

CONCEPTUALIZING STRESS TO STUDY EFFECTS ON HEALTH: ENVIRONMENTAL, PERCEPTUAL, AND EMOTIONAL COMPONENTS

MARCI LOBEL and CHRISTINE DUNKEL-SCHETTER
University of California, Los Angeles

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Stress has been operationalized in numerous ways across studies of physical and mental health, raising questions about the appropriate definition of stress and the construct validity of stress measures. The present paper discusses the theoretical and operational strengths of three prominent approaches to stress definition and then attempts to integrate them into a comprehensive and robust multidimensional definition of stress. In a study of socioeconomically disadvantaged pregnant women, structural equation modelling techniques were used to test whether a single latent construct underlies environmental, perceptual, and response-based indicators of stress. Results suggested a two-factor, rather than a single-factor, model of stress. Stress perception and emotion were part of a single underlying latent factor, a phenomenological stress construct, whereas environmental conditions in the form of major life events represented a second and distinct component of stress. Failure to find a single latent stress construct is interpreted as evidence for the importance of individual perception or appraisal as a mediator of response to difficult environmental conditions. The findings suggest that multidimensional models of stress are theoretically justified and that enhancement of stress measurement in this manner may enable researchers to better identify health effects of stress.

KEY WORDS: Stress, emotion, pregnancy, appraisal, life events, anxiety

As more Americans have become concerned about health and fitness in recent years, there is burgeoning interest in the health-threatening effects of stress (Hobfoll, 1989; Leventhal & Tomarken, 1987). A number of popular publications warn us about the ill effects of stress in the workplace, in the family domain, and in the various activities and responsibilities that are associated with urban living in the 1990's (e.g., "For Less Stress," 1989; Miller, 1989; "Stressbusters," 1989). Although they are often exaggerated, popular claims that stress is harmful to physical and mental health are not without some scientific support. Stress has been linked empirically with increased susceptibility to infectious disease (Jemmott & Locke, 1984), with the occurrence of immune-related disorders (Schleifer, Keller, McKegney, & Stein, 1980), peptic ulcer disease (Tennant, 1988), coronary heart disease (Cebelin & Hirsch, 1980; Syme, 1975; Theorell & Rahe, 1975), hypertension (Henry & Stephens, 1977), with shorter survival of cancer (Cooper, Cooper, & Faragher, 1986; Temoshok, Heller, Sagebiel, et al., 1985) with psychological symptomatology (Dohrenwend, B. P. & Dohrenwend, B. S., 1981; Kessler, Price, & Wortman, 1985; Thoits, 1983), and with adverse birth outcomes including infant prematurity and morbidity (Istvan, 1986; Lobel, 1989). The strength of these results is uneven, however. For example, the best-replicated effects of stress appear

Address correspondence to: Marci Lobel, now at the Department of Psychology, State University of New York at Stony Brook, Stony Brook, NY 11794-2500, USA

to be on psychological symptoms and on the immune system, whereas effects of stress on cancer survival and prognosis are more controversial (Cassileth, Lusk, Miller, Brown & Miller, 1985).

Findings from studies of stress are difficult to integrate because they lack a uniform definition of stress. Many operational definitions have been used (cf. Elliott & Eisdorfer, 1982; Hobfoll, 1989). For example, stress has been operationally defined as the occurrence of major life events (B. S. Dohrenwend & B. P. Dohrenwend, 1984) or daily hassles (DeLongis, Folkman, & Lazarus, 1988), as chronic stressors (Eckenrode, 1984), role strain (Pearlin, 1983), or perceived stress (Cohen, Kamarck, & Mermelstein, 1983), as environmental noise or crowding (Glass & Singer, 1972), as catastrophes (Collins, Baum, & Singer, 1983), and in animals, as such stimuli as loud noise (Myers, 1975) or bright light (Morishima, Pedersen, & Finster, 1978). Whether these variables are conceptually equivalent as indicators of stress is not clear. Moreover, there has been debate about stress definition and measurement, specifically over the importance of objectively-identified events relative to more subjective, individual perceptions of stress (B. S. Dohrenwend, Dohrenwend, Dodson, & Shrout, 1984; B. P. Dohrenwend & Shrout, 1985; Lazarus, DeLongis, Folkman, & Gruen, 1985).

In the present paper, we describe the three most prominent approaches to stress definition — environmental, perceptual, and response-based definitions. We discuss the relative theoretical and operational strengths of each approach, and their integration into a more comprehensive definition of stress. We then present results from a study of stress in pregnancy to test this conceptualization of the stress construct. Our goal was to develop a powerful operational definition of stress and examine the effects of this construct prenatally on infant and maternal birth outcomes. The latter results are reported elsewhere (Lobel, Dunkel-Schetter, & Scrimshaw, 1990).

Early Conceptualizations of Stress

Early research by Cannon (1932) and Selye (1950; 1956) defined stress as a biological response. Selye, who was influenced by Cannon's work on the fight-or-flight response, proposed that any stressor, either psychological or biological, triggers a uniform series of physiological responses, which he labelled the General Adaptation Syndrome (GAS). Subsequent work by Frankenhaeuser (1975) and Mason (1974) has disproved several features of Selye's theories, such as the view that stress is purely a physiological process or that stress involves a uniform response. Yet Selye's original ideas are still influential today, especially in their focus on physiological response to threat.

Defining stress as response has not been limited to physiological formulations (Lazarus & Folkman, 1984). Stress has often been equated with specific psychological responses, especially emotional states such as fear, anger, or anxiety. Negative emotional states or responses to stimuli are thought by some to represent the phenomenological component of stress, and as such have been equated with "stress" more frequently than other responses (Baum, Davidson, Singer, & Street, 1987; Leventhal & Tomarken, 1986). Scales measuring anxiety and depression, for example, are widely used as indicators of negative emotional response to situations perceived as dangerous or threatening (e.g., Billings & Moos, 1982; Kowlison & Felner, 1988; see reviews by Spielberger, 1983 and Thoits, 1983). Popular sources often go so far as to equate stress with emotional experience such as depression and

anxiety (e.g., see "Energy Up, Stress Level Down," 1989), which may be why laypeople view stress as the amount of emotional disturbance they are feeling (cf. DeLongis et al., 1988). Furthermore, perceptions of stress have selective effects on negative affect, not merely a general effect on emotion. Watson and colleagues (Clark & Watson, 1986; Watson, 1988), for example, have shown that perceptions of stress are related to greater negative affect including nervousness, fear, anger, and guilt, but not to reductions of positive state affect.

Standardized measures of emotion may be particularly valuable as indicators of stress because of their proven reliability and validity and because they offer norms against which to compare subjects' scores. Another advantage is that stress can easily be rated by subjects using standard scales of negative affect or mood. However, irrespective of the advantages to assessing emotion as an indicator of stress, response definitions have been criticized on at least two grounds. First, response-based definitions of stress underemphasize the characteristics of conditions and of individuals that may increase or decrease the intensity of particular responses (cf. Cattell, 1966; Depue & Monroe, 1986; Spielberger, 1983; Watson & Clark, 1984). Second, response definitions of stress are circular. If stress is defined as that which produces physiological disturbance or emotional distress, prospective identification of stressors is not possible (Lazarus & Folkman, 1984).

Current Conceptualizations of Stress

A second approach to conceptualizing stress is stimulus-based, or environmental. This position in stress definition has been advocated most strongly by researchers interested in unconfounding stressors or stressful stimuli from their postulated effects on psychological state (B. P. Dohrenwend & B. S. Dohrenwend, 1981; Holmes & Rahe, 1967) and physical health (e.g., Kasl, 1978). These researchers have sought to develop objective measures of stress, most prominently those of major life events (e.g., Holmes & Rahe, 1967; Sarason, Johnson, & Siegel, 1978). Such measures are designed to disentangle threatening, harmful, or taxing objective environmental stimuli from perceptions of events and emotional concomitants (see B. P. Dohrenwend & Shrout, 1985). There is considerable evidence that such objective environmental occurrences are related to physical and mental health, but only to a modest degree (Rabkin & Struening, 1976; Thoits, 1983).

On the other hand, as demonstrated by a third major approach to conceptualizing stress, we cannot attach the label "stress" to a given set of objective conditions or events because these do not produce distress for all individuals who experience them (Lazarus, 1966; Lazarus & Folkman, 1984; Lazarus & Launier, 1978). Individuals differ in the degree to which they are taxed, distressed, or bothered by objective events and conditions (Cohen et al., 1983; Rabkin & Struening, 1976; Thoits, 1983). In the work of Lazarus and colleagues, stress is defined as the product of a dynamic interaction between the individual and the environment (Lazarus, 1966; Lazarus & Folkman, 1984; Lazarus & Launier, 1978). According to this formulation, the stressful impact of events is mediated by appraisal. That is, Lazarus views stress as a process in which individuals evaluate the significance of an event for their well-being and their ability to rally resources to manage its demands. This perspective suggests that individual perceptions or appraisals are more central to conceptualizing stress than events or conditions in the objective environment or physiological and emotional responses.

The differences between these "environmental" and "appraisal" approaches to

stress definition were illustrated in a recent exchange between B. P. Dohrenwend and ShROUT (1985) and Lazarus and colleagues (Lazarus et al., 1985) over correlations between the Daily Hassles Scale, a measure of stress developed by the Lazarus research group (DeLongis, Coyne, Dakof, Folkman, & Lazarus, 1982; Kanner, Coyne, Schaefer, & Lazarus, 1981), and measures of psychological disorder. Lazarus et al. interpreted the correlations as evidence that stress is related to poorer psychological adaptation. Dohrenwend and ShROUT, however, emphasizing the common self-report element in perceptions of hassles and perceptions of psychological symptoms, viewed the correlations as evidence for confounding between Lazarus et al.'s stress measure and psychological disorder. B. P. Dohrenwend and ShROUT contended that both the Daily Hassles Scale and the measures of psychological disorder reflect a common underlying factor of subjective upset. Thus, they argued for a more conceptually distinct definition of stress removed from individual perception.

Reconceptualizing Stress

Although there are important differences between the environmental, appraisal, and response-based approaches to stress definition, there are also several similarities between them. These similarities are reflected in their measures, in theoretical aspects underlying the various approaches, and in demonstrated relationships among environmental events, appraisal, and emotional states or responses. First, measures associated with the various stress definitions share some features. For example, although life events measures represent environmental approaches in essence, many incorporate appraisal as well. Most current versions of life events measures ask subjects to report the perceived stressfulness of each major life event, so that appraisals as well as reports of events are obtained (e.g., Rowlison & Felner, 1988; see also Brown, 1974; Brown & Harris, 1978). Likewise, the Hassles and Uplifts Scale (DeLongis et al., 1988), a current revised version of the original Daily Hassles Scale (Kanner et al., 1981) is both an objective and an appraisal measure of stress because it assesses whether a hassle (or uplift) has occurred and the perception of its severity or intensity. Thus, these measures of stress do not appear to be purely environmental or appraisal-based.

Similarly, there is also some overlap in the various theoretical approaches to stress research. For example, although recent critiques of Lazarus' and Dohrenwend's work create the impression that the former is wholly perceptual and the latter wholly environmental (e.g., Hobfoll, 1989), in fact, each approach has encouraged the use of both environmental and perceptual indicators of stress by researchers. Lazarus et al. described stress as a "multivariate, multiprocess system [in which] no single variable — whether in the environment or within the person... — can stand for stress (1985, p. 777)." Likewise, B. P. Dohrenwend and ShROUT (1985) wrote,

We do indeed urge researchers to measure pure environmental events, uncontaminated by perceptions, appraisals or reactions — but as one, not the only, important source of stress. We hardly advocate ignoring the fact that the impact of most environmental events will vary with such factors as individual differences in vulnerability, in personal agendas, and in resources (p. 782).

The environmental and perceptual conceptualizations of stress are also similar to

a widely-used emotion-based approach to stress, namely Spielberger's conceptual framework for anxiety (e.g., Spielberger & Jacobs, 1978; 1979). Like Lazarus, Spielberger invokes the idea of cognitive appraisal, emphasizing that any situation has the potential to be appraised as threatening. Spielberger's framework incorporates "stressful environmental stimuli, [as well as] the cognitive processes and emotional reactions that are evoked by these stimuli . . ." (Spielberger & Jacobs, 1979, p. 15). Thus, stimuli, appraisals, and responses are all included in this framework as well.

Convergence between the various theoretical and measurement approaches to stress definition can also be seen in the recognition by many researchers of synergistic effects among environmental events, appraisal, and emotion. Pearlman (1983; 1989), for example, calls attention to the bidirectional causal relationship between events and chronic perceived strain. Others (e.g., Brown & Harris, 1978; Thoits, 1983) describe the contributing effect of psychological dysfunction to the occurrence of major life events. Similarly, Billings and Moos (1982) have demonstrated reciprocal relationships between events and negative emotion, whereas Monroe (1983) has examined some of the complex associations between events, hassles, and psychological symptoms. These studies illustrate the fact that there is shared variance among environmental events, stress appraisals, and emotional response. As Baum et al. (1987) write, "distinctions between stress and constructs such as anxiety, arousal, strain, threat, and so on are often hard to draw" (p. 19).

Although the preceding discussion highlights some important differences and similarities between the various approaches to stress definition, we know of no empirical attempt to reconcile them. Since no single measure exists which assesses emotional response, stress appraisal, and environmental conditions, the task of empirical reconciliation between these types of variables must be tackled with separate measures. The goal would be to identify a single underlying latent construct from measured environmental, perceptual, and response indicators. Structural equation modeling is a powerful tool to examine the structure of latent factors, and it has been used in recent research to clarify the structure of other latent constructs such as social support (Newcomb, 1990), loneliness (Russell, Kao, & Cutrona, 1987), and political deviance (Sidanius, 1988). As Newcomb (1990) explains, structural equation modeling provides a method to separate the conceptually important common component (the latent factor) of measured variables from the measurement error that each contains.

The objective of developing a powerful operational definition of stress arose from a study on the effects of maternal stress during pregnancy on birth outcomes such as prematurity and complicated labor. Evidence from many studies (see reviews by Carlson & LaBarba, 1979; Chalmers, 1983; Istvan, 1986; Lobel, 1989; McDonald, 1968; Reading, 1983) suggests that stress during pregnancy is a significant contributor to infant prematurity, infant morbidity, and labor and delivery complications. However, the findings are inconsistent across studies, particularly with respect to the magnitude of stress effects. One reason may be that previous pregnancy research, like much research on the health effects of stress, has used weak measures of stress and has not been theoretically based. Most studies have applied exclusively environmental or response approaches to stress definition, by utilizing either life events measures or anxiety measures, respectively. However, in the few pregnancy studies which examine joint effects of life events, anxiety, and other distress variables, adverse effects on birth outcome have been strongly documented (Nethercut & Adler, 1983; Norbeck & Tilden, 1983; Nuckolls, Cassel,

& Kaplan, 1972). If stress were likely to have an effect on unreliable, multiply-determined outcome variables such as prematurity, the independent variable would need to be operationalized very powerfully and reliably.

We reasoned that stress could be modelled as a latent factor with measured environmental, appraisal, and response variables as indicators of the latent stress factor. Combining multiple means of assessment to define stress would help to extricate the construct from the variety of existing stress definitions (Elliott & Eisdorfer, 1982), and help establish its convergent validity (Wortman, 1982, see also Campbell & Fiske, 1959). Also, since measurement error is a frequently-cited problem with many existing stress indices (e.g., see Rabkin & Struening, 1976; Thoits, 1983), eliminating measurement error through the structural equation model will produce a more reliable operational definition of stress. This would enable researchers to conduct more powerful tests of the relationship of stress to physical and mental health.

The Current Study

Life events during pregnancy were used to represent the objective environmental component of stress. To represent perceptions of stress, two types of appraisals were assessed. The first were subjects' appraisals of how stressful life events had been, which we call "Event Distress." These capture the stress appraisals that are elicited by major occurrences. The second type of stress appraisals were those that come from feeling overwhelmed by chronic strains (Cohen et al., 1983). Finally, to capture the emotional response component of stress, we assessed anxiety because it has been examined in many other studies of pregnancy. State anxiety was assessed rather than trait anxiety, so that the ratings would represent responses to stressfully-appraised conditions, not individual dispositions or tendencies.

An additional feature of the study was that we used repeated measures of state anxiety and perceived stress throughout pregnancy. Since pregnancy covers an extended period of time during which perceptions and emotional responses might fluctuate, measuring these at several timepoints should improve the reliability of the prenatal stress construct.

To summarize, we measured life events, event distress, perceived chronic stress, and state anxiety during pregnancy and hypothesized that these are highly interrelated because they tap the environmental, perceptual, and emotional response components of a single underlying stress construct. Using structural equation modeling, confirmatory factor analysis was expected to reveal a single latent factor for these measured indicators, as depicted in Figure 1.

METHOD

Overview

Data analyzed for the current paper are from the UCLA Psychosocial Factors in Pregnancy Project, a large-scale investigation of pregnancy and birth conducted from 1984 to 1987 in the public prenatal clinic of a metropolitan, university-affiliated teaching hospital. The clinic serves Spanish-speaking and English-speaking women of moderately low income. Subjects were interviewed repeatedly at each prenatal care visit and once postpartum by trained female

interviewers fluent in English and Spanish. The minimum interval between interviews was 10 days. Because patterns of clinic attendance are variable, subjects were interviewed prenatally from one to ten times ($M = 5$, $SD = 2$).

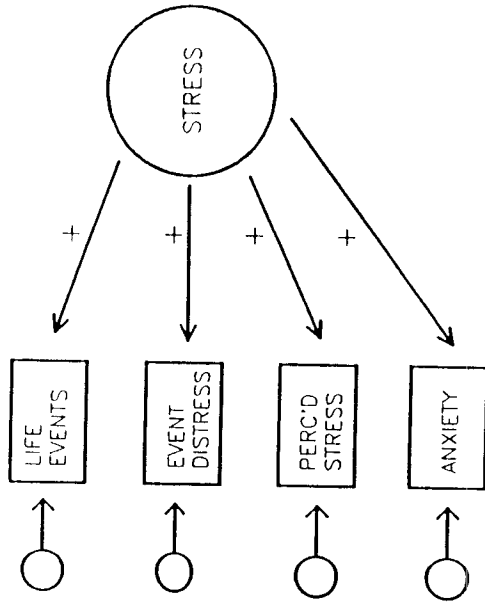


Figure 1. Proposed model of stress.

Subjects

The sample was comprised of 130 women aged 18 to 42 years ($M = 27.7$, $SD = 5.0$) with an average of 10.8 years of education ($SD = 3.3$). Approximately 20% of the sample had attended school for fewer than nine years. Forty-one of the subjects were pregnant with their first child, while the majority, 68.5% ($n = 89$), had at least one other child. Subjects were an average of 12.4 weeks pregnant when first interviewed ($SD = 3.2$, range = 4 to 20 weeks).

More than half of the subjects, 72 women, chose to be interviewed in Spanish. Fifty-seven women were interviewed in English, and one subject completed interviews using a combination of English and Spanish. Only 34.6% of the sample was born in the United States; 60.8% were born either in Mexico, El Salvador, Guatemala, or other Latin American countries. A fourth of the sample had lived in the United States for seven years or less.

The majority of subjects (77.7%) were living with the baby's father at the time of the study whether married to him or not. A total of 58.1% of the subjects were married. Approximately one-fifth of the subjects, 21.5%, reported that they received no monetary support from the baby's father. One of the women in the study stated that she did not know the identity of the baby's biological father.

Measures

The selection of measures was made with particular concern for the cultural

diversity and level of education of the sample, and the necessity to administer interviews quickly. Measures were translated and organized into interview protocols during a one-year period of pretesting in the clinic. Although other measures were administered as part of the larger Pregnancy Project, for the current study, data from a subset of measures were analyzed (prenatal life events and life event distress, repeated measures of prenatal perceived chronic stress, and repeated measures of prenatal state anxiety).

Prenatal Life Events. A measure of stressful life events adapted from the version used by the Los Angeles Epidemiological Catchment Area (ECA) Study (Golding, 1985) was administered in the postpartum interview. Most postpartum interviews were conducted by telephone, although some were completed in the hospital clinic when subjects returned for their first visit following the birth.

The original ECA version (Golding, 1985) consisted of 18 events. In that version, respondents indicated which events they had experienced within the last six months, and for some events, whether they had occurred to "someone important to you" in that time period. The Pregnancy Project adapted version contained all of the original items except one item pertaining to retirement. Other items were modified to make them more appropriate for the sample at hand. For example, rather than asking whether the subject "suffered a business loss or failure," subjects were asked if they had experienced "unusually big pressures or conflicts at work." Also, rather than asking whether a subject had "become a parent, step-parent, or star[ed] acting as a parent for a child," subjects were asked if they had accepted "major responsibility for someone else's children without pay." Other minor modifications in item wording and order were found to be necessary during pretesting.

Two additional adaptations were made to the ECA life events instrument. First, the reporting period was changed from the previous six months to the time since a woman's last menstrual period before pregnancy, which was determined from medical records before interviewing each subject. Thus life events were those that occurred during the time between conception and delivery. Second, for any event reported as occurring, subjects were asked how undesirable or negative the event was on a scale from 1 to 4. This question was added to assess the subjective meaning, or appraisal, of the stressfulness of events which a subject had experienced.

Two indices were computed from the life events instrument. First, the total number of prenatal life events was tallied. Second, a mean life event distress score was computed for each subject by averaging the distress reported for each event she experienced. Women reporting no events were assigned a mean distress score of zero.

Perceived Chronic Stress. A five-item abbreviated version of the Perceived Stress Scale was used (Cohen et al., 1983; see also Cohen & Williamson, 1988). This instrument assesses "the degree to which situations in one's life are appraised as stressful" (Cohen et al., 1983, p. 385). Items are evaluations of unpredictability, uncontrollability, and overload in one's life. According to the measure's authors, these are the three components of stress appraisal.

Since the Perceived Stress Scale (PSS) taps current levels of stress, it is suitable for use as a repeated measure. The PSS has been shown to be psychometrically sound; it yields high discriminant validity from measures of depressive symptomatology, is internally consistent, and is sensitive to fluctuations in stress over time. The measure is appropriate for use with subjects who have a junior high school education or better. Statements describe feeling nervous, out of control, or feeling

that one is successfully managing irritations and unexpected events, for example. Responses are given on a five-point frequency scale with each point descriptively labelled.

The five items with highest factor loadings were selected from the original 14-item PSS to create an abbreviated version of the instrument (S. Cohen, personal communication, August 1984). A version comprised of four of the five items has been used successfully in telephone interview studies (Cohen, 1986; Cohen et al., 1983) and in a random sample general population study (Cohen & Williamson, 1988). Three of the items are negative indicators of stress, the remaining two are positive indicators. Total scores are obtained by reversing scores on the three negative items and then summing across all five items.

Two additional modifications of the original instrument are reflected in the PSS version developed for the Pregnancy Project. First, Spanish translation of idiomatic expressions in two items proved difficult, so the wording of these two items was altered to permit literal translation. Second, the time frame subjects were asked to reflect upon was shortened from one month, used in the original full-length version of the PSS, to "the past seven days." This modification, made after consultation with Cohen, was necessary for the instrument to be administered repeatedly in intervals less than one month.

Pretesting confirmed that PSS items were understandable and had comparable meaning in both languages. Subjects had no difficulty responding to the items using the given response scale. Five-inch by eight-inch cards displaying the response scale were prepared for ease in administering the instrument orally. Internal consistency was slightly higher for English interviews ($\alpha = .74, n = 57$) than for Spanish interviews ($\alpha = .60, n = 72$). Reliability analyses indicated that internal consistency could not be significantly enhanced by dropping any of the PSS items. This was true for both language versions.

State Anxiety. The state form of Spielberger's State-Trait Anxiety Inventory (STAI; Spielberger, 1983) was also included in the Pregnancy Project set of repeated measures. Respondents are asked how they feel "right now, at this moment," differentiating the state measure from trait anxiety measures which ask how respondents "generally feel." Subjects respond to 20 adjectives using a 4-point response scale with responses "not at all, somewhat, moderately, or very much." The STAI has been widely used and validated. The psychometric quality of the instrument is well-established (see Spielberger, 1983 for a comprehensive discussion of the STAI's psychometric characteristics).

Pretesting began with a published Spanish version of the State Anxiety Inventory (Spielberger, 1983). However, because ten items of the Spanish version were not understandable to subjects, these items were reworded in Spanish and the instrument was approved through additional pretesting. English changes to these items were not necessary as the translations remained comparable. As with the abbreviated PSS, subjects were able to look at response cards when reporting their answers. Internal consistency for the measure was high in both languages; the coefficient alpha was .91 in Spanish interviews, and .94 in English interviews.

RESULTS

Life Events

Women reported an average of 2.3 life events during pregnancy ($SD = 2.2$), with a range from 0 to 10 events. As illustration of the type of events women experienced,

18% of the subjects had moved during pregnancy. Ten percent were robbed, and 17% reported that a family member or close friend had died. Only 28 subjects, or 21.5% of the sample, experienced no event. The rate of events in the sample is slightly higher than in most pregnancy studies which assess prenatal life events: three studies report averages between 1.0 and 1.5 (Newton & Hunt, 1984; Newton, Webster, Binu, Maskrey, & Phillips, 1979; Omer, Friedlander, Palti, & Shekel, 1986) and two other studies report averages close to 2.0 (Berkowitz & Kasl, 1983; Gorsuch & Key, 1974). The average is also high in comparison to a sample of males and non-pregnant females using the original Epidemiological Catchment Area version of this study's life events measure (Golding, 1985). In that investigation, subjects reported less than one event on average over a six-month period. Mean life event distress in the present sample averaged 2.2 ($SD = 1.4$) on a scale from 0 (no events) to 4 ("very much"). No comparison data is available on this variable for pregnant women.

Perceived Stress

Perceived stress scores were averaged across interviews to create a single prenatal perceived stress score for each subject. Averaging is preferable to creating a summary score, because of variability in the total number of stress and anxiety assessments completed by subjects. Perceived stress was highly stable throughout pregnancy; mean levels did not fluctuate significantly across interviews. Pairwise correlations between these interview assessments are high and statistically significant (all p 's < .001). As would be expected, correlations between contiguous interviews are highest. Thus average scores are a reliable index of prenatal perceived stress.

Perceived stress score averages over pregnancy ranged from 0 to 13.7 out of a possible 0 to 20 range, and the sample mean was 5.0 ($SD = 3.0$). There are no available norms for this five-item version of the instrument. However, in the general population study using the four-item PSS (Cohen & Williamson, 1988), the average score for women was 4.7 ($SD = 3.1$). Extrapolation to the present five-item scale suggests that women in the current study perceived little stress during pregnancy.

State Anxiety

State anxiety scores from each interview were averaged to create a prenatal anxiety score for each subject, correspondent to the average prenatal perceived stress score already described. Mean state anxiety remained constant during pregnancy. Correlations of state anxiety scores across interviews also confirm that anxiety was highly stable; these correlations are high and statistically significant (all p 's < .001). Correlations of anxiety from contiguous interviews are highest.

Mean prenatal state anxiety ranged from 20.5 to 65 out of a possible 20 to 80 range. The average was 36.2 ($SD = 8.9$). This figure is similar to but slightly lower than levels of state anxiety reported in other studies of pregnant women. Nethercut and Adler (1983), for example, reported an average state anxiety score of 36.8 ($SD = 10.0$) in their sample. In Bradley's (1983) sample of predominantly white, college-educated women pregnant with their first child, more women had higher state anxiety scores: the 25th and 75th percentile scores in Bradley's study were 30.8 and 57.7, respectively; in the current study these were 30.4 and 35.3 (Bradley

does not report the mean). According to published norms for this instrument (Spielberger, 1983), average state anxiety for working women ages 19 to 39 is 36.2 ($SD = 11.0$). Thus women in the current study are not more anxious than non-pregnant women of similar age.

Intercorrelations among Stress Variables

As shown by the correlation coefficients in Table 1, there were strong relationships among the set of psychological stress variables, namely, among the number of life events, mean life event distress, mean prenatal anxiety, and mean prenatal perceived stress. All of the correlations are positive, as would be predicted. Number of life events is the variable least correlated with the other indicators of stress. That is, the lowest correlations are between number of life events and perceived stress ($r = .20$, $p < .05$) and between number of life events and anxiety ($r = .14$, $p = .12$). It is consistent with Cohen et al.'s (1983) findings that perceived stress scores are related more highly to life events distress ratings ($r = .38$) than to number of events.

Model of Stress

The hypothesized latent model of stress, using number of life events, event distress, perceived chronic stress, and state anxiety as indicators, was tested using the EQS program (Bentler, 1985). The model was a poor fit. The Comparative Fit Index (CFI) for the model was .76 out of a possible 1.0. The CFI is a more appropriate fit index to use with samples of this moderate size than the chi-square statistic (Bentler, 1990).

Because the intercorrelations between the four stress indicators in Table 1 suggest that number of life events might not fit well with the other indicators of stress, we decided to retest the latent stress model without this variable. Thus, the revised version of the latent factor contained only life events distress, perceived chronic stress, and state anxiety as indicators.

Table 1 Intercorrelations Among the Four Stress Indicators

	Number of Life Events	Life Event Distress	Anxiety
Life Event Distress	0.53**		
Anxiety	0.14	0.33**	
Perceived Stress	0.20*	0.38**	0.67**

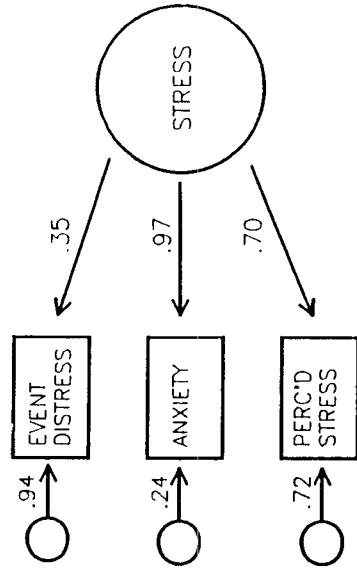
* $p < 0.05$

** $p < 0.001$

This revised model of the latent stress factor, which appears in Figure 2, fit very well. The CFI for the model was .95. All of the paths are significant, although event distress does not load as highly on the latent factor as do state anxiety and perceived stress. This may be because the latter two measures are more reliable indices of stress since they contain a greater number of items. The results of Lagrange Multiplier and Wald Tests (see Bentler, 1985) indicate that the model cannot be improved by adding additional paths or by removing paths, respectively.

For example, the model is not improved by adding a path to represent the covariance between number of events and event distress.

Models of stress using alternate combinations of the manifest indicators were tested to rule out the possibility that a better model of stress could be constructed from the present set of indicators. For example, a model incorporating two correlated latent factors was tested, one factor associated with state anxiety and perceived stress, the other factor associated with number of life events and event distress. This model produced an uninterpretable solution involving a negative estimate for the error variance of event distress and an event distress loading of 1.0 onto its predicted latent factor. A two-factor solution could not be fit without these problems. A model incorporating number of life events, state anxiety, and perceived stress as indicators of a single latent factor was also tested. In this model, the path from the latent stress variable to number of life events was not statistically significant, indicating that the model should be rejected.



Comparative Fit Index (CFI) = .95

Figure 2. Best-fitting model of stress.

DISCUSSION

Summary of Results

Compared to norms and to other studies of pregnancy, women in the sample experienced more life events. They were moderately distressed on the life events distress measure, but not high in state anxiety. Perceived chronic stress also appears to be low. For the most part, number of life events, degree of life event distress, degree of perceived chronic stress, and state anxiety were related, although both the correlations of anxiety and perceived stress with number of events were very low. The best-fitting latent stress model was constructed using life event distress, perceived chronic stress, and state anxiety as indicators of a single latent factor. This model fit the data very well.

Stress as a Latent Construct

Although our theoretical framework for conceptualizing stress included environmental conditions, subjective perceptions, and emotional response, the latent stress model which fit best did not incorporate environmental conditions, at least not the major life events that we measured. The best-fitting model was a single latent factor which included only perceptual and emotional components of stress. In other words, it was a phenomenological factor. This suggests that appraisal and emotion may be part of a single underlying construct that is a central component of stress — the experience of stress or distress. Environmental conditions, although not part of this phenomenological latent factor, may represent a second and distinct component of stress. Our results do not clarify the relative definitional importance of phenomenological or environmental approaches, but they do suggest that a two-factor, rather than a single-factor model of stress is indicated.

Although we found that perceived stress and emotional distress define a single latent factor, it is still valuable to distinguish these types of variables theoretically as they contribute to the stress process. Folkman and Lazarus (1985; 1988) offer a conceptually well-elaborated distinction which identifies perceptions of stress as mediators of emotion in a given stressful encounter. They write that "the appraisal process generates emotion" (p. 467, 1988), meaning that emotions are a response to specific evaluations of the encounter and of one's coping resources. It is important to point out, however, that situation-specific appraisals and emotions were not measured in the present study. That is, we did not assess the amount of anxiety attendant to each life event, and we measured general perceptions of chronic stress, not chronic strain tied to specific events. Therefore anxious emotion in the current study did not necessarily occur in response to perceptions of stress, as in the temporal sequence of the Folkman and Lazarus framework. Instead, the observed associations among state anxiety, perceived stress, and life event distress may have signified a variety of relationships, both unidirectional, and bidirectional, among these variables. For example, an already anxious subject may have been more distressed by the occurrence of a major life event, and chronic perceived stress may have contributed to higher state anxiety. Thus, while the present results suggest that stress perceptions and emotion are highly related across situations, event-specific appraisal and emotional responses may be separable as Folkman and Lazarus theorize (1985; 1988).

Why are objective events not an element of the latent factor? One explanation, as Lazarus and his colleagues have emphasized (Lazarus, 1966; Lazarus & Folkman, 1984; Lazarus & Launier, 1978), is that many factors mediate whether an event is perceived as stressful and whether it produces an emotional response. These factors include individual dispositions, beliefs, and commitments, and situational features such as available social support, all of which are captured in the assessment of stress appraisals and emotional response. Number of events does not correlate with extent of stress experience strongly enough to define the construct.

A second aspect of our findings also suggests that perceptions of stress and emotion are critical elements of stress definition, and that these may be partly independent of environmental conditions. Although the women in the sample experienced higher than normal numbers of life events and they are a group with chronic financial difficulties, few socioeconomic resources, and little information about pregnancy (see Scrimshaw, Zambrana, & Dunkel-Schetter, in press), the sample is not very high in perceived distress overall. Objective conditions were a

poor indicator of distress. The fact that women in this population are not highly distressed despite environmental factors predisposing them to be, suggests that there are mediators that reduced or prevented distress. One possibility is that chronic difficulties and major events are expected in their lives. Frequent experience with difficult conditions may lead the women in the sample to become accustomed to the fact that paying for food and medical care is difficult, that they will not receive much support from the baby's father, or that deportation, burglary, and assault are constant threats. Billings and Moos (1982) have shown that chronic experience of life events reduces associated emotional distress. Social comparisons to other members of their communities or neighborhoods may also lead women to expect that difficult conditions are the norm. Habituation and low expectations then may temper the perceived distress aroused by stressful conditions.

A related belief that may protect women from distress is an assumption that they cannot control whether such events occur, which in this socioeconomically disadvantaged population is probably accurate. When individuals truly do not have control over the occurrence of difficult circumstances, correspondingly low perceptions of control may protect them from distress by sparing them the worry or anguish that there is something they could do to keep bad things from happening (cf. Folkman, 1984; Rothbaum, Weisz, & Snyder, 1982). An earlier study of women in the same clinic found low perceptions of control over labor and delivery (see Scrimshaw et al., in press), suggesting that the subjects may expect little control over other domains of their life as well.

A third factor that may buffer distress from chronic difficulty and major events in this population is their strong faith in God. Many of the women in the study believe that God will take care of them. Over 85% of the subjects pray often or almost always "that the birth will go well." This may be what Rothbaum et al. (1982) label a secondary form of control, that is, the identification with a more powerful force which is in control of things. Belfief in God may enable women in this population to withstand chronic strains and major predicaments without being greatly distressed.

Whereas habituation to stressful conditions and low perceived control over one's conditions may have alternated the relationship between objective environmental conditions and perceived stress or emotional upset, there may be other characteristics, such as low self-esteem (Pearlin, 1989), high trait anxiety (Spielberger, 1983) or emotionality (Aldwin, Levenson, Spiro, & Bosse, 1989), that could lead some individuals to appraise environmental conditions as more stressful. If such variables affect the perceptual and emotional impact of objective conditions, as we hypothesize, then stress researchers should not rely exclusively upon or overemphasize objective environmental conditions in the definition of stress.

Perceptions of chronic stress and state anxiety were both stable throughout pregnancy in this sample, which may reflect stable characteristics of the subjects underlying these phenomenological reports. On the other hand, ongoing conditions evoking distress and anxiety might also have been constant throughout pregnancy, as related to the unchanging financial, educational, and marital status of subjects and, for many, their low acculturation. It is also possible that the STAI and PSS measures were not sufficiently sensitive to fluctuations over the nine-month period and that finding stress stability is merely an artifact of the measures. However, especially for the better-validated STAI, which has been shown to be responsive to changes in anxiety in other studies, this seems unlikely. Subject response biases can also be ruled out because both measures contained positively- and negatively-worded items which were scored oppositely. Thus, stable levels of perceived stress

and anxiety are probably caused by relatively enduring characteristics of individuals such as their world views or personalities, and perhaps by unchanging conditions themselves.

In summary, based on a large body of research and theory on stress, we hypothesized that stress is a unitary construct comprised of environmental conditions, individual perceptions of stress, and negative emotion. Our results suggest, however, that environmental conditions are somewhat distinct from perceptions and emotion, and therefore that two factors, rather than one, underlie the definition of stress, at least in the particular population we chose to study. We attempted to validate this conception for use in studies relating stress to health outcomes. Correspondingly, we have evidence that demonstrates the predictive validity of the latent perceptual and emotional stress construct but not the number of life events that occur during pregnancy (Lobel, 1989; Lobel et al., 1990). Number of life events did not contribute at all to the prediction of birth outcome by prenatal stress, whereas the phenomenological latent construct did.

The present study incorporates several theoretical perspectives, specifically environmental, perceptual, and response approaches to the definition of stress. Theoretically well-elaborated definitions of stress have rarely been used in empirical research on stress (Hobfoll, 1989; Leventhal & Tomarken, 1987). This is unfortunate because it slows conceptual development, and because the measures used to draw conclusions about the antecedents and consequences of stress may lack sufficient construct validity. We offer one verifiable approach to examine the factor structure of stress in an attempt to further the multivariate operational and theoretical definition of this variable. We hope to expand the model in future research by examining mediators of perceived stress and emotional upset, such as individual dispositions and beliefs, and to investigate whether relationships between the environmental and perceptual components of stress differ in other populations.

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