\gamma = -0.02, p < .001$ ). As illustrated in Figure 7, LSE individuals (but not HSE individuals) reported increased physical symptoms following their high rejection days (relative to their low rejection days).



**FIGURE 6** The lagged association between *yesterday's* feelings of rejection and *today's* self-reported feelings of poor health.



**FIGURE 7** The lagged association between *yesterday's* feelings of rejection and *today's* self-reported physical symptoms.

## Discussion

The current study had two main goals: (1) to investigate the effects of rejection on daily health/well-being, and (2) to investigate SE differences in reactivity to daily rejection as well as recovery from rejection. With respect to our first goal, the findings revealed that rejection was associated with significant within-person declines in psychological well-being, but not in physical health. On days when people felt socially rejected or excluded, they reported significant increases in perceived stress and depressed mood and significant decreases in self-regulatory ability. The effects for depressed mood and self-regulatory ability persisted the next day, indicating that rejection had an important impact on well-being that took time to dissipate. With respect to our second goal, we found that SE played an important role in shaping experiences of rejection and responses to it. SE moderated the effects of rejection on both physical health and emotional well-being. With regard to *physical health*, on days when they felt more socially rejected, individuals with LSE (but not those with HSE) were more likely to engage in risky health behavior and to experience poor sleep quality; they also reported increased physical symptoms and feelings of poor health the next day, suggesting slower recovery. The effects of rejection and SE on *emotional well-being* were somewhat more complicated. Both HSE and LSE individuals reported increases in perceived stress on high rejection days. However, contrary to our predictions individuals with HSE (compared to those with LSE) experienced greater relative increases in perceived stress. However, for HSE individuals these effects did not persist the next day, suggesting rapid recovery. In contrast, individuals with LSE reported significant increases in both perceived stress and depressed mood on days following a high rejection day, indicating slower

emotional recovery. Thus, as was true for physical health outcomes, LSE individuals seemed to suffer more detrimental mental health outcomes following social rejection.

Taken together, our findings suggest that everyday feelings of social rejection have a negative impact on emotional well-being for both HSE and LSE individuals, leading to increases in perceived stress and depressed mood and to decreases in self-regulatory ability. But our findings also reveal that rejection may be especially damaging to the health and well-being of people with LSE. Relative to those with HSE, people with LSE were more reactive to rejection and recovered more slowly from it. Over time the cumulative effects of increased reactivity to rejection, as well as slower recovery, may put them at greater risk for poor health and psychological well-being.

Although LSE individuals fared more poorly following rejection, it is important to note that HSE individuals were not immune to rejection. On days when they felt rejected they reported significant increases in depressed mood and perceived stress. Moreover, people with HSE, compared to those with LSE, reported a greater relative increase in perceived stress on a high rejection day. Given that this finding was unexpected it is important to consider possible reasons for it. One possible explanation is that because HSE individuals had lower levels of perceived stress to begin with they had more room to rise. This is evidenced by the fact that even on high rejection days, when HSE individuals reported a significant increase in perceived stress, they still had lower absolute levels of perceived stress than LSE individuals, reflecting better mental well-being. Additionally, it is possible that rejection was more surprising to HSE individuals, who tend to expect positive outcomes, such as acceptance, and feel more deserving of these outcomes (Anthony, Holmes, & Wood, 2007; Leary et al., 1995; Murray, Holmes, & Griffin, 2000; Wood, Heimpel, Manwell, & Whittington, 2009). Research evidence suggests that people have a need for self-verification and that feedback that is inconsistent with an individual's self-concept can produce discomfort (Stinson et al., 2010; Swann & Schroeder, 1995). Thus, an unexpected rejection experience may have caused more dissonance for HSE individuals (relative to LSE individuals), initially resulting in increased perceptions of stress. However, they clearly bounced back quickly despite their initial increased perceptions of stress. Another possible explanation for the greater increase in perceived stress in HSE individuals is that LSE individuals may have responded to rejection by engaging in behaviors designed to distract them from thinking about the rejection experience. For example, the risky health behaviors that they engaged in (e.g., drug use) may have served to distract them and therefore mitigated perceptions of stress. However, this distraction was only temporary, as LSE individuals reported increased perceptions of stress on the day following a high rejection day.

### *Theoretical Implications*

The current study extends research on the relationship between rejection and self-regulatory failure in several important ways. First, our findings suggest that SE is an important moderator of this relationship. Following rejection, only LSE individuals reported behaviors that reflected self-regulatory failure (namely increases in risky behaviors). Second, the findings suggest that the effects of rejection on self-regulation can have negative effects for health and well-being beyond the immediate context of the rejection. Over time, engaging in risky health behaviors, such as tobacco use, drug-use, alcohol use, poor eating and risky sexual behavior may also result in deterioration of bodily systems and increased risk for disease (Mokdad, Marks, Stroup, & Gerberding, 2004). Future investigations should explore the links between

rejection, self-regulatory failure, and subsequent declines in health and well-being over a longer period of time. This would allow for a better understanding of the mechanism by which rejection impacts health. Mediation analyses could be conducted to investigate the cumulative effects of risky health behaviors on a variety of health outcomes. This would also allow for a more careful investigation of the process of recovery. We believe that the slow recovery exhibited by LSE individuals may be especially diagnostic of negative outcomes. Given that rejection is normatively distressing and that there may even be evolutionary benefits associated with being reactive and responsive to rejection we expect all individuals to display some degree of reaction to rejection (and the current findings support this assumption). However, what may differentiate a healthy response from an unhealthy response is the ability to recover quickly from rejection so that it does not continue to color perceptions, emotions, and physiology for hours or even days.

The findings from the current study also suggest that the current conceptualization of the relationship between rejection and self-regulatory failure in terms of a model of *underregulation* (Baumeister, Heatherton, & Tice, 1994; Baumeister et al., 2005; Sayette, 2004) may be incomplete. According to this model self-control is a limited resource and the stress of rejection depletes this resource, leaving individuals with reduced ability to control their behaviors. The findings from the current study are only partially consistent with an underregulation model of self-regulatory failure. Specifically, in the current study rejection was associated with a reduction in perceived self-regulatory strength for both HSE and LSE individuals. However, only LSE individuals reported engaging in *behaviors* that reflected self-regulatory failure (risky health behaviors). HSE individuals, who also experienced reductions in perceived self-regulatory ability, did not report engaging in behavior that reflected self-regulatory failure. How might this pattern of results be explained using an underregulation model? It is possible that although all individuals experienced some decrease in regulatory resources on their high rejection days, LSE individuals, who chronically possess fewer self-regulatory resources (Tangney, Baumeister, & Boone, 2004), were the only ones who crossed a regulatory threshold, whereby their resources were depleted enough to impact actual behaviors. For example, following rejection LSE individuals may have had fewer resources available for monitoring their behavior standards and this may explain their increased tendency to engage in risky health behaviors.

However, findings from the current study can also be explained using another model of self-regulatory failure, namely that of *misregulation*. Misregulation involves a misguided attempt to control one's behavior that results in unintended consequences (Baumeister et al., 1994). Thus far, misregulation processes have been largely neglected in research on the association between interpersonal rejection and self-regulation processes. However, the current findings suggest that both underregulation and misregulation processes may be at work here. Specifically, it is possible that although both HSE and LSE individuals had depleted self-regulatory resources (underregulation) on their high rejection days, only LSE individuals responded by misregulating their health-related behaviors. For example, LSE individuals who were coping with rejection may have been more likely to engage in risky health behaviors (e.g., alcohol or drug use) in order to decrease self-awareness and escape aversive feelings about the self. This may be why LSE individuals did not show the expected steep increase in perceived stress on high rejection days. Engaging in risky health behaviors may have temporarily had the intended effect of buffering against the impact of rejection on mental well-being, but it may also have had unintended negative effects (such as causing feelings of poor health the following

day), which are characteristic of misregulation attempts. Additionally, the benefits of the distraction from self-awareness had clearly worn off by the next day, when LSE individuals experienced decreases in both mental and physical well-being. Although the current study cannot provide clear evidence for either the underregulation or the misregulation model, it does suggest that both models deserve research attention in future work on rejection and self-regulation.

In addition to extending the literature on rejection and self-regulation, the current findings also have important implications for social psychological research on SE and health. Several studies have demonstrated an association between SE and poor health outcomes (Antonucci, Peggs, & Marquez, 1989; Brown & McGill, 1989; Shimizu & Pelham, 2004; Stinson et al., 2008). However, little is known about the nature of this mind–body connection. One recent longitudinal study suggests that the association between LSE and poor health is mediated by interpersonal stressors (Stinson et al., 2008), but it is still unclear how interpersonal stress is converted into poor health outcomes. Research suggests that maladaptive patterns of hypothalamic-pituitary-adrenal (HPA) axis activation (in response to social stress) may be one important mechanism linking interpersonal stress to long-term health (Ford & Collins, 2010). The findings from the current study contribute to this literature by showing that poor self-regulation, maladaptive health-related behaviors, and declines in restorative behaviors may be other important pathways linking interpersonal stress to long-term health outcomes.

#### *Limitations and Future Directions*

Some limitations of this study must be noted. First, given the self-report nature of this study, we did not have objective information about the rejection experiences that participants reported. Thus, it is possible that individuals with HSE and LSE were responding to rejections of different magnitudes or intensities. For example, HSE individuals, who tend to be less likely to construe events as rejecting, may have only reported feeling rejected in response to serious rejections. In contrast, LSE individuals may have construed more benign events as rejecting. However, if this was the case, then the results of the current investigation are even more striking because this would suggest that individuals with LSE, compared to those with HSE, experienced more negative outcomes in response to less severe events. Second, because we did not manipulate rejection we cannot draw unqualified causal inferences about the effect of rejection on health outcomes. Fortunately, experimental studies provide ample evidence for the causal effect of acute rejection on adverse outcomes in the context of a laboratory setting.

The current study suggests several important avenues for future research. One important avenue is to explore the strengths associated with HSE as well as the vulnerabilities associated with LSE. Future research should investigate the mechanisms by which HSE buffers individuals from the impact of rejection and allows them to recover more quickly from a rejection experience. Individuals with HSE tend to engage in coping strategies that protect their overall sense of worth in the face of rejection or social exclusion (Sommer, Williams, Ciarocco, & Baumeister, 2001). For example, they are better able to protect their self-image following negative events by focusing on their strengths (Dodgson & Wood, 1998), spontaneously affirming their worth in other valued domains of personal identity (Blaine & Crocker, 1993), and attributing the negative event to external causes (Ford & Collins, 2010). They are also more motivated to repair their negative moods (Heimpel, Wood, Marshall, & Brown, 2002). Individuals with HSE may also be

more likely to reach out to close others for social support. It is important to understand which of these coping responses may be responsible for the buffering effect of HSE on health and well-being following rejection.

Research should also be conducted to further investigate the impact of rejection on health behaviors, and a larger variety of health behaviors should be measured. Participants in the current study reported relatively low base rates of risky health behaviors. There are three possible explanations for these low base rates. First, individuals may engage in very few of these behaviors over the relatively short time period of 14 days. Future investigations should examine health-related behaviors that occur with higher base rates and examine respondents' behaviors over longer time periods. Second, the instruments we used may not have been sensitive enough to capture the true variability in these behaviors. Future research should utilize more sensitive instruments to capture more variability. Lastly, participants may have underreported their risky behavior due to the sensitive nature of some of these behaviors. Future studies should follow up on the present findings by making efforts to encourage honest reporting of sensitive behaviors.

Additionally, research is needed on the role of other individual difference factors that may modulate health-related responses to rejection, including rejection sensitivity and insecure attachment style. We focused on SE because there are well-documented findings relating LSE to harmful physiological responses to rejection (Ford & Collins, 2010) and because SE is related to long-term health outcomes (e.g., Stinson et al., 2008; Taylor, Lerner, Sherman, Sage, & McDowell, 2003). Of course, there are differences between SE and these other constructs, and it will be important to investigate their shared and unique roles in regulating health-related responses to rejection.

Lastly, future research should closely investigate the association between LSE and adverse outcomes following a variety of stressors in order to determine whether the pattern of findings reported in the current study is unique to rejection or whether it would occur for any daily stressor. Although we cannot fully address this question, exploratory analyses of our data revealed that on days when LSE participants experienced high levels of general daily stress they did not report the same declines in health and well-being as they reported on days where they experienced high levels of social rejection. This finding, although preliminary, suggests that threats to social belonging may be uniquely challenging for individuals with LSE.

### *Conclusion*

The current investigation extends research on SE, rejection and health/well-being by investigating responses to *daily* relationship experiences and by measuring health outcomes in the hours and days following rejection. The findings reveal that rejection impacts health and well-being more for LSE individuals than for HSE individuals and that these negative effects linger for those with LSE. The findings from the current study emphasize the differential impact of rejection on HSE and LSE individuals and they highlight the need to better understand how LSE poses a vulnerability in the face of rejection as well as how HSE confers resilience.

### **Notes**

1. Potential participants were screened and excluded from the study if they received a score above 28 on the Center for Epidemiological Studies Scale for Depression (CES-D),

- indicating a moderate to severe level of depressive symptomology (Radloff, 1977). This was done to protect the welfare of depressed individuals who may have experienced adverse effects (such as negative rumination) as a result of focusing on daily events related to acceptance and rejection.
2. Given that recreational use of certain prescription drugs (e.g., Vicodin, Adderall) is common among college students, we assessed both non-prescription and prescription drug use. Because we were interested in risky use of prescription drugs, we excluded any drugs that were used on a daily basis such as birth control pills or antidepressants. This helped us minimize the chance that we were capturing the use of non-risky drugs.
  3. The correlation between self-esteem and neuroticism was  $r = -.59$ ,  $p < .001$ .
  4. With regard to mood, our primary interest was in depressed mood because this outcome is clearly linked to mental well-being and to physical health. However, we also measured general positive mood (e.g., happy, content) and negative mood (e.g., annoyed or upset, stressed out). HLM analyses on these variables revealed significant within-person effects of daily rejection on positive mood ( $\gamma = -0.307$ ,  $p < .001$ ) and negative mood ( $\gamma = 0.396$ ,  $p < .001$ ) but no significant SE  $\times$  rejection interaction effects. We also investigated self-conscious emotions (e.g., ashamed, embarrassed), as these have been theoretically linked to rejection. Once again, there was a significant effect of daily rejection on self-conscious emotions ( $\gamma = 0.317$ ,  $p < .001$ ) but no significant SE  $\times$  rejection interaction. Taken together, these findings indicate that participants experienced more negative moods on their high rejection days compared to their low rejection days, and these effects were not moderated by SE.
  5. As noted previously (see note 2) we assessed both non-prescription and some prescription drug use in our risky health behavior variable because of the common recreational use of some prescription drugs among college students. Nevertheless, we also conducted analyses on our risky health variable after excluding all prescription drugs and we found the same interaction effect that fell just short of significance ( $\gamma = -0.04$ ,  $p = .066$ ). The pattern of simple slopes for both LSE individuals ( $\gamma = 0.04$ ,  $p = .070$ ) and HSE individuals ( $\gamma = -0.025$ ,  $p = .522$ ) was also similar to those found for the original variable (and reported in Figure 2).
  6. This sleep variable was actually measured the following day so that it would reflect sleep quality on the evening immediately following a high (or low) rejection day.

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