

The Impact of Daily Stress on Health and Mood: Psychological and Social Resources as Mediators

Anita DeLongis
University of Illinois at Urbana-Champaign

Susan Folkman
University of California, San Francisco

Richard S. Lazarus
University of California, Berkeley

This study examined daily stress processes among 75 married couples across 20 assessments during a 6-month period. The somatic and psychological effects of common everyday hassles were investigated. Overall, there was a significant relationship between daily stress and the occurrence of both concurrent and subsequent health problems such as flu, sore throat, headaches, and backaches. The relationship of daily stress to mood disturbance was more complex. The negative effects of stress on mood were limited to a single day, with the following day characterized by mood scores that were better than usual. Furthermore, striking individual differences were found in the extent to which daily stress was associated with health and mood across time. Participants with unsupportive social relationships and low self-esteem were more likely to experience an increase in psychological and somatic problems both on and following stressful days than were participants high in self-esteem and social support. These data suggest that persons with low psychosocial resources are vulnerable to illness and mood disturbance when their stress levels increase, even if they generally have little stress in their lives.

Despite long-standing misgivings about its usefulness, the concept of stress continues to generate great interest because of the conviction that it is a causal factor in illness. This conviction has motivated widespread use of measures of stress based on life events and also lies behind our own measure of stress based on daily hassles.

There are methodological and theoretical grounds for questioning much of the research that has attempted to relate stress, whether measured in terms of life events or hassles, to long-term health status. One difficulty is that stress itself is not a simple variable but a system of interdependent processes, including appraisal and coping, which mediate the frequency, intensity, duration, and type of psychological and somatic response. Most investigators of the stress-health relationship treat stress as a unitary variable and do not take these processes into account.

A second difficulty is that much of the research that attempts to demonstrate the causal relationship between stress and

health is cross-sectional rather than longitudinal. Of the longitudinal studies, few have been adequately designed to overcome the many obstacles to drawing appropriate causal inferences (cf. Kasl, 1983). For example, causality is best addressed when change is shown in the dependent variable. However, in studies of the effects of stress on health, health status is typically measured in terms of stable, chronic symptoms and conditions. If the dependent measure used in a given study is designed to assess that which is stable or characteristic for a given person, then the very change that is crucial for examining causal processes is systematically eliminated from examination.

In the typical prospective study, the proposition that level of life stress measured at Time 1 has an important impact on health measured at a much later Time 2 assumes that the measure of stress at Time 1 be representative of the person's continuing stress status and psychobiological stress response. In such a case, the *sustained* level of stress and the psychobiological response might be expected to produce health problems at Time 2 (see, e.g., House, Strecher, Metzner, & Robbins, 1986). In most research on stress and health, the time between the initial measurement of stress (based, say, on major life events) and health status is not monitored. With two widely spaced assessments it is difficult and perhaps impossible to disentangle what has been going on not only psychobiologically, but environmentally as well, during the interval prior to the measurement of health status at Time 2.

The preceding discussion has several methodological implications for stress researchers. First, more may be learned about the stress-health relationship if a strategy is adopted whereby covariations between the stress of daily living (as opposed to major events) and health-related symptoms (as op-

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Correspondence concerning this article should be addressed to Anita DeLongis, Department of Psychology, University of Illinois, Champaign, Illinois, 61820.

posed to general health status) are examined. Second, it may be useful to follow patterns of stress and illness across a relatively short period using a within-subject, intraindividual mode of analysis rather than an across-subject, interindividual mode.

Across-subject and within-subject designs address somewhat different questions. In the across-subject mode the question is whether there is a relationship between stress and health within a particular population. A single score for stress and a single score for health are obtained for each subject based on a single observation or on multiple observations aggregated across occasions. These scores are correlated across subjects. The problem with this approach is that whereas it can be used to characterize a relationship between stress and health, it obscures what may be systematic differences among persons. In the within-subject mode, the question addressed is the more conceptually important one of whether fluctuations in daily stress levels covary with changes in health and well-being. Multiple measures of stress and health are obtained over time and can be used to calculate a separate correlation for each subject. The subject serves as his or her own control, which eliminates the effects of between-subjects differences.

Psychophysicologists learned the importance of the within-subject approach a number of years ago while trying to assess the relationship between different autonomic nervous system indicators of arousal such as heart rate and skin conductance. The basic question was whether or not skin conductance rises when an individual's heart rate rises. Extending Lacey's (1959, 1967) work, Lazarus, Speisman, and Mordkoff (1963) found a low correlation between indicators when the data were analyzed using an across-subject approach. However, the correlation was substantial when the data were analyzed with a within-subject approach. The across-subject approach introduced individual differences that masked the relationship between indicators; the within-subject approach controlled for these differences (see also Opton & Lazarus, 1967).

This issue is also exemplified in Rehm's (1978) work. In aggregating both mood and daily events across time points, he found that average event level was not significantly correlated with average mood level across the same period. However, using disaggregated data, within-subject correlations revealed a highly significant association between increases in events and declines in mood. In other words, mood was affected not by the individual's average level of stress, but rather by whether the individual was experiencing more or less stress than usual.

Few studies have used within-subject analyses to examine the covariations between daily stressful experiences and physical health. Holmes and Holmes (1970) found that subjects reported approximately twice as many life events on symptomatic days as on nonsymptomatic days. However, the most frequently reported events in their study were changes in health behaviors—for example, a change in amount of sleep. Changes such as these are often prodromal signs of illness, which makes interpretations of the findings difficult. Another study (Meyer & Haggerty, 1962) examined the role of family crisis in streptococcal infections. It was found that streptococcal acquisition and illness, as well as nonstreptococcal respiratory infections, were about four times as likely to be preceded as to be followed by a stressful family episode.

Recently, a few studies have used within-subject analyses to examine the role of daily stress in subsequent mood disturbance. These studies have found that whereas minor stressful events were associated with same-day mood problems, there was no effect of daily stress on subsequent mood (Eckenrode, 1984; Stone & Neale, 1984). Another study (Caspi, Bolger, & Eckenrode, 1987) did find that daily stress increased the likelihood of mood disturbance for at least the day following the occurrence of the stressor.

Lewinsohn and his colleagues (Lewinsohn & Amenson, 1978) found large individual differences in intraindividual correlations between daily events and same-day mood. Their findings suggest that within-subject research might be profitably supplemented by a consideration of person and situation factors that might account for differences in somatic and psychological responses to daily stress. In the present study we considered two psychosocial resources, self-esteem and emotional support. Self-esteem is a psychological resource that influences stress and coping processes (Pearlin & Schooler, 1978). Presumably, people who have positive views of themselves should be less likely to feel overwhelmed when confronted with stressful demands than should people who do not have positive views, because the former would see themselves as able to cope with a broad array of problems. In one study, for example, persons with high self-esteem reported less depression in the face of job loss than did those with low self-esteem (Pearlin, Lieberman, Menaghan, & Mullan, 1981).

With respect to social support, there is fairly consistent evidence that its perceived availability moderates the effects of stress on subsequent physical (Wallston, Alagna, DeVillis, & DeVillis, 1984) and psychological distress (Kessler & McLeod, 1985). Although a number of dimensions of social support have been examined, the perception of having available emotional support from close others appears to account for much of the effect of social support on stress (Coyne & DeLongis, 1986). One of the ways that social support may protect people from the potentially damaging effects of exposure to stress is through its effects on mediating appraisal and coping processes (Lazarus & DeLongis, 1983; Lazarus & Folkman, 1984). For people with support, fewer situations should tax or exceed their resources and, consequently, less stress should be experienced. Even when people do experience stress, having close others to rely upon should make it less likely that they will cope ineffectively and thus have a negative psychological or health outcome.

The present study examined relationships between daily stress and two aspects of well-being, physical symptoms and mood, across 20 assessments. We hypothesized that when participants were studied across time, increases in daily stress would be associated with increases in somatic symptoms and negative mood. We expected these effects to remain even after taking into account average levels of stress, mood, and illness across the study. We further hypothesized that there would be considerable individual variation in the size of these relationships, and that people low in either self-esteem or emotional support would be particularly susceptible to the potentially negative health consequences of day-to-day stress and therefore show the highest covariations among hassles, symptoms, and mood.

Method

As part of a larger study, 75 married couples completed a battery of questionnaires and were interviewed once monthly during a 6-month period concerning their social support, self-esteem, beliefs, values and commitments, life stress, health, and psychological well-being. During periods of 4-days between each of the six monthly interviews, participants completed the Hassles and Uplifts Scale and the Daily Health Record at the end of each day. This procedure resulted in 20 daily assessments of stress and illness, in addition to data obtained during the six interviews.

Sample

Participants were selected by random-digit dialing. The participant pool was limited to married couples in which the wife was between the ages of 35 and 45 and that had at least one child living in the home, an above marginal family income (\$18,000 for a family of four in 1980), and at least an eighth-grade education. The participant pool was also limited to couples in which both members were white and either Protestant or Catholic. These limitations were placed on the sample in order to reduce unwanted variance on sociodemographic variables that might otherwise make interpretations of relationships among the study variables more difficult given the moderate N .

Couples identified as eligible for the study using these criteria were sent a letter explaining the study, which was followed by a telephone call from an interviewer who explained the participant's role in the study and set up an initial interview for those willing to join the study. Forty-six percent of the couples who were asked to participate agreed to do so. Of those couples who agreed, 62% were Protestant and 38% were Catholic. Wives ranged in age from 35 to 45 years ($M = 39.6$), and their husbands' ages ranged from 26 to 54 years ($M = 41.4$). The number of years of education ranged from 12 to 24; husbands had a mean of 15.9 years of education, and wives a mean of 15.0 years. Eighty-four percent of husbands and 57% of wives were employed for pay. The median family income was \$45,000. Those who refused to be in the study did not differ from those participating in terms of age, $t(148) = 0.85, p > .10$, or religion, $\chi^2(3, N = 150) = 2.01, p > .10$. Persons refusing to be in the study had fewer years of education ($M = 14.3$) than did those agreeing to participate ($M = 15.5$), $t(148) = 4.62, p < .001$.

During the course of the study 10 of the 85 couples who originally agreed to be in the study dropped out, yielding an attrition rate of 11.8%. Couples who did not remain in the study for the full 6 months were excluded from analyses. Thus, the final sample size was 75 couples. Participants were interviewed in their homes, or at another location if they preferred, once a month for 6 months. In order to preserve confidentiality and minimize biasing of responses, husbands and wives were interviewed separately.

Instruments

The Hassles and Uplifts Scale. A thoroughly revised version of the Hassles and Uplifts Scale used in prior research (DeLongis, Coyne, Dakof, Folkman, & Lazarus, 1982; Kanner, Coyne, Schaefer, & Lazarus, 1981) was used in the present study. (See DeLongis, 1985, for a more detailed discussion of the characteristics of the scale.) In the revised version, redundant items and items and words that suggested psychological and somatic symptoms were eliminated. Further, the format was changed so that subjects could rate each item on how much of a hassle and/or an uplift it was for them that day on a 4-point scale ranging from 0 (*none or not applicable*) to 3 (*a great deal*). The revised scale consists of 53 items (see Appendix). Total hassles scores were obtained by sum-

ming across ratings given to all items except health-related items (see DeLongis, 1985). Only data on hassles are reported here.

At the first interview, interviewers instructed participants on how and when they were to complete the Hassles and Uplifts Scale. Also, interviewers assisted participants in completing the scale for the current day in order to ensure that they understood the procedures for completing the scale between monthly interviews. Interviewers left a packet of four Hassles and Uplifts Scales and four Daily Health Records with the participant at each of five interviews, to be picked up by the interviewer at the next monthly interview. Participants were instructed to complete the scales during the week prior to their next interview, on four consecutive nights just before going to bed. Interviewers called to prompt couples at the start of their assessment period each month. Husbands and wives were asked to fill out the scales separately, but for the same days. The scales were filled out by participants a total of 20 times.

The Daily Health Record. The Daily Health Record (Verbrugge, 1980, 1983, 1985) contains questions about a single day's health and mood. Participants rated their "spirits" (mood) each assessment day on a 7-point scale from *terrible* to *wonderful*. Specific information regarding illness and injuries was obtained in a diary format. Participants were asked to write any symptoms or discomforts they had that day on a chart provided.

Commonly reported symptoms included headaches ($M = 1.85$ across 20 days, $SD = 2.61$); musculoskeletal system symptoms ($M = 3.30$, $SD = 4.93$) such as backaches, shoulder pain, and swollen ankles; respiratory system symptoms ($M = 3.97$, $SD = 4.80$) such as nasal congestion, flu, coughing, and sore throat; and digestive system complaints ($M = 1.10$, $SD = 2.25$) such as nausea and abdominal cramping.

In coding the Daily Health Record we followed Verbrugge's (1980) method with minimal modifications. The information on symptoms and discomforts was coded using the National Center for Health Statistics' (1979) Reason for Visit Classification. For additions and exceptions to this coding procedure, see DeLongis (1985). Participants completed the Daily Health Record after filling out the Hassles and Uplifts Scale on 20 evenings.

Self-esteem. Rosenberg's (1965) scale was used to assess self-esteem. Participants were asked to rate how strongly they agreed or disagreed with each of 10 statements on a scale from 1 (*strongly agree*) to 4 (*strongly disagree*). The scale was completed during the second interview. In the current study, as in past research, the scale was found to have high internal consistency ($\alpha = .78$).

Emotional support. Participants rated their perceptions of the availability of emotional support from people in their network on four dimensions. Up to eight members of their social network were rated on each of the dimensions. First, participants responded to the question: "How much does this person make you feel he/she cares about you?" Participants rated their spouse, up to three of their closest relatives, up to three of their closest friends, and their supervisor at work if they had one. In addition, they rated separately how much they trusted and confided in each of these individuals. Finally, ratings were obtained of how accessible each person was when needed. Each of these four dimensions of emotional support was rated on a 5-point scale (*not at all*, *slightly*, *moderately*, *very*, and *extremely*). For use in the present study, these ratings were summed across all dimensions and all network members. Scores were then divided by the number of network members rated in order to provide an index of the average amount of emotional support received from network members. Internal consistency for this scale was moderate ($\alpha = .54$).

Results

Descriptive Statistics

Within-subject mean daily hassles scores ranged from 1.25 to 46.50 ($M = 16.26$, $SD = 10.87$). The within-subject variance

in hassles scores ranged from 2.58 to 379.58 ($M = 61.93$, $SD = 61.80$).

The within-subject mean number of somatic symptoms reported per day ranged from 0 to 2.55 ($M = 0.68$, $SD = 0.54$). Three participants did not report experiencing any health problems on any of the diary days. Because some variance is essential in computing correlation coefficients, these 3 participants were excluded from intraindividual analyses that utilized symptom scores. For the remaining 147 participants, within-subject variance in symptoms across occasions ranged from 0.05 to 3.99 ($M = 0.71$, $SD = 0.64$). Consistent with past research (Porter, Leviton, Slack, & Graham, 1981; Verbrugge, 1983), husbands ($M = 11.35$, $SD = 10.58$) reported significantly fewer symptoms than did their wives ($M = 16.04$, $SD = 10.72$), $t(74) = 2.70$, $p < .001$.¹

For mood scores, within-subject means ranged from 2.85 to 6.65 ($M = 4.78$, $SD = 0.76$). Within-subject variance in mood across occasions ranged from 0.13 to 5.10 ($M = 1.24$, $SD = 0.81$).

Overall, study participants scored on the high end of the self-esteem scale ($M = 35.24$, $SD = 4.32$). Whereas scores on the scale had a potential range from 10 to 40, the actual range in the present sample was from 18 to 40, with a modal score of 40.

On the whole, participants tended to rate members of their social networks as *moderately* to *extremely* supportive. There were no participants whose mean support rating fell below 3 (moderate) on a scale from 1 to 5. Despite this, support scores were normally distributed ($M = 3.89$, $SD = 0.41$, skewness = 0.00).

Autocorrelations for total hassles scores were high: The mean correlation from day to day was .77 ($p < .001$). Averaging the four daily time points within each month, the mean correlation from month to month was .82 ($p < .001$). The correlation between Month 1 and Month 5 was .72 ($p < .001$). Thus, whether due to stable characteristics of the participants, the situation in which they found themselves, or the interaction of these variables, the amount of stress reported across the study period was highly stable.

Somatic symptom levels were also highly stable across consecutive days (mean $r = .61$, $p < .001$), with one day's symptom levels accounting for a mean of 37% of the variance in next-day symptoms. Symptom reports from one month to the next were somewhat less stable, with the mean amount of variance accounted for in consecutive months' scores being only 16% (mean $r = .40$, $p < .001$). The stability of symptom levels across a 5-month period, using the Pearson correlation between aggregated scores for Month 1 and for Month 5, was .38, not significantly lower than from one month to the next.

Mood on a given day accounted for an average of 25% of the variance in mood on the following day (mean $r = .50$, $p < .001$). Likewise, when mood ratings were aggregated within each month (4 consecutive days per month) and autocorrelated, 25% of the variance in mood could be accounted for from one month to the next (mean $r = .50$, $p < .001$). The relationship between aggregated mood scores for Month 1 with those for Month 5 was comparable, with mood for Month 1 accounting for 23% of the variance in mood scores 4 months later (mean $r = .48$, $p < .001$).

Daily Hassles, Subsequent Physical Symptoms, and Disturbed Mood

To examine whether periods of illness and mood disturbance were associated with prior hassles, a set of paired t tests was performed. The paired- t statistic allowed within-person comparison of each participant's stress level at two points in time: (a) before a period of somatic or psychological distress, and (b) during a well or happy period.

To test hypotheses about the role of everyday stress in subsequent health problems using this approach, only participants who met certain requirements could be included. First, participants had to have a well period, which was operationalized as 4 consecutive days without any somatic symptoms. One hundred (66.7%) participants met this criterion. Second, in order to assess pre-illness stress levels, an attempt was made to identify for each participant a period of physical symptoms that was preceded by at least 1 study day. Such a period was operationalized as a period of 1 or more days on which the person experienced any somatic symptoms. Ninety-nine participants (66%) met this criterion.

For the 67 participants (44.7%) who had both a symptomatic period and a well period, comparisons were made between their mean hassles scores per day during a well period and their mean hassles scores per day on the day *preceding* a symptom episode. If participants had more than one period that fit the criteria for either a symptomatic period or a well period, the mean hassles scores of all such periods were used in the analysis. As expected, hassles scores were significantly higher prior to a symptomatic period ($M = 16.55$, $SD = 14.10$) than during a period free of somatic complaints ($M = 14.10$, $SD = 11.57$), paired $t(66) = 2.06$, $p = .02$.

To test the hypothesis that mood disturbance is preceded by higher stress than occurs during a happy period, comparisons similar to those made for illness were made for happy and distressed periods. Mood disturbance was operationalized as a period of 1 or more days during which a participant's mood level was at least one half of a standard deviation below his or her own mean level. As in the analysis of illness episodes, only those participants who had a distressed day that was preceded by at least 1 study day were included in the analysis ($n = 90$, 60%). Again, this was done so that stress levels prior to the occurrence of psychological distress could be assessed.

Happy periods were operationalized as 4 consecutive days during which the participants' moods were above their own mean levels. Seventy-four participants (49%) had a period of relative happiness by this criterion. However, only 46 participants (31%) had both a distressed period *and* a happy period during the 20 assessment occasions. Again, if participants had more than one period that fit the criteria for distressed or happy mood, the mean hassles scores were computed across all such episodes. Periods of distressed mood were preceded by slightly, but not significantly, higher levels of hassles ($M = 15.52$, $SD = 10.81$) than were happy periods ($M = 14.50$, $SD = 12.52$).

¹ Gender differences in scores were nonsignificant unless noted.

Intraindividual Correlations of Daily Hassles and Symptoms

Four sets of within-subject Pearson correlation coefficients were computed for each of the 150 participants across 20 assessment occasions. Hassles scores and the number of somatic symptoms experienced on the same day were correlated. Intraindividual r s ranged from $-.42$ to $.85$ ($M = .14$, $SD = .30$).² Approximately one third (39%) of the participants had negative correlations (r s from $-.01$ to $-.42$) between hassles and symptoms. For these participants, higher levels of stress were associated with slightly better health. Another third of the sample (32%) had low positive correlations between hassles and symptoms (r s from 0 to $.30$). For these participants, increases in everyday stress on a particular day were associated with slight increases in the number of health problems experienced that day. For the final third of the sample (29%), there was a strong positive correlation (r s from $.31$ to $.85$) between hassles and symptoms. For these participants, increases in daily stress levels were accompanied by an increase in health problems.

Within-subject correlations were also examined between hassles and next-day symptom levels. The pattern of relationships between hassles and symptoms on the following day was similar to that between hassles and same-day symptoms. The one-day lagged r s ranged from $-.52$ to $.87$ ($M = .17$, $SD = .30$). As with the relationships between hassles and same-day symptoms, one third (35%) of the sample had a negative relationship between everyday stress and subsequent health problems (r s from $-.52$ to $-.01$). Another third (35%) had low positive correlations (r s from 0 to $.30$), and the final third (30%) had high positive correlations (r s from $.31$ to $.87$) between the amount of stress experienced on a given day and the number of health problems on the following day.

Intraindividual Correlations of Daily Hassles and Mood Disturbance

As expected, participants tended to experience poorer mood on stressful days than on nonstressful days. Intraindividual correlations between hassles and same-day mood were similar to those between hassles and health, ranging from $.44$ to $-.70$ (mean $r = -.27$, $SD = .30$). Fifty-four participants (42%) had a high association between fluctuations in hassles and same-day mood (r s from $-.30$ to $-.70$). Fifty-six participants (43%) had low to moderate negative associations between hassles and mood (r s from 0 to $-.30$), experiencing somewhat poorer mood on stressful days. Finally, a group of 20 participants (15%) tended to report slightly higher mood when they experienced more hassles (r s from 0 to $.44$).

It is interesting that a quite different pattern of within-subject correlations was observed between hassles and next-day mood. Overall, participants reported relatively better mood on the day following a stressful day than on other days (mean $r = .34$, $SD = .22$). In fact, 94% of the sample (132 participants) had positive within-subject correlations (r s from $.01$ to $.80$) between hassles and next-day mood, with higher levels of hassles associated with better mood on the following day. A few participants showed

Table 1
Pearson Correlation Coefficients Among Within-Subject Coefficients

Within-subject coefficients	1	2	3
1. Hassles with same-day health problems			
2. Hassles with next-day health problems	.59**		
3. Hassles with same-day mood	-.36**	-.22*	
4. Hassles with next-day mood	-.28*	-.24*	.50**

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

either no relationship (1%) or a negative relationship (5%; r s from $-.01$ to $-.33$) between hassles and next-day mood.

Relationships Among Within-Subject Correlation Coefficients

All four sets of within-subject correlation coefficients were significantly intercorrelated (see Table 1). Thus, participants who experienced poor health or mood on stressful days were also likely to have had problems with health ($r = .59$, $p < .001$) and mood ($r = .50$, $p < .001$) on the following day. Similarly, those participants who tended to experience health problems either on or following a stressful day tended to be the same ones who experienced mood disturbance both during and following a stressful day (r s from $-.22$ to $-.36$, $ps < .01$).

Relationships Among Within-Subject Correlation Coefficients and Hassles, Symptoms, and Disturbed Mood

To explore the possibility that differences in within-subject correlations between hassles and outcomes were due primarily to across-subject differences in either hassles, symptoms, or mood scores, within-subject coefficients between hassles and outcomes were correlated with mean hassles, symptoms, and mood scores across time. These relationships are presented in Table 2. Three possible explanations were considered.

First, the possibility existed that individual differences in intraindividual correlations between hassles and daily outcomes could be accounted for by the total amount of daily stress experienced across the study. Thus, for example, it was possible that only those who reported many hassles across time had a high relationship between stress and symptoms, or between stress and mood. In fact, hassles scores, when aggregated across the

² Mean correlations reported were obtained by first transforming the r s to z scores, using the Fisher z' transformation, then transforming the mean z scores back to r s. This procedure was followed for all four mean correlations reported here, because the transformed scores are more likely to satisfy normality and equality variance assumptions (Cohen & Cohen, 1975).

Table 2
Pearson Correlation Coefficients Among Within-Subject
Coefficients and Hassles, Symptom, and Mood Scores

Hassles, symptoms, and mood	Within-subject coefficients			
	Hassles with same-day symptoms	Hassles with next-day symptoms	Hassles with same-day mood	Hassles with next-day mood
Mean hassles	-.08	.03	.07	.36**
Hassles variance	.01	.02	-.06	.10
Mean symptoms	.01	.16*	-.04	.05
Symptom variance	.07	.03	-.01	-.03
Mean mood	.00	-.11	.01	.17*
Mood variance	.13	.15*	-.19*	-.30**

* $p < .05$. ** $p < .001$.

time points used in the analysis (20 time points for same-day correlations, and 15 for next-day correlations) were not associated with intraindividual correlations between hassles and symptoms ($r_s = -.08$ and $.03$; $p_s > .10$). Similarly, mean hassles scores across time were not associated with intraindividual correlations between hassles and same-day mood ($r = .07$, $p > .10$). However, mean hassles scores accounted for a significant 13% of the variance in the within-subject correlations between hassles and next-day mood ($r = .36$, $p < .001$). Thus, participants with higher average levels of stress across time were more likely to experience mood disturbance following an increase in their already high levels of day-to-day stress.

Second, although mean hassles scores did not account for much of the overall variance in within-subject correlations, the possibility remained that individual differences in the amount of variance in day-to-day hassles scores accounted for individual differences in intraindividual relationships between hassles and outcomes. However, hassles variance scores were not significantly associated with any of the four within-subject correlations ($r_s < .11$, $p_s > .10$).

A third possible explanation for individual differences in intraindividual relationships was that either the number of somatic symptoms or the amount of negative mood experienced across the study accounted for the individual differences in correlations. It could be argued that only those participants who were frequently ill or distressed would have had a high association between stress and various outcomes. It seemed plausible that participants who were characteristically well or happy would not respond to stress with illness or distress. In fact, none of the variance in intraindividual relationships between hassles and symptoms occurring on the same day could be accounted for by the total number of symptoms reported across the study ($r = .01$, $p > .10$). Individual differences in variance in symptoms over time did not account for differences in within-subject correlations either ($r_s < .08$, $p_s > .10$). However, a small but significant 2% of the variance in within-subject correlations of hassles with subsequent illness was accounted for by the total

amount of illness reported across the study ($r = .15$, $p < .05$). This suggests, not surprisingly, that the poorer one's overall health, the more likely one is to suffer negative health consequences from common stress.

As expected, neither mean symptom levels nor the amount of variance in symptoms across the study was related to within-subject associations between hassles and mood ($r_s < .06$, $p > .10$). Although mean mood across time accounted for none of the variance in the intraindividual correlations between hassles and same-day mood ($r = .01$, $p > .10$), mean mood accounted for a small, but significant 3% of the variance in the within-subject correlation between hassles and mood on the following day ($r = .17$, $p < .05$). It is interesting that individual differences in the amount of variance in mood across the study were significantly associated with intraindividual correlations between hassles and both same-day ($r = -.19$, $p < .05$) and next-day mood ($r = -.30$, $p < .001$). The amount of variance in mood across time accounted for 2% of the variance in within-subject correlations between hassles and next-day symptoms, as well ($r = .15$, $p < .05$). Thus participants whose mood fluctuated more from day to day tended to have symptoms and mood disturbances that coincided with stressful days.

Self-Esteem and Emotional Support as Moderators of the Impact of Daily Hassles on Symptoms and Mood Disturbance

As expected, self-esteem served as a significant predictor of individual differences in the relationship between hassles and health. Self-esteem was significantly correlated across subjects with within-subject coefficients between both hassles and same-day physical symptoms ($r = -.19$, $p < .05$) and hassles and next-day physical symptoms ($r = -.25$, $p < .01$). Thus, participants with low self-esteem tended to have significantly higher stress-illness associations, with such participants experiencing increased physical symptoms both on and following stressful days. On the other hand, self-esteem did not predict the role of hassles in either same-day ($r = .03$, $p > .10$) or next-day ($r = .04$, $p > .10$) mood. (See Table 3).

Just as self-esteem was more strongly correlated across subjects with the within-subject hassles/next-day-symptoms co-

Table 3
Pearson Correlation Coefficients Between Within-Subject
Correlation Coefficients and Social Support and
Self-Esteem

Social support and self-esteem	Within-subject coefficients			
	Hassles with same-day symptoms	Hassles with next-day symptoms	Hassles with same-day mood	Hassles with next-day mood
Emotional support	-.07	-.19*	-.20*	-.12
Network size	.14*	.06	-.01	.05
Self-esteem	-.19*	-.25**	.03	.04

* $p < .05$. ** $p < .01$.

efficient than with the hassles/same-day-symptoms coefficient, emotional support was more strongly correlated across subjects with the hassles/next-day-symptoms coefficient ($r = -.19, p < .05$). Thus, the average amount of emotional support a participant reported from all sources was associated with how physically responsive the participant was to hassles on a day subsequent to, but not on the same day as, the day the stress occurred. The more support available to the participant in coping with stress, the lower the link between daily stress and illness.

Emotional support played a larger role in the hassles-mood relationship than it did in the hassles-symptoms relationship. The across-subject correlations between support and within-subject hassles-mood coefficients were $-.12 (p < .10)$ for next-day mood and $-.20 (p < .05)$ for same-day mood. Thus, participants with lower perceived support tended to experience mood disturbances on stressful days. They were also somewhat, but not significantly, more likely to experience mood disturbance on the day following a stressful day.

Next, we examined the possibility that network size, in addition to the average amount of support available from network members, was associated with physical and mood responses to stress. In fact, the relationship of network size to the within-subject coefficients was rather weak, with only the hassles/same-day-symptoms coefficient significantly correlated ($r = .14, p < .05$) with network size. It is interesting that the larger the network that participants reported, the more likely they were to respond to hassles with physical symptoms, at least for the duration of the stressful day itself.

It should be noted that self-esteem and emotional support are not entirely independent ($r = .21, p < .01$). Network size, however, is not significantly associated with either self-esteem ($r = .12, p > .05$) or average level of emotional support ($r = -.14, p > .05$). To examine the independent contribution of each of these variables to participants' responses to daily stress, each of the four within-subject coefficients was again treated as an index of participants' responsiveness to daily hassles. The coefficients were regressed on self-esteem, emotional support, and network size (see Table 4). In regressing participants' physical responsiveness to hassles, we found that only self-esteem was a significant predictor of such reactions to stress on both a stressful day and on the following day, and only emotional support had a significant independent relationship to mood disturbances associated with same-day daily hassles. Participants with lower emotional support were more likely to have experienced a mood disturbance on a stressful day than were participants with higher emotional support. As a set, self-esteem, support, and network size were significantly associated with only one of the four within-subject coefficients, hassles with next-day symptoms.

Discussion

The central questions addressed by this research were as follows: (a) Is an increase in daily stress associated with an increase in subsequent somatic symptoms and mood disturbance? (b) What is the extent of individual differences in this relationship? (c) Can such individual differences be accounted for by the

Table 4
Regression of Within-Subject Coefficients on
Social Support and Self-Esteem

Social support and self-esteem	Dependent variables: within-subject coefficients			
	Hassles with same-day symptoms	Hassles with next-day symptoms	Hassles with same-day mood	Hassles with next-day mood
Network size	.12	.05	-.06	.04
Emotional support	.00	-.12	-.20*	-.16
Self-esteem	-.20*	-.23*	.02	.02
R^2	.06	.08*	.04	.03

Note. Values are beta coefficients.

* $p < .05$.

moderating effects of two psychosocial assets, self-esteem and emotional support?

To summarize the main findings briefly, there was a tendency for an increase in daily hassles to be associated with a decline in health and mood. However, there were large individual differences in this relationship, with health and mood in some individuals actually improving when daily stress levels rose. Finally, as anticipated, persons with low self-esteem and low emotional support had a higher probability of a positive association between stress and both physical symptoms and poor mood than did those who were high in these psychosocial assets.

Let us first attend to the findings of the within-subject correlational analysis. The pattern of covariation for hassles and mood differed in an interesting way from the pattern observed for hassles and physical symptoms. For most participants, a high score for daily hassles was associated with increases in both same-day and next-day physical symptoms and same-day mood disturbances. However, the more stressful a day was, the better the person's mood was likely to be the following day. Several interpretations of this difference are possible. One is that physical symptoms endure longer than mood disturbances, and therefore mood is more immediately responsive to a decrease in stress than somatic symptoms are. Although this may explain why the effects of stress on physical health would persist longer than the effects of stress on mood, the delayed positive effect of stress on mood is left unexplained. Apparently, there is much relief when daily hassles decrease from a high level. This relief may be like that described in the old adage about how good it feels when one stops hitting one's head against a wall. Whatever the interpretation, however, mood appears to be particularly sensitive to both rises and falls in levels of stress.

The enormous individual variation found in the association between hassles and health and mood is of great importance, because the usual expectation is that illness and depressed mood will increase rather than decrease following a rise in stress. Yet one third of the participants reported just the opposite; increases in stress were accompanied by somewhat improved health and mood. In other words, some participants actually seemed to thrive when stress levels increased. It should be

noted, however, that those participants who had relationships between daily stress and health and mood across time that were opposite to the predicted direction all had low to moderate relationships, whereas relationships in the predicted direction (that is, more stress associated with poorer health and mood) tended to be larger.

Self-esteem and emotional support helped explain these individual differences, especially with respect to physical symptoms. High levels of self-esteem and emotional support moderated the relationship between hassles and physical symptoms both on the day hassles increased and on the day following the increase. This moderating effect was less clear for mood, where emotional support moderated the effects of hassles only on the day they increased; there were no significant effects on mood due to self-esteem, though the nonsignificant differences were in the predicted direction.

The failure of these variables to produce very large and stable moderating effects may have been due to the attenuated range of both perceived emotional support and self-esteem in this sample. Not only was the sample fairly homogeneous with respect to these variables, but most participants fell toward the positive end of the continuum, seeing themselves as well supported and having high self-esteem. Therefore, the findings represent a conservative test of the roles of self-esteem and social support as moderators of the relationship between daily hassles and well-being.

Consistent with the findings of others (see Cohen & Wills, 1985, for a review) network size had no independent effect on the hassles-symptoms and hassles-mood relationships. Thus, the effects of emotional support appear to be due to feeling that one has support available from important others. Having a larger network apparently does not compensate for having non-supportive others in one's network.

The great individual variation in the relationships between hassles and health and hassles and mood could also be the result of still other factors, none of which are mutually exclusive. For example, at the *physiological level* there may be specificity in the immune-system response to different kinds of stress or emotional experience occurring in different individuals. At the *psychological level*, variations in the ways people cope with the problems that create hassles, or in their emotional response to those hassles, could influence the relationships. For example, some people may be more effective at problem solving than others; and some people may be more effective at regulating their distress than others, leading in such cases to low or negative relationships. Those ineffective in coping, in contrast, should show strongly positive relationships between stress levels and symptoms or disturbed mood. There could also be important individual differences in symptom monitoring (Pennebaker, 1982) and in the psychological response to symptoms, which in turn could have affected symptom reporting. For example, an awareness of physical symptoms might evoke a counterphobic, denial-like reaction in certain people; such people should display low or even negative correlations between stress and symptoms or mood. They may want to demonstrate that they are not demoralized by adversity. Other people might use the fatigue or aches and pains they experienced in response to an increase in stress to make excuses or to gain sympathy and attention from

others. These people would probably show a positive correlation between stress and health symptoms or disturbed mood.

Another possibility is that when some persons experience a physical symptom or mood disturbance, they may treat it as a sign or signal that something is not quite right in their lives. In particular, many people may view symptoms of depression, anxiety, or even physical symptoms such as headaches, nausea, or diarrhea as signs that they are experiencing too much stress or need to change the way they are handling stress. This possibility may explain, in part, why most of our study participants had improved mood on the day following a stressful day. Perhaps the sequence for these people is one in which they have a stressful day, feel distressed, realize they need to deal with the stress in some way, and then successfully change either the stressful situation itself or the way they handle it.

As we noted earlier, the methodological pitfalls in seeking causal links between stress and well-being are many and profound. The difficulty in differentiating between illness behavior and illness symptoms itself must make us cautious about causal interpretations. However, this study avoided some of the most significant pitfalls by using as dependent variables changes in health symptoms and mood, which are likely to occur during relatively short periods of time; by using a prospective design, which reduces the likelihood that causal-aetiological relationships will be misinterpreted; and by using a within-subject design with disaggregated data in which the subjects are their own control, thereby eliminating variance due to extraneous between-subject variables.

There remains the issue of confounding between hassles and health outcomes, particularly psychological outcomes, about which we have debated with the Dohrenwends and their colleagues (B. S. Dohrenwend, Dohrenwend, Dodson, & Shrout, 1984; B. P. Dohrenwend & Shrout, 1985; Lazarus, DeLongis, Folkman, & Gruen, 1985). In the present study we used a revised version of the Hassles and Uplifts Scale that eliminates item properties that might contribute to confounding. The items on the revised measure are basically an enumeration of various aspects of living that might or might not be hassles. Also, as noted earlier, illness-related items and items that appeared to be confounded with psychological status were removed from scores used in the present analysis. Thus, the argument that confounding accounts for relationships between hassles and illness symptoms or disturbed mood does not appear tenable. This argues against the idea that hassles and the dependent variables reflect the same process. In short, many of the methodological issues generated by previous studies that used the Hassles and Uplifts Scale do not apply in the present study.

In the stress-illness research literature, hypotheses are usually phrased in terms of intraindividual changes in adaptational outcomes (i.e., What impact does exposure to a particular stressor have on an individual's well-being?) yet are tested in terms of across-subject variations. The present study demonstrates the value of simultaneous consideration of both intraindividual, within-subject relationships and interindividual, across-subject relationships. We are inclined to argue that questions about how people respond to increases and decreases in daily stress require a within-subject strategy because what is being asked is how a given biological or psychological system responds to

stress or emotional change. Each such system—that is, each individual—has its own response characteristics as well as sharing common mechanisms of response.

There is much to be gained by refining and expanding on the methodology of this study in several ways. For example, the number of consecutive days that are assessed should be increased to allow for the longer incubation period of many infectious disorders. Sample sizes should also be larger so that details of the mechanisms of individual differences in the stress–illness relationship can be more fully explored. In addition, the role of coping and illness behavior as mediators of the stress–illness relationship needs to be evaluated (see, e.g., DeLongis, Kessler, & Bolger, 1987). The present findings strengthen our conviction that these methodological expansions will make the methodology used in this study even more fruitful in advancing our understanding of the complex and variable relationship between daily stress and health outcomes.

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Appendix

The Hassles and Uplifts Scale

HASSLES are irritants—things that annoy or bother you; they can make you upset or angry. UPLIFTS are events that make you feel good; they can make you joyful, glad, or satisfied. Some hassles and uplifts occur on a fairly regular basis and others are relatively rare. Some have only a slight effect, others have a strong effect.

This questionnaire lists things that can be hassles and uplifts in day-to-day life. You will find that during the course of a day some of these things will have been only a hassle for you and some will have been only an uplift. *Others will have been both a hassle AND an uplift.*

DIRECTIONS: Please think about how much of a hassle and how much of an uplift each item was for you today. Please indicate on the left-hand side of the page (under "HASSLES") how much of a hassle the item was by circling the appropriate number. Then indicate on the right-hand side of the page (under "UPLIFTS") how much of an uplift it was for you by circling the appropriate number.

Remember, circle one number on the left-hand side of the page and one number on the right-hand side of the page for each item.

PLEASE FILL OUT THIS QUESTIONNAIRE JUST BEFORE YOU GO TO BED.

HASSLES AND UPLIFTS SCALE

How much of a hassle was this item for you today?

HASSLES

- 0 = None or not applicable
- 1 = Somewhat
- 2 = Quite a bit
- 3 = A great deal

How much of an uplift was this item for you today?

UPLIFTS

- 0 = None or not applicable
- 1 = Somewhat
- 2 = Quite a bit
- 3 = A great deal

DIRECTIONS: Please circle one number on the left-hand side and one number on the right-hand side for each item.

- | | | |
|---------|--|---------|
| 0 1 2 3 | 1. Your child(ren) | 0 1 2 3 |
| 0 1 2 3 | 2. Your parents or parents-in-law | 0 1 2 3 |
| 0 1 2 3 | 3. Other relative(s) | 0 1 2 3 |
| 0 1 2 3 | 4. Your spouse | 0 1 2 3 |
| 0 1 2 3 | 5. Time spent with family | 0 1 2 3 |
| 0 1 2 3 | 6. Health or well-being of a family member | 0 1 2 3 |
| 0 1 2 3 | 7. Sex | 0 1 2 3 |
| 0 1 2 3 | 8. Intimacy | 0 1 2 3 |
| 0 1 2 3 | 9. Family-related obligations | 0 1 2 3 |
| 0 1 2 3 | 10. Your friend(s) | 0 1 2 3 |
| 0 1 2 3 | 11. Fellow workers | 0 1 2 3 |
| 0 1 2 3 | 12. Clients, customers, patients, etc. | 0 1 2 3 |
| 0 1 2 3 | 13. Your supervisor or employer | 0 1 2 3 |
| 0 1 2 3 | 14. The nature of your work | 0 1 2 3 |
| 0 1 2 3 | 15. Your work load | 0 1 2 3 |
| 0 1 2 3 | 16. Your job security | 0 1 2 3 |
| 0 1 2 3 | 17. Meeting deadlines or goals on the job | 0 1 2 3 |

- | | | |
|---------|---|---------|
| 0 1 2 3 | 18. Enough money for necessities (e.g., food, clothing, housing, health care, taxes, insurance) | 0 1 2 3 |
| 0 1 2 3 | 19. Enough money for education | 0 1 2 3 |
| 0 1 2 3 | 20. Enough money for emergencies | 0 1 2 3 |
| 0 1 2 3 | 21. Enough money for extras (e.g., entertainment, recreation, vacations) | 0 1 2 3 |
| 0 1 2 3 | 22. Financial care for someone who doesn't live with you | 0 1 2 3 |
| 0 1 2 3 | 23. Investments | 0 1 2 3 |
| 0 1 2 3 | 24. Your smoking | 0 1 2 3 |
| 0 1 2 3 | 25. Your drinking | 0 1 2 3 |
| 0 1 2 3 | 26. Mood-altering drugs | 0 1 2 3 |
| 0 1 2 3 | 27. Your physical appearance | 0 1 2 3 |
| 0 1 2 3 | 28. Contraception | 0 1 2 3 |
| 0 1 2 3 | 29. Exercise(s) | 0 1 2 3 |
| 0 1 2 3 | 30. Your medical care | 0 1 2 3 |
| 0 1 2 3 | 31. Your health | 0 1 2 3 |
| 0 1 2 3 | 32. Your physical abilities | 0 1 2 3 |
| 0 1 2 3 | 33. The weather | 0 1 2 3 |
| 0 1 2 3 | 34. News events | 0 1 2 3 |
| 0 1 2 3 | 35. Your environment (e.g., quality of air, noise level, greenery) | 0 1 2 3 |
| 0 1 2 3 | 36. Political or social issues | 0 1 2 3 |
| 0 1 2 3 | 37. Your neighborhood (e.g., neighbors, setting) | 0 1 2 3 |
| 0 1 2 3 | 38. Conserving (gas, electricity, water, gasoline, etc.) | 0 1 2 3 |
| 0 1 2 3 | 39. Pets | 0 1 2 3 |
| 0 1 2 3 | 40. Cooking | 0 1 2 3 |
| 0 1 2 3 | 41. Housework | 0 1 2 3 |
| 0 1 2 3 | 42. Home repairs | 0 1 2 3 |
| 0 1 2 3 | 43. Yardwork | 0 1 2 3 |
| 0 1 2 3 | 44. Car maintenance | 0 1 2 3 |
| 0 1 2 3 | 45. Taking care of paperwork (e.g., paying bills, filling out forms) | 0 1 2 3 |
| 0 1 2 3 | 46. Home entertainment (e.g., TV, music, reading) | 0 1 2 3 |
| 0 1 2 3 | 47. Amount of free time | 0 1 2 3 |
| 0 1 2 3 | 48. Recreation and entertainment outside the home (e.g., movies, sports, eating out, walking) | 0 1 2 3 |
| 0 1 2 3 | 49. Eating (at home) | 0 1 2 3 |
| 0 1 2 3 | 50. Church or community organizations | 0 1 2 3 |
| 0 1 2 3 | 51. Legal matters | 0 1 2 3 |
| 0 1 2 3 | 52. Being organized | 0 1 2 3 |
| 0 1 2 3 | 53. Social commitments | 0 1 2 3 |

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