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An evolutionary investigation of depressed mood: The relationship between daily stressors and patterns of depressive symptoms

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ABSTRACT

Background and objectives: The situation-symptom congruence hypothesis (SSCH; (Keller & Nesse, 2006), grounded in evolutionary theory, argues that different types of adversity should lead to distinct patterns of depressive symptoms that help individuals deal with adaptive challenges. Situation-symptom congruence hypotheses were tested in this study using experience sampling methodology.

Methods: Two hundred and sixty-five individuals, including 54% who scored at least 16 on the Center for Epidemiologic Studies Revised Depression Scale, responded to text prompts daily for up to 9 days, reporting depressive symptoms as well as the most stressful event or issue they had experienced or focused on within the past 24 h.

Results: Multilevel modeling analyses indicated that the relationships between stressors and depressive symptom patterns were largely consistent with SSCH predictions. All stressors were significantly associated with symptoms hypothesized to be adaptive in response to those stressors. Moreover, in separate analyses, nine of the ten symptoms examined were either predicted by the stressors hypothesized to lead to that symptom or negatively related to stressors hypothesized to not elicit those symptoms.

Limitations: It is unclear whether the results generalize to those diagnosed with a major depressive disorder; the study did not assess actual life events.

Conclusions: Findings suggest that depressive symptoms may, in part, be adaptations that have evolved through natural selection to help individuals cope with adverse situations.

1. Introduction

The symptom profiles of those with major depressive disorder (MDD) vary significantly across individuals. Fried and Nesse (2015), for example, found 1030 unique symptom profiles for 3703 depressed outpatients in the Sequenced Treatment Alternatives to Relieve Depression (STAR*D) study. Research suggests that these variations may be due, in part, to the effects of different stressful life events (SLEs). Keller et al. (2007), for example, found significant differences in the pattern of depressive symptoms associated with nine different SLEs. Those who had experienced the death of a loved one or a romantic breakup in the past year, for example, were more likely to experience increased sadness, anhedonia, and appetite loss whereas those who had experienced chronic stress showed fatigue and hypersomnia. Cramer et al. (2012) also found four different SLEs (stress, health problems, interpersonal conflict, and romantic loss) led to markedly different correlations among depressive symptoms and Fried et al. (2014) reported that different risk factors (a history of depression versus stressful life events, for example) led to increases in significantly different depressive symptoms over time.

Evolutionary approaches to understanding depressive symptoms (see Durisko et al., 2015, for a review) hypothesize that these differences occur because different situations evoke symptoms that are best suited to solving adaptive challenges specific to each situation. Moreover, several studies support an evolutionary approach to understanding the relationship between SLEs and depressive symptom patterns. Keller and

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Nesse (2005), for example, asked undergraduate students if they had gone through a 2-week period in which they experienced low mood during the previous 12 months and to write down their symptoms and what they believed might have caused the experience. Results indicated that sadness and crying were prominent after romantic losses and deaths of loved ones; sadness, crying, and self-reproach increased after social isolation; self-reproach, fatigue, and pessimism were heightened after failure; and fatigue, pessimism, and increased eating and sleeping were more pronounced during the winter season. Depressive symptom patterns were thus consistent with the authors' evolutionary hypotheses.

In 2006, Keller and Nesse developed the situation-symptom congruence hypothesis (SSCH), grounded in evolutionary theory, and conducted an additional study in which undergraduate participants imagined either failing at a major goal or the death of a loved one. These results indicated that a different pattern of depressive symptoms resulted from each adverse life event and symptoms were consistent with SSCH theory.

Other research also lends some support for SSC hypotheses. Couyoumdjian et al. (2012) asked participants to report on a 5-day period of low mood in the previous 12 months and to recall the depressive symptoms they experienced as well as the cause of the low mood. As with the previous studies, the pattern of symptoms differed significantly based on the reported triggering event. In addition, Gray et al. (2011) asked participants to imagine either failing at an important goal or losing a loved one to cancer. Results indicated that both scenarios led to equivalent levels of sadness but only the social loss scenario led participants to want to engage in more social activities. The results are consistent with the specific SSC hypothesis that only sadness induced by social loss would increase the desire for social connectedness.

Research supporting an evolutionary model of depressive symptoms, however, has several limitations. First, much of the research that has directly examined evolutionary models included only college student participants. Moreover, Gray et al. (2011) specifically excluded depressed participants to avoid inducing a sad mood in already depressed individuals. Second, all studies either had participants retrospectively recall the hypothesized cause of their low mood, which may have occurred up to one year previously, or had participants imagine a stressful life event. Thus, biases in retrospective recall may have affected the results or findings may not generalize to actual symptomatology when, in fact, reacting to a stressful event. Finally, all studies identified only one stressful life event for each depressive episode. Previous research suggests that a significant number of depressive episodes are associated with multiple SLEs (Keller et al., 2007).

The present study attempted to address some of the limitations of previous research in this area. First, we included both depressed and non-depressed individuals in our sample. While the SSC is agnostic with respect to whether the theory applies to individuals with major depressive disorder, we thought it was important to include a large number of individuals with significant clinical levels of depression to examine whether the theory is applicable to those with noteworthy depressive symptoms. Second, our study utilized an experience sampling methodology in which we collected information about perceptions of SLEs that occurred over the past day rather than the past year. Moreover, participants completed daily measures for up to nine days. Thus, by utilizing a repeated measure design in which each participant assessed both SLEs and depressive symptoms each day, we were able to focus on both within- and between-person variations in the relationship between SLEs and depressive symptoms. Finally, participants could endorse multiple SLE categories each day and indicate the degree to which their self-identified stressful life events involved each SLE category. As a result, we were able to examine associations between a participant's level or degree of SLE and his or her pattern of depressive symptoms.

2. Method

2.1. Participants

Participants were recruited through advertisements on various websites (e.g., Craigslist, Facebook, Reddit, Backpage, Twitter, and Google) and at various universities and colleges in the area. Data collection took place from early January to late June 2013. Interested individuals were asked to visit the study website to review the consent form. The consent form as well as the methods and procedures used in this study were reviewed and approved by the Institutional Review Board at the first author's university. The incentive for participation was entrance into a raffle in which participants could win up to four $100 cashier's checks. Participants' chances of winning the raffle prizes increased with continued participation. Participants were told that the purpose of the study was to examine the relationship between mood and daily events.

Individuals had to be at least 18 years of age and live in the United States to participate. Individuals who reported that they had been diagnosed with any of the following pre-existing diagnoses were also excluded: current substance dependence, schizophrenia, schizoaffective disorder, and/or psychotic disorders. In addition, individuals who endorsed more than passive suicidal thoughts were excluded from participating after appropriate steps were taken to ensure their safety. Individuals who indicated that they had suicidal thoughts but would not act on them could participate.

Three hundred and twenty-five individuals volunteered to participate. Sixteen individuals were excluded: 10 for significant suicidal ideation, four for a self-reported psychosis diagnosis, and two for a self-reported current substance dependence diagnosis. An additional 44 individuals failed to respond to any of the daily experience-sampling prompts and were considered to have dropped out.

The final sample included 265 participants. Participants included 197 females (74%) and 68 males (26%) between the ages of 18 and 63 ($M = 27.43$, $SD = 9.89$). Table 1 provides a summary of the sample's demographic characteristics. The largest portion of the sample was non-Hispanic White/Caucasian/European American (49%). Seventy-one percent of the sample was single, approximately 42% had a high

Table 1
Participant demographic variables.

	M	SD	n	%
Age (years)	27.4	9.8		
Gender (female)			197	74
Ethnicity				
% White			128	49
% African-American			38	14
% Latino/Hipanic-American			48	18
% Asian-American			35	13
% Other			16	6
Education				
Less than high school			42	16
High school graduate			111	42
Some college			87	33
College graduate			25	9
Relationship Status				
Single			188	71
Married			58	22
Separated/divorced/widowed			19	7
Employment				
Employed			137	52
In school			139	53
CES-D [a] score	19.5	13.4		
0-10			78	29
11-15			44	17
16-24			58	22
> 24			85	32

N = 265
[a] Center for Epidemiologic Studies Depression Scale—Revised.

school degree and about 33% had completed some college, a vocational or professional certification program, or an associate's degree. Fifty-two percent of the sample was employed, and 53% were students.

2.2. Procedure

Those who agreed to participate in the study went to the study website where they could access the demographic questionnaire, a suicidality screening question, and the Center for Epidemiologic Studies Depression Scale Revised (CESD-R; (Eaton et al., 2004). The CESD-R, a widely used 20-item self-report scale based on DSM-IV criteria, was used to assess for depression. The CESD-R mean score was 19.51 (SD = 13.44). Fifty-four percent had a CESD-R score of 16 or above and 32% had a CESD-R score of 25 or above. A recent meta-analysis of 28 studies (N = 10,617) found 87% of those scoring 16 or above on the CESD-R met criteria for major depressive disorder (Vilagut et al., 2016); a score of 25 or above is considered severe depression (Chwastiak et al., 2002).

2.3. Experience sampling methodology

The day after completing intake measures, participants began receiving daily text prompts on their cell phones at randomly selected times (determined by www.random.org/clock-times) between 8:00 a.m. and 10:00 p.m. Upon receiving a text prompt, participants were asked to complete daily measures within 3 h. Participants could complete measures on either their phone or computer.

Daily measures included the Depressive Symptoms Scale (DSS; Keller & Nesse, 2006), and Stressful Events Measure (SEM). Compliance with study procedures was checked by examining submission times of all measures. After participants completed their Day 10 measures, they completed a post-study suicidality screening and were debriefed. Fig. 1 shows a flow chart of the study procedures.

2.3.1. Depressive Symptoms Scale

We assessed depressive symptoms using the Depressive Symptoms

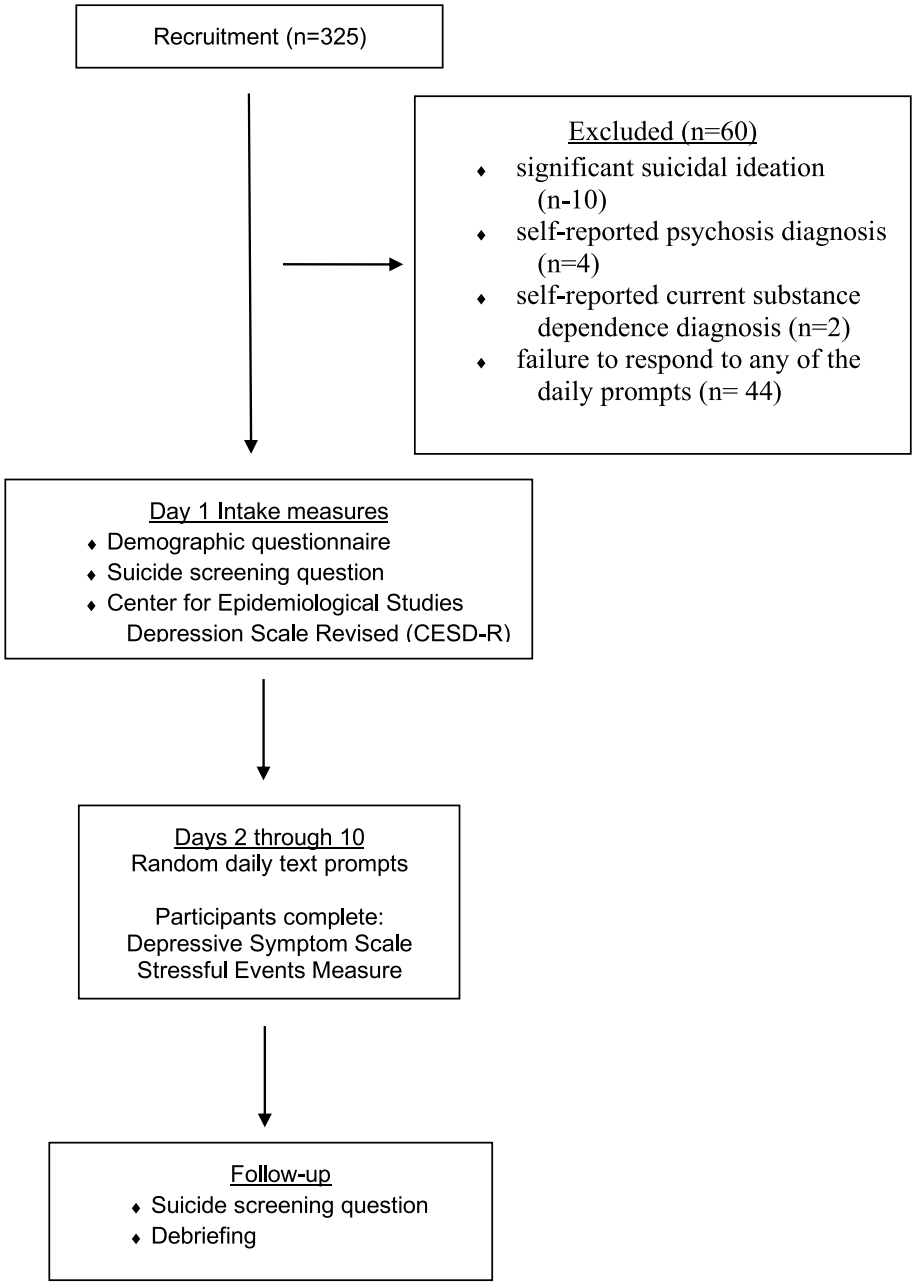

Fig. 1. Flow chart of study procedures.

Scale (DSS; Keller & Nesse, 2006). The DSS required participants to indicate the extent to which they were experiencing 47 depressive symptoms on a 0 (rarely or none of the time) to 4 (most or all of the time) scale since they last completed daily measures, or in the past 24 h if they had not completed daily measures in the past 24 h. The scale includes 11 subscales, each of which is composed of three to five items measuring a particular depressive symptom. Keller and Nesse (2006) found that the 11 DSS symptom scales had an average coefficient alpha of .86.

On days 2 through 10 of our study, the DSS was completed by participants to assess depressive symptoms. A composite score was calculated for each of the 11 symptom scales by taking the average of the responses that make up a particular scale. On the first day of our study, coefficient alpha for the 11 scales ranged from 0.76 to 0.92, and the total DSS score correlated highly with participants' CESD-R scores ($r = 0.71$, $p < .001$).

2.3.2. Stressful Events Measure

Our Stressful Events Measure (SEM), used to assess daily perceptions of stressful life events, was adapted from Keller and Nesse (2006). Keller and Nesse (2006) asked participants to identify a 2-week period in the previous 12 months in which they felt "down, sad, or disturbed." They then indicated the precipitant they thought caused the episode from among the following: chronic stress, social isolation, a romantic loss, failure at an important goal, death of a loved one, winter, something else, or no specific cause. These eight specific categories were derived from Keller and Nesse (2005), wherein participants wrote a free-form paragraph about what, if anything, caused a weeklong period during which they felt "the most down, sad, or disturbed" in the past 12 months and raters who were blind to the participants' symptoms placed responses into one of these categories; raters were able to agree that responses belonged to the identical category 73% of the time.

In our study, Item 1 asked participants to identify and write about the most stressful event/issue they had experienced or focused on since they last completed this measure, or in the past 24 h if they had not completed this measure in the past 24 h. Item 2 asked participants to indicate the extent to which their self-identified stressful event/issue negatively affected them using a 5-point Likert scale (1 = not at all to 5 = entirely). Subsequent items asked participants to indicate the extent to which their self-identified stressful event/issue involved each of the six specific stressful life event categories identified by Keller and Nesse (2005) (failure, death of a loved one, romantic loss, chronic stress, social isolation, and winter) using the same 5-point Likert scale. For example, the question to assess whether the event related to failure read "To what extent does this event/issue represent a failure or a disappointment that is final (not ongoing)?"

2.3.3. Attrition

This was a nine-day study that consisted of nine repeated measures. Those who missed days were given the opportunity to complete make-up days. The average number of days completed was 6.80 ($SD = 2.73$).

2.4. Data analysis

Data were collected online at the Qualtrics website ([http://www.qualtrics.com]; Qualtrics, 2013) and downloaded into SPSS Statistics for Windows, Version 26.0 (SPSS v26), which was used to perform all data analyses. The study utilized a between- and within-person, repeated measures design to test multilevel models. Level 1 data consisted of observations of individuals at multiple time points (i.e., repeated measures of stressful events/issues and depressive symptoms) while Level 2 data included gender and age.

Data were examined in two ways. First, we examined the symptoms associated with each stressful event. Each day, we combined the ratings for the symptoms that we hypothesized would be adaptive in each situation and compared that mean rating to the mean rating for all remaining symptoms. Table 2 (based on Keller & Nesse, 2006) shows the symptoms hypothesized to be adaptive in response to each stressor and the hypothesized function of those symptoms. For example, for the stressor failure, each day we entered, as the dependent variable, the response (on a 5-point Likert scale) to the question, "To what extent does this event/issue [i.e., the most stressful event/issue they had experienced or focused on] represent a failure or a disappointment that is final (not ongoing)?" The independent variables included, at level 1, the mean of the SEM ratings for the symptoms emotional pain, pessimism, fatigue, anhedonia, rumination, and guilt (the hypothesized adaptive symptoms) and the mean rating for the remaining symptoms (crying, desire for social support, anxiety, increased appetite, and increased sleep). Gender, age, and time (a level-one variable, scored by day) were also controlled in all analyses. As a follow-up, in Fig. 2, instead of combining symptoms into adaptive and other symptoms, we examined symptoms individually. We also controlled for time (a level 1 predictor), age and gender (level 2 predictors) in these analyses.

In the second set of analyses, as an additional check on the validity of the SSCH, we examined the stressors associated with each symptom. Similar to the first set of analyses, each day, we combined the responses to the stressors hypothesized to elicit each symptom (see Table 3) and

Table 2
Multilevel models of symptoms in response to daily stressors.

			Hypothesized adaptive symptoms		Other symptoms	
Adverse event	Hypothesized adaptive symptoms	Hypothesized function of the symptoms	*b*	SE	*b*	SE
Failure at an important goal	Emotional pain, pessimism, fatigue, anhedonia, rumination, guilt	Stop investing resources in unattainable goals	.635***	.055	.024	.085
Death of a loved one	Emotional pain, crying, desire for social support	To make loss of fitness-relevant resources painful	.126***	.030	.021	.041
Romantic loss	Emotional pain, rumination, crying, guilt, desire for social support	To make social losses painful and to gain insight to avoid similar losses in the future	.458***	.050	-.072	.070
Chronic stress	Pessimism, fatigue, anhedonia, rumination, guilt	To decrease effortful behavior and risk-taking and learn from the current situation	.710***	.064	.372***	.092
Social isolation	Emotional pain, crying, desire for social support	To make isolation painful and to strengthen social bonds	.476***	.049	.489***	.064
Winter	Fatigue, anhedonia, increased sleep	To conserve energy	.103*	.045	.053	.031

$N = 265$; $n = 1801$ * $p < .05$ ** $p < .01$ *** $p < .001$.

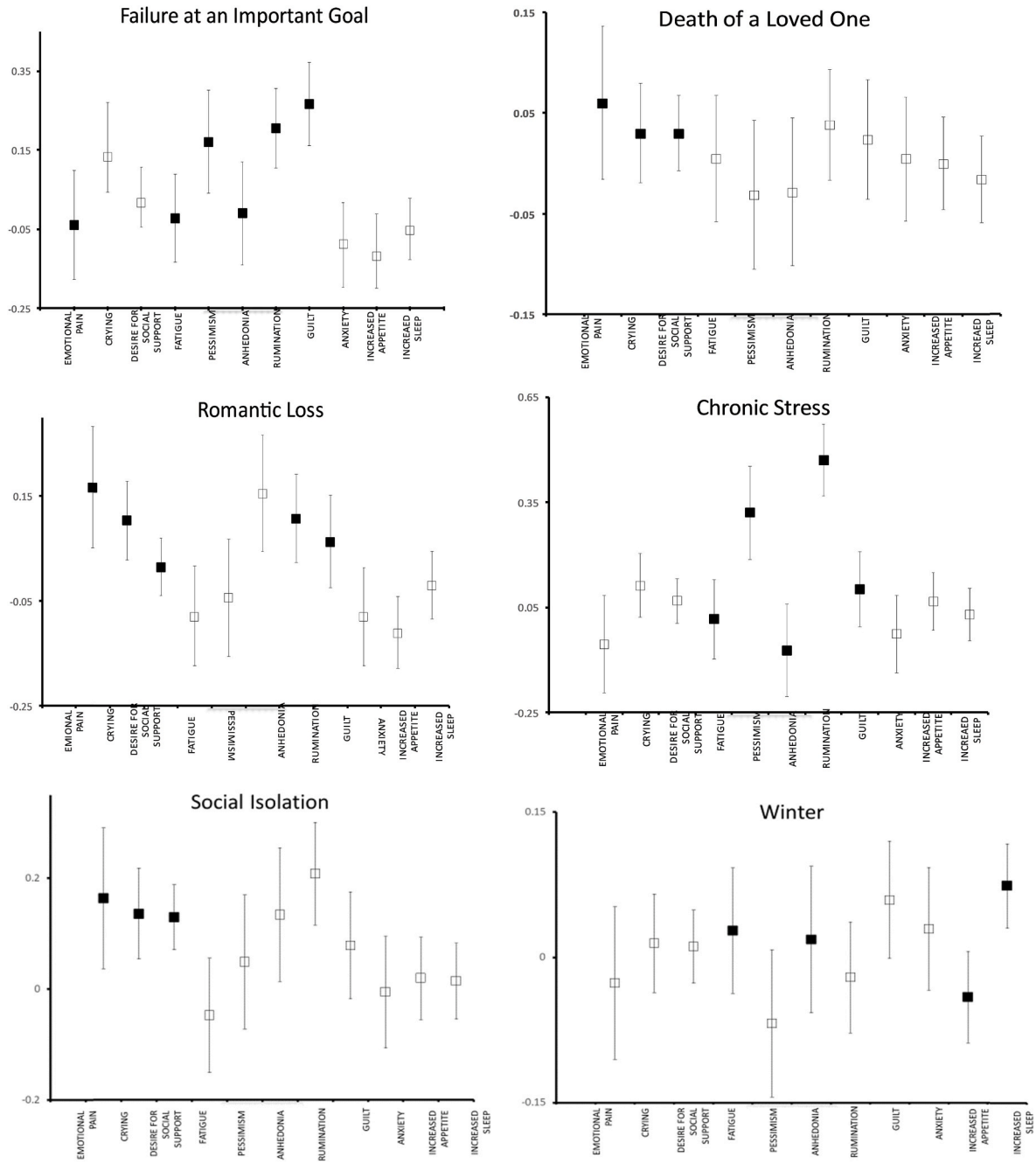

Fig. 2. *Daily Stressors Associated with Each Symptom Note*
Y-axis represents parameter estimate. See text for model details. Darkened squares are stressors hypothesized to lead to that symptom. Error bars reflect 95% confidence intervals.

compared the mean of those stressors to the mean of all remaining stressors. Table 3 (based on Keller & Nesse, 2006, Table 4) shows the hypothesized function of each symptom and the stressors we hypothesized each symptom to be most prominent in response to. Ten symptoms were examined; anxiety was not examined since the SSCH makes no predictions regarding this symptom.

With the mean rating for the symptom emotional pain as the dependent variable, for example, each day we entered, at level 1, the mean of the SEM ratings for the stressors death, romantic loss, social isolation, and failure (the stressors hypothesized to elicit emotional pain) and the mean rating for the remaining precipitants (the stressors chronic stress and winter). Total Depressive Symptoms Scale (DSS) scores were also controlled for in these analyses since some stressors were associated with higher symptom scores for all symptoms and failing to control for overall depression scores would have biased our analysis of differences among the precipitants. For example, almost all symptoms were higher in response to failure than to the winter season (see Fig. 2) and failing to control for mean depression score when examining the symptom emotional pain as the dependent variable would have magnified the differences between the stressors we hypothesized would elicit emotional pain (because the mean score include the rating in response to failure) and the remaining stressors (because the mean score for winter is included in those ratings). Gender, age, and time (a level-one variable, scored by day) were also controlled in all analyses. As a follow-up, in Fig. 3, we examined each stressor/issue individually. We also controlled for time and overall depression score

Table 3
Multilevel models of daily stressors associated with each symptom.

			Situations in which symptoms should be prominent		Other situations	
Symptom	Proposed function of symptom	Situation in which symptom should be prominent	*b*	SE	*b*	SE
Emotional pain	To make situations in which there is a loss of fitness-relevant resources painful	Death of a loved one, romantic loss, failure at important goal, social isolation	.076***	.016	-.045**	.013
Crying	To strengthen social bonds	Death of a loved one, romantic loss, social isolation	.106***	.024	-.011	.022
Desire for social support	To create new social bonds or strengthen deficient social bonds	Death of a loved one, romantic loss, social isolation	.059*	.031	-.027	.028
Fatigue	To decrease effortful behavior in unfavorable situations	Failure at important goal, chronic stress, winter	-.017	.018	-.070***	.020
Pessimism	To stop investing resources in unattainable goals	Failure at important goal, chronic stress	.042***	.010	-.054**	.019
Guilt	To gain insight into one's role in problematic situations	Romantic loss, failure at important goal, chronic stress	.051**	.015	.010	.022
Rumination	To learn from a current situation in order to avoid similar ones in the future	Romantic loss, failure at important goal, chronic stress	.105***	.016	-.001	.024
Anhedonia	To decrease approach and risk-taking behaviors in unfavorable situations	Failure at important goal, chronic stress, winter	-.033*	.016	.020	.017
Increased appetite	To increase caloric intake when food is scarce	Winter	-.048*	.024	-.102***	.027
Increased sleep	To conserve energy in unfavorable situations	Winter	.098***	.024	-.129***	.027

$N = 265$; $n = 1801$ * $p \leq .05$ ** $p < .01$ *** $p < .001$.

(level 1 predictors), and age and gender (level 2 predictors) in these analyses.

3. Results

3.1. Symptoms associated with each stressor

The first set of analyses examined the symptoms associated with each stressful event or issue. Six multilevel models were examined. Table 2 shows, for each analysis, the model estimates for the mean of the hypothesized adaptive symptoms and the mean for the remaining symptoms. As can be seen in the Table, for all 6 stressors, the hypothesized adaptive symptoms were significantly associated with the stressor. The mean of the remaining symptoms was also significantly associated with the stressors chronic stress and social isolation.

Fig. 2 shows the model estimate for each individual symptom with each stressor. As can be seen in the figure, as hypothesized, the symptoms most highly associated with a focus on failure at an important goal were guilt, rumination, and pessimism; in addition, anxiety and increased appetite were negatively associated with failure. A focus on the death of a loved one in the past 24 h led to feelings of emotional pain and was negatively related to feeling pessimistic. See Fig. 2 for the model estimates for each symptom in response to each stressor or issue.

3.2. Daily stressors associated with each symptom

The next set of analyses examined the stressors associated with each symptom. Ten multilevel models were developed. Table 3 shows, for each analysis, the parameter estimates for the mean of both the hypothesized adaptive precipitants/stressors and the mean for the remaining stressors. As can be seen in the Table, the hypothesized adaptive precipitants were significantly associated with 7 of the 10 symptoms. The mean of the other precipitants was also significantly associated with 5 of the 10 symptoms, yet for each symptom, the mean for the precipitants hypothesized to not elicit that symptom was *negatively* associated with emergence of the symptom. Thus, for 9 of the 10 symptoms, either the stressors hypothesized to elicit the symptom were significantly associated with that symptom and/or the stressors hypothesized to not elicit that symptom were negatively related to emergence of the symptom. Only anhedonia was not associated with either the stressors hypothesized to elicit that symptom or negatively related to the stressors hypothesized to not lead to anhedonia.

Fig. 3 shows the relationship between each symptom and individual stressors. As can be seen in the figure, emotional pain was most likely to occur in response to romantic loss and was negatively associated with a focus on the winter season. Increased sleep, on the other hand, was most likely to occur in response to the winter season; increased sleep was negatively related to a focus, in the past 24 h, on the death of a loved one. See Fig. 3 for the model parameter estimates for each stressor or issue related to the emergence of each symptom.

4. Discussion

The findings were largely consistent with the situation-symptom congruence evolutionary model of depression. All 6 stressors were significantly associated with symptoms hypothesized to be adaptive in response to those stressors. Moreover, when we examined the stressors most likely to lead to individual symptoms, nine of the ten symptoms were either predicted by the combination of stressors hypothesized to be associated with that symptom or negatively related to the combination of stressors hypothesized to be unassociated with those symptoms.

The results indicated, for example, that crying occurred most often in response to death of a loved one and romantic loss (see Fig. 3). The SSCH asserts that crying tends to elicit empathy and comfort and may

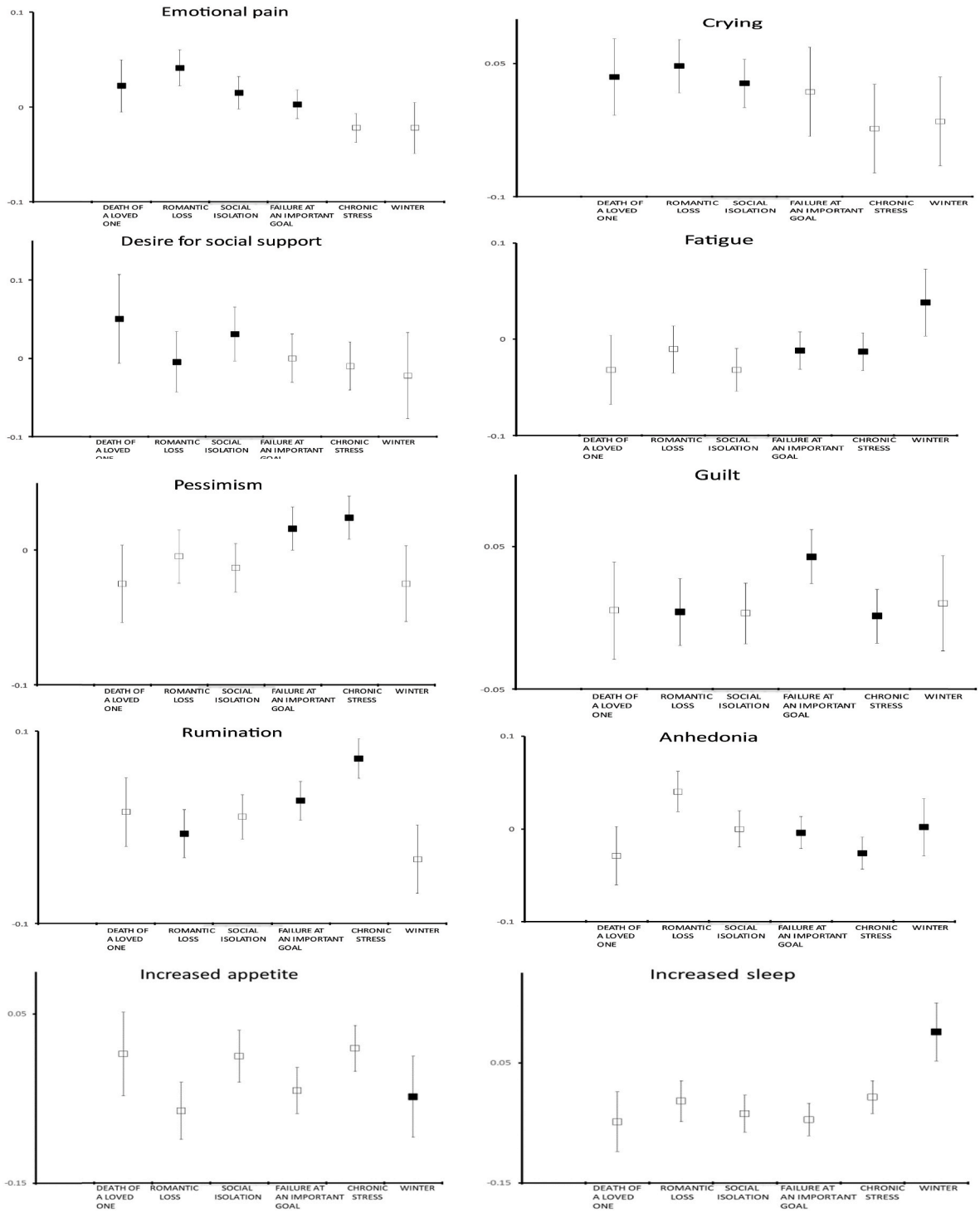

Fig. 3. *Daily Stressors Associated with each Symptom Note*. Y-axis represents parameter estimate. See text for model details. Darkened squares are stressors hypothesized to lead to that symptom. Error bars reflect 95% confidence intervals.

strengthen social bonds (Keller & Nesse, 2006). Results also indicated that chronic stress was most likely to lead to pessimism and rumination (see Fig. 2). Pessimism, we hypothesize, may serve to dampen initiative when feeling overly stressed while rumination may help individuals reconsider strategies and goals. Finally, increased sleep and decreased appetite were prevalent in response to a focus on the winter season (see Fig. 3). Both symptoms are methods of conserving energy and thus should be most adaptive in unpropitious situations.

It is noteworthy that only anhedonia failed to be associated significantly with the stressors hypothesized to elicit that symptom or negatively related to precipitants hypothesized to not lead to anhedonia. Keller and Nesse (2006), using the same measure of depressive symptoms, also found that anhedonia did not correlate significantly with the stressors hypothesized to elicit that response. In examining the specific anhedonia symptoms assessed in our study, it is noteworthy that all five symptoms relate to a lack of positive affect (e.g., "Nothing could make me smile; " see Keller & Nesse, 2006, p. 321) and none of the symptoms relate to a lack of motivation to engage in pleasurable activities, which is also typically associated with anhedonia (Ho & Sommers, 2013). It may be that the absence of positive affect is a ubiquitous depressive response

to all adverse situations while a lack of motivation to engage in pleasurable activities is a specific response to specific adverse situations. It is noteworthy that both Keller et at (2007) and Couyoumdjian et al. (2012), using different measures of depression, did find significant differences in anhedonia based on the precipitant. It may be, then, that the lack of significant findings for anhedonia in this study may be due to the particular depression measure utilized.

In addition to supporting an evolutionary model of depression, the data are also consistent with research that indicates that different depressive symptoms have different risk factors (Cramer et al., 2012; Fried et al., 2014, 2015; Keller et al., 2007). The data, overall, suggest that depressive symptoms are not merely interchangeable indicators of a latent disorder. Instead of viewing depression as a discrete entity, results indicate that it may be more parsimonious to view the disorder as a network of symptoms, each with distinct etiologies (Fried, 2015).

4.1. Limitations

The study has several limitations. First, it is unclear whether these results generalize to those diagnosed with a major depressive disorder. Fifty-four percent of the sample (n = 143), however, scored at least 16 on the CESD-R, which is the traditional cut-off used to screen for the disorder. Moreover, Keller et al. (2007), examining only individuals who had experienced a major depressive episode in the last year, found significant differences in the pattern of depressive symptoms associated with nine different stressful life events. Future research, however, should examine whether depressive symptoms serve an adaptive function in individuals who are clinically depressed.

Second, the study did not assess actual life events. Participants were asked to focus on the most stressful event they had experienced or the issue they had focused on the most in the past 24 h. Although it is reassuring that results from this study replicated previous research that assessed symptomatic responses to actual life events (Couyoumdjian et al., 2012; Keller & Nesse, 2005; 2006), previous research in this area did not include clinically depressed individuals and the low mood episode examined may have occurred up to one year previously. A more robust test of SSC hypotheses would be to examine whether individuals who have recently experienced a major depressive disorder show adaptive symptoms in response to different adverse situations.

Third, compliance with completion of the study was difficult. Although participants were asked to complete measures for nine days, less than half the sample (41.9%) completed all nine days of the study. Compliance may have been limited, in part, because participants were asked to respond to 59 depression and stress-related items each day. Future studies should attempt to assess daily symptoms and stressors with a more limited number of items.

Finally, because the DSS only assessed 11 depressive symptoms, we were only able to examine 6 life stressors. Traditionally, life events research includes a larger number of life stressors (e.g., Brown & Harris, 1978; Kendler, Karkowski, & Prescott, 1999). It would be important for future research to examine evolutionary models of depression with a wider range of precipitants.

5. Conclusions

In conclusion, this study expanded upon previous research with college students that assessed retrospective recall of depressive symptoms in response to life events that occurred up to one year in the past. Results of this study were consistent with those previous investigations. Overall, the data suggest that instead of viewing depression as a maladaptive response to life stress, depressive symptoms may, in part, be adaptations that have evolved through natural selection to help individuals cope with adverse situations.

CRediT authorship contribution statement

Alissa A. Maitini: Study design, data analysis, Writing - original draft. **Irwin Ford Rosenfarb:** Writing – original draft. **Dale N. Glaser:** Formal analysis, conducted the analyses. All authors have approved the final article. **Matthew C. Keller:** Writing – review & editing, designed the study. AM collected the data. IR took the lead in writing the manuscript and MK helped with manuscript writing. AM, IR, and.

Declaration of competing interest

All authors declare that they have no conflicts of interest. There was no outside funding source for this study.

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