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Measurement Issues in Research on Psychosocial Stress

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INTRODUCTION

Our goal in this chapter is to raise and discuss issues relevant to the measurement of psychosocial stress. We go beyond the usual review of stressful life event measurement and attempt to address the stress concept from a broader perspective. In particular, we view stress as a process through which environmental events are interpreted by people in relation to their own values and resources and responded to psychologically, behaviorally, and biologically (Cohen, Kessler, & Underwood Gordon, 1995b). To tackle our goal, we provide a short discussion of the stress process and then outline the major issues in measuring its environmental

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and psychological components: environmental demands (major life events, daily events, chronic strains), psychological appraisals, and emotional responses. The reader is referred elsewhere for discussions of biological stress responses (for cardiovascular response see Krantz & Falconer, 1995; for neuroendocrine response see Baum & Grunberg, 1995; for immunologic response see Kiecolt-Glaser & Glaser, 1995). Because of space limitations, we provide only essential information in regard to assessing each phase of the stress process, and we refer the reader to Cohen, Kessler, and Underwood Gordon (1995a) for an extensive theoretical integration of the components of the stress process and detailed chapters on measurement of each (for major life events see Turner & Wheaton, 1995, and Wethington, Kessler, & Brown, 1995; for daily events see Eckenrode & Bolger, 1995; for chronic stress see Lepore, 1995; for psychological appraisal see Monroe & Kelley, 1995; for emotional response see Stone, 1995).

The sequential relations between the components of the stress process are illustrated in Figure 1. When confronting environmental demands, people evaluate whether the demands pose a potential threat and whether they have sufficient coping resources to deal with them. If they simultaneously find the demands taxing or threatening, and view their coping resources as inadequate, they perceive themselves to be under stress (Lazarus & Folkman, 1984). The appraisal of stress is presumed to result in negative emotional states. If extreme, these emotional states may directly contribute to the onset of affective psychiatric disorder. Negative emotional responses may also trigger behavioral or biological responses that increase risk for physical or psychiatric disorder. The model implies that each component of the stress process is more strongly associated

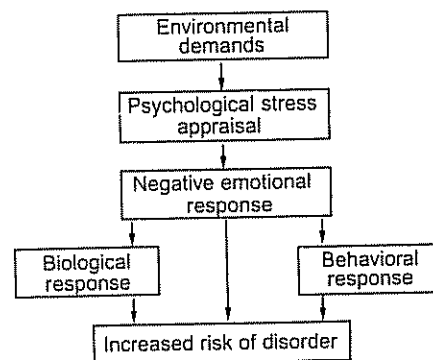


FIGURE 1 The heuristic model showing the sequential relations between the environmental and psychological components of the stress process (i.e., environmental demands, psychological stress appraisal, and negative emotional responses)

with components proximal to it than components distal to it. For example, a measure of environmental demands should be more strongly associated with emotional response than it is with risk for cardiovascular disease. This model is, of course, oversimplified. It fails to specify possible feedback loops and alternative paths through which environmental events may influence responses. We use it here only as a heuristic model to illustrate how different approaches to stress measurement may all tap a single process.

Separately measuring each of these components of the process can lead to the accumulation of information that elucidates important mechanisms regarding the role of stress in psychiatric or physical disorder. Whether investigators choose to assess one, two, or several of these components depends on the outcome of interest as well as in the specific questions they pose.

Separate sections of this chapter focus on the three environmental and psychological components of the stress process (environmental demands, psychological appraisal, and emotional response). Within each section, we describe the kinds of questions the particular approach to measuring stress is best fit to answer, specific approaches to its assessment, as well as some conceptual and logistical issues in its use.

ENVIRONMENTAL DEMANDS

By studying environmental demands we learn about the nature of environmental changes that put persons at risk for the onset or progression of disorder. Although the majority of research investigating the links between environmental demands and disorder has focused on major life events, two other perspectives are also of interest: daily events and chronic stressors. Major life events have been defined in several ways (e.g., Holmes & Rahe, 1967; Turner & Wheaton, 1995), however, for our purposes they are defined as those environmental occurrences that are sufficiently important in their impact that they increase adaptive demands above what would be considered a normative level (e.g., death of a spouse or child, loss of job, divorce). Therefore, these demands have the *potential* to lead to the perception of stress, which occurs when environmental demands are perceived to exceed available coping resources (Lazarus & Folkman, 1984). In contrast, microlevel or daily events are familiar types of daily "hassles" (Lazarus & Folkman, 1984) that seem relatively unimportant compared with major life events (e.g., traffic jams, losing keys, being late for an appointment). Finally, chronic stressors can be conceived of as *enduring* problems that have the potential for arousing threat, for example, the persistent life strains that people encounter as they act as parents, employees, and spouses (Pearlin & Schooler, 1978).

All of these conceptualizations of environmental demands can be used to study questions regarding the stress process. For example, one can document exposure to life events, daily events, or chronic stressors, to determine when and how often stressors in different domains and with different characteristics occur. One could also study the impact of stressors on physical and mental health, or assess the extent to which stressors mediate the effects of personality and social variables on disease. Finally, one might want to explore the personality and social variables that modify the impact of life events, daily events, or chronic stressors.

The Assessment of Major Life Events

Researchers typically adopt one of two approaches to study the association between stressful life events and disorder. The first involves recruiting a sample of individuals who have experienced a similar event. Studies of bereaved individuals, caregivers of people with chronic illness, or survivors of natural disaster exemplify this approach. The second uses samples who have not undergone a common life event. In this case, the goal is to document their varied experiences in relation to disorder. Because this approach is more common and our space is limited, we focus our discussion on it. However, many of the issues we raise are also relevant to the study of event-disorder relations in samples who have experienced a single event.

Major stressful life events occur infrequently and, therefore, life event measures generally assess the occurrence of events over six months or more. Existing techniques not only assess the occurrence of events, but other characteristics as well, for example, event type or domain, magnitude, temporal characteristics, and nature or relations between combinations of events.

Checklist Measures of Life Events

Checklist measures of life events represent the traditional and dominant procedure for gathering data on event exposure, especially within large-scale studies (Turner & Wheaton, 1995). The 43-item Social Readjustment Rating Scale (SRRS) has been used extensively for over twenty years and is a well-known example of a checklist measure of life events. In the SRRS, each event is assigned a standardized weight based on judges' ratings of the degree of adjustment required by the event (Holmes & Masuda, 1974). These weights are called "life change units" (LCU) and their sum represents the amount of environmental stress an individual has experienced (Holmes & Rahe, 1967). Investigators who use the SRRS implicitly assume that the amount of stress experienced by an individual is determined by the *cumulative* amount of change or readjustment brought about by events occurring in one's life.

Do checklist measures of life events predict disorder? There are reliable associations between the experience of life events and the occurrence of psychological distress, and to a lesser extent, clinical disorders including psychiatric disorder, infectious, allergic, and autoimmune diseases, coronary disease, accident and athletic injuries (Turner & Wheaton, 1995). The magnitude of these associations, however, has been moderate at best. Correlations are usually under .30 and rarely exceed .40 (Rabkin & Struening, 1976). This means that events explain *at most* 16% of the variance in psychological outcomes (and even less in physical outcomes). Even when vulnerability factors (e.g., social support, skills, attitudes, personality characteristics) are taken into account, seldom does the amount of variance in psychological outcomes increase dramatically (Cohen & Edwards, 1989; Cohen & Wills, 1985; Kessler & McLeod, 1985; Kessler, Price, & Wortman, 1985). This is a modest association given the theoretical importance attached by many stress researchers to the occurrence of life events. In an attempt to understand why so little variance is explained by life event measures, we discuss five issues, including: the comprehensiveness of event coverage; event weighting; timing of the measurement of events and disorder; reliability and validity of event measurement; and the valence of life events.

Event List Comprehensiveness It is desirable that checklists contain representative or comprehensive samples of the population of possible events. Although no checklist measure of life events can include the full universe of possible life events, the SRRS and other checklists typically omit certain relatively common experiences (e.g., being a crime victim), and exclude other common but socially sensitive events (e.g., marital infidelity, difficulty conceiving) (Thoits, 1983). "Nonevents" are also omitted (Gersten, Langner, Eisenberg, & Orzek, 1974). These are events that are desired or anticipated, but do not occur (e.g., not getting married, not getting a new job, not having children). As Thoits (1983) notes, most standard checklists also selectively emphasize events of young adulthood (Rabkin & Struening, 1976), underrepresent events that occur to women (Makosky, 1980), and omit events that are common in the lives of the poor and certain racial and ethnic groups (Rabkin & Struening, 1976). The use of checklists that omit events that occur with reasonable frequencies results in attenuated relations between stress and disorder.

How comprehensive do event lists need to be? Turner and Wheaton (1995) suggest beginning with a list of 30 to 50 prevalent events from existing checklists and supplementing the list so as to make sure that relevant events are included for the population being studied. Relevance to the population, of course, includes consideration of the age (or life stage) of the target sample, as well as income level, race, and cultural group from which the sample is drawn. An appendix is included in

Turner and Wheaton (1995) that lists available checklists separated by developmental stage (e.g., childhood, adolescence, adulthood, old age). Although this results in the use of somewhat different event lists in different studies, content differences do not seem to result in major differences in the magnitude of event-disorder relations with traditional mental health outcomes. Whether this is the case with physical health outcomes is less clear (Turner & Wheaton, 1995).

One caution regarding inclusion of events in lists needs to be made. It is important to consider excluding items that confound events with outcomes. For example, many items on checklists are either indications of or possible products of existing disorder, rather than independent events that might lead to disorder (e.g., changes in eating habits, changes in sleeping habits). Many items on event checklists may overlap with the outcomes they are intended to predict (Thoits, 1983), and such confounding might partly account for the persistent associations observed between event scores and health outcomes. Dohrenwend and Dohrenwend (1974, 1978) suggest that events found in the typical inventory include those that reflect psychological functioning, those that reflect physical illness, and those that are independent of physical and psychological health status. They suggest that when considering event-disorder relations, it is most appropriate to rely only on the latter category of events. The dropping of events from existing inventories must be done with great care, however, since this may alter the psychometric properties of the scale or bias the domain that the scale assesses (Cohen et al., 1995b). Moreover, some events that appear to be confounded with outcome might be important predictors of the outcome (e.g., changes in sleeping habits leading to illness). Fortunately, event-disorder relations appear to persist, although attenuated, when clearly confounded and questionable events are excluded from consideration (Turner & Wheaton, 1995). Regardless, we suggest that careful consideration be given to whether potentially confounded items should be included in particular contexts and how these items will be dealt with if they are included.

Another issue is that the endorsement of life events on checklists may reflect enduring personality characteristics. Certain characteristics (e.g., neuroticism) may lead individuals to perceive the occurrence of more events, report more events, or experience more events (Costa & McCrae, 1985). If the same personality characteristic is also associated with higher rates of disorder, it may be that the personality characteristic is responsible for both more events and greater disorder. This problem is minimized with prospective designs, where the experience of events are used to predict changes in the outcome from one time to another (Cohen et al., 1995b). In addition, researchers can assess key personality characteristics that are viable explanations for potential event-disorder associations, and test for their utility in accounting for variance in the relations (e.g., Cohen, Tyrrell, & Smith, 1991).

Event Weighting Recall that in the SRRS each event is assigned a standardized weight based on judges' ratings of the degree of adjustment required by the event (Holmes & Masuda, 1974). These weights are called "life change units" (LCU) and their sum allows for a summary measure of environmental stressors (Holmes & Rahe, 1967). Other methods of weighting events include asking subjects to subjectively rate the impact of experienced events (Sarason, Johnson, & Siegel, 1978; Vinokur & Selzer, 1975) and unit weighting each experienced event (i.e., weighting them equally). Little predictive power is gained from the use of either objective or subjective weights (Sandler & Guenther, 1985; Zimmerman, 1983; Monroe, 1982a,c). Rather, unit weighting all events results in virtually identical or higher correlations between total number of life events and disorder (Thoits, 1983; Turner & Wheaton, 1995).

Why is it that attempts to weight events in various ways do not lead to more accurate prediction of disorder? LCUs have been criticized for several reasons, including that readjustment ratings differ by cultural and ethnic group, age group, and sex (Thoits, 1983). Therefore, applying one set of weighting norms to subjects from different subcultures, or from different ethnic or sociodemographic groups will probably decrease the accuracy of prediction of disorder. Subjective weights might also spuriously enhance the association between events and disorder because these ratings can reflect concurrent psychological distress and hence confound event scores with psychiatric outcomes. In cross-sectional studies that use subjective weights, the correlation found between life events and disturbance may be partly attributable to the biased ratings of events made by distressed individuals. This problem is eliminated in prospective designs, where a stress measurement is used to predict changes in the outcome from the point of measurement to a follow-up (Cohen et al., 1995b).

A more recent alternative approach for weighting life events has also been suggested, although there is much discussion regarding the validity of the approach. Specifically, multiple regression techniques can be used to derive weights for events. When this approach is applied post hoc, it produces much larger correlations with outcomes than the other approaches described above (Ross & Mirowsky, 1979; Shrout, 1981; Taussig, 1982). In this technique, individual events are weighted in the total index by their effects on the outcome. The use of regression-based weighting, however, has been criticized as being atheoretical and leading to nongeneralizable weights. More seriously, the approach capitalizes on chance, thereby producing the larger correlations with outcomes. Turner and Wheaton (1995) provide a comprehensive discussion of the benefits and drawbacks associated with the use of regression-based weighting. We suggest, however, that if this technique is going to be used, it should be used with a very large sample. Weights can be generated with half the sample and prediction of disorder can be accomplished using the other

half. Alternatively, one could apply regression weights derived from one sample to other similar samples.

Timing of Measurement of Events and Disorder Most studies using the checklist approach to the assessment of life events have used a one-year time frame for the occurrence of events, although time frames have ranged from a few weeks to a lifetime (Turner & Wheaton, 1995). A one-year time frame was used because of the assumption that that is when the effects of stress would be evident (Holmes, 1979; Holmes & Masuda, 1974). Evidence for this assumption is actually limited (Monroe, 1982b), and very little is known about the time lag between event occurrence and symptom formation. Some research indicates that onset of psychological symptoms is most likely to begin 3–4 weeks after a closely spaced cluster of events (Brown & Birley, 1968; Brown & Harris, 1978; Paykel, 1974, 1979), and other research suggests higher correlations between events and disorder when events are aggregated over shorter time periods than one year (Grant, Sweetwood, Yager, & Gerst, 1981). It is likely that the time lag varies with different disorders. The problem is that many studies are cross-sectional, use a one-year time frame for the cumulation of events, and concurrently assess disorder. Thus, the low correlation between events and disorder may occur because the timing of measurement of disorder relative to the occurrence of events is not optimal for detecting relations.

Of course, in order to time the assessment of symptoms, it is important to be able to accurately date the occurrence of the event. That is, did the event occur 6, 9, or 12 months ago? For some events (e.g., deaths, births), recalling specific dates may not be problematic. For the vast majority of events, however, recall biases arise. For example, people are likely to misdate distant events into a more recent time period (McQuaid et al., 1992; Raphael, Cloitre, & Dohrenwend, 1991). Providing a calendar with holidays and birthdays of the respondent and close relatives has been found to help subjects' memories. Accurate dating of events allows for the investigation of time elapsed since the occurrence of events as a predictor of disorder. Paying attention to the timing of events *relative to one another* might also enhance the predictiveness of events for the onset and severity of disorder. Important events often create other events. For example, loss of a job may result in a change in income, force a residential relocation, and the loss of friends. Such chains of related events tend to cluster within a relatively short period of time. Coping resources may be overtaxed when events cluster in time.

Finally, the speed with which individuals resolve events will also influence the event-disorder association (Thoits, 1994; Turner & Avison, 1992). For example, compare a person who divorced ten years ago and is still distressed by the fact with another whose spouse died six months ago

after battling a long illness and is starting to feel relief rather than grief. The second person has obviously started to resolve the loss, while the first has not. If a one-year time frame is used for the assessment of events and disorder, the association between the two would be attenuated because the second person has been able to resolve the event, while the first person would be reporting distress without the occurrence of an event. Therefore, in order to better understand event-disorder relations, it may aid the investigator to obtain an assessment of event resolution for each experienced event. This has been done within a checklist framework and results have shown that information about whether events were resolved added to the ability to predict levels of psychological distress (Turner & Avison, 1992).

Reliability and Validity of Checklist Measures of Life Events Three types of reliability are typically examined with respect to checklist measures of life events: (1) recall reliability; (2) test–retest reliability; and (3) internal consistency. Examining the distribution of recalled events over time estimates the reliability of recall (Thoits, 1983). No significant decline in the average number of events reported for recent to more remote months should be found if recall is accurate. However, people may not be all that accurate in recalling events. Uhlenhuth, Haberman, Balter, and Lipman (1977), for example, found a falloff rate of approximately 5% per month over an 18-month period, suggesting that more events were reported in recent than in remote months.

Second, test–retest correlations have been low to moderate in size. For time periods of 6 months they range from .38 to .55 (Neugebauer, 1981). However, some of these test–retest studies have included life events on the second testing that occurred during the test–retest interval. Including the events that occur during this time period would naturally lower test–retest correlations. When shorter time periods are used between test and retest (e.g., 3 to 5 weeks), reliabilities tend to be around .60 to .70 (Sarason et al., 1978). Although these are higher, one might expect better reliability for “major” stressful life events over such a short time period. Another issue to consider is that test–retest correlations only indicate whether there is stability in overall scores, not whether specific events are reliably reported over time. In fact, when test–retest reliabilities for specific events are examined, reliability of recall seems to decline even more. For example, although Horowitz et al., (1977) found a test–retest correlation of .82 between the total number of events experienced, only 60% of the events checked at the first assessment were checked again at the retest. If reliabilities for the number of specific events are to be examined, we suggest using the kappa statistic rather than percent agreement scores because kappa adjusts for chance agreements (Siegel & Castellan, 1988). Without a correction for chance, a

percent agreement score increases with increases in the numbers of life events reported.

Third, estimates of internal consistency for life event checklists have also been in the low to moderate range. As Turner and Wheaton (1995) point out, however, this is one case when it is not clear if high reliability is desirable. For example, some argue that these measures should have low internal consistency as well as low interitem correlations (Cleary, 1981; Pugh et al., 1971). The rationale for this point of view comes from the assumption that items on a checklist are *not* intended to be estimates of a single underlying construct or characteristic and, therefore, should have nothing in common save their potential relevance to the dependent variable. In other words, "since there is no *necessary* expectation that the experience of one event increases the likelihood of another, there should be no expectation that event inventories would display internal reliability" (Turner & Wheaton, 1995: 37). On the other hand, Turner and Wheaton (1995) also note that there are reasons to anticipate modest relations among some events in checklists. One rationale for this point of view comes from the assumption that some stressors arise for social or developmental reasons (Aneshensel, 1992; Pearlin, 1989). To the extent that events are linked by an individual's location in the social system, intercorrelations among these items will be observed (Turner & Wheaton, 1995). Interitem correlations might also be expected in the case of clusters of events. As mentioned earlier, important events often create other events. For example, divorce may result in a change in income, may force a residential relocation, or result in the loss of children. Such related events tend to cluster within a relatively short period of time and would increase internal consistency.

Are life event instruments valid? That is, do checklist measures of life events measure what they are supposed to? Perhaps not. Raphael et al. (1991) and McQuaid et al. (1992), for example, demonstrated that respondents misclassify their experiences in order to fit life events, and thus report inappropriate life events on checklists. Furthermore, respondents have been shown to report minor or even positive events in response to questions that were designed to elicit only highly negative and undesirable events (McQuaid et al., 1992). Reports of life events are also influenced by current mood. Specifically, current mood is related to selective memory for recent events or biased appraisal of remembered events if subjective evaluations of experienced events are used instead of normative judgment (Bower, 1981; Clark & Isen, 1982; Cohen, Towbes, & Flocco, 1988). Finally, the endorsement of life events on checklists may reflect enduring personality characteristics. That is, as mentioned before, certain characteristics (e.g., neuroticism) may lead an individual to perceive the occurrence of more events, report more events, or experience more events (Costa & McCrae, 1985). So the endorsement of events

may not reflect their chance occurrence, but the influence of the personality characteristic instead. One method for circumventing this issue is to assess prime personality traits that might be responsible and account for them statistically when considering event-disorder associations.

Valence of Life Events The historical perspective on the association between the occurrence of life events and disorder was that the effects of stressors operated largely through the creation of excessive adaptive demands. This perspective emphasized that the amount of stress experienced was determined by the cumulative amount of change or readjustment brought about by events occurring in one's life. That is, the more life change individuals experienced, regardless of whether it was positive or negative, the more likely their coping or resistance resources would be overtaxed and disorder would follow (Holmes, 1979; Holmes & Rahe, 1967). More recently, this assumption has been challenged and an alternative hypothesis has gained prominence. Specifically, the more severe a single negative event, or the more negative events experienced, the more likely coping abilities will be depleted and disorder will follow (Brown & Harris, 1978). The critical quality of life events here is thought to be their undesirability or valence, rather than the amount of change they require.

Substantial evidence has accumulated that suggests that undesirable change is more predictive of disorder than total amount of change (see Turner & Wheaton, 1995). Zautra and Reich (1983), for example, reviewed 17 studies of the relations of desirable and undesirable events to measures of psychological distress. Events were classified by researchers' or judges' evaluations of their desirability, or by respondents' subjective ratings of each event. A consistent pattern emerged with increased psychological distress associated with negative events, but findings with positive events were conflicting and weak. Furthermore, even in those cases where positive events *were* associated with distress, controlling for differences in the number of negative events eliminated the associations. Therefore, the relations between total number of events (or total amount of life change) and psychological distress reported in several previous studies are probably attributable to effects of negative events alone.

Can we conclude with confidence that positive life changes play *no* role in the stress process? Probably not. First, it may be that the domain of positive events has not been tapped comprehensively. Many current scales ask only about normatively negative events. Moreover, on scales that include positive events, there are many fewer positive than negative items. If the full domain of positive events is not being tapped, the relation between their occurrence and various outcomes will be attenuated. Alternatively, the mechanism of effect that positive events have in the stress process may not have been tested adequately (e.g., using ap-

propriate statistical models to test whether they are buffers of the stress process; Cohen & Hoberman, 1983). Therefore, we suggest that further work is needed to develop the assessment of positive events in a way analogous to the comprehensive assessment of negative events. A fair test for the role of positive events needs to be accomplished prior to discounting their effects.

Summary of Checklist Measures Checklist measures remain the dominant method for assessing exposure to major life events by those who view that it is the cumulative magnitude of life change (or negative life change) that predisposes individuals to disorder. We have discussed several issues that bear on the original question of why checklist measures of life events do not predict psychological or physical disorder better than they do. These same issues also help determine some of the things important to consider if a checklist measure is used. Regarding event list comprehensiveness, the population of possible events should be represented as fully as possible. The universe of events will necessarily differ depending on specific characteristics of the sample like age, sex, race, or income. In addition, inclusion of nonevents and positive events should be considered. Because of evidence indicating that event resolution may be an important moderator of event-disorder relations, assessment of event resolution should be considered. Moreover, efforts to accurately date the occurrence of events will aid in the prediction of disorder. Finally, unless the available sample size is very large, we recommend weighting items in the checklist equally. This approach yields empirically equivalent findings and avoids potential confounds that arise when subjects rate the impact of events. If access to a large sample is possible, however, the investigator might wish to attempt the regression-based weighting technique. Again, weights should be generated with only a portion of the sample, and the prediction of disorder should be made using the remainder of it.

Interview Measures of Life Events

There are several reasons that investigators might prefer interview measures over checklist measures of major life events. First, studies comparing checklist and interview methods demonstrate that interview methods are able to achieve higher test-retest reliability (Katschnig, 1986; McQuaid et al., 1992). Second, interviews allow for more flexibility in event elicitation and recording, as well as self-nomination of stressful experiences not evoked by direct questions about specific events and transitions (Brown & Harris, 1978; Wethington et al., 1995). Therefore, interview techniques are more likely to *comprehensively* cover the full range of experienced events. Finally, interviews allow for more accurate dating of events than checklist methods. Checklist methods are more

prone to a “telescoping” effect, that is, the misdating of more distant events into a more recent time period (McQuaid et al., 1992; Raphael et al., 1991). Memory aids such as calendars, visual representations of important events of the preceding year, or well-timed reminders of personally salient dates improve dating accuracy (Wethington et al., 1995).

However, interview methods are costly and time consuming. Depending on the interview, the amount of time required from the respondent can range from 1 to 3 hours. Training of interviewers and raters, as well as rating interviews take additional time. Wethington et al. (1995) suggest that if the sample size is manageable (less than 400), respondents are not overtaxed, and financial resources are available, interview methods may be a better choice than checklist measures for assessing the experience of major life events.

Currently, the most widely used personal interview method is the Life Events and Difficulties Schedule (LEDS; Brown & Harris, 1978; Harris, 1991; Wethington et al., 1995). The LEDS is a semistructured survey instrument that assesses whether a wide variety of life events have occurred over the past 12 months. This protocol uses investigator-based ratings that attempt to estimate the impact of an event for the average person, avoiding individual subjective reactions (Wethington et al., 1995). The interview elicits detailed descriptions of events as well as social and biographical data on respondents. Ratings of *threat* constituted by each event are done by a group of at least three trained persons. The interviewer describes each event and circumstances surrounding the event to the group. The raters use a dictionary of events that has been compiled over the years since the inception of the LEDS, to decide on events that are similar to the experienced event. Since events listed in the dictionary have been previously rated, the trained raters can evaluate the likely meaning of the experienced event (i.e., normative degree of threat), given its nature and the individual circumstances surrounding it. These contextual ratings indicate both whether a particular event poses short- or long-term threat, and the degree of that threat. Short-term threat is defined as that implied on the day of the event (or soon afterward), while long-term threat is that implied about one week after the occurrence of the event. The rating of contextual threat is made on a four-point scale ranging from little or none to marked. The rating of contextual threat is the critical component of the LEDS, because it is the experience of severe threat that is hypothesized to pose a risk for developing disorder (Wethington et al., 1995). In fact, from this perspective, as long as a *single event* characterized as posing severe threat has occurred, the individual is hypothesized to be at risk for disorder. This is in contrast to other approaches to the assessment of major life events, where it is the cumulation of events and their impacts that is thought to place people at risk.

Wethington, Kessler, and Brown (1993) are currently developing a shortened version of the LEDDS called the Structured Life Events Inventory (SLI). There were two goals associated with the development of this scale: (1) to use more typical structured interview techniques; and (2) to reduce the amount of time required to produce contextual threat ratings and to train interviewers (Wethington et al., 1995). Preliminary data suggest that SLI interviewers can reliably distinguish severe from minor events, that risk of depression using ratings from the SLI is similar to that using ratings from the LEDDS, and total time per interview is 15 hours compared to 22 for the LEDDS (Wethington et al., 1995).

A recent alternative to the LEDDS is the Structured Event Probe and Narrative Rating (SEPRATE; Dohrenwend et al., 1993). The protocol is very similar to the LEDDS, however, there are two conceptual differences. First, in the SEPRATE the importance of events is viewed cumulatively. Second, recall that in the LEDDS the raters evaluate the normative degree of threat given the nature of the event *and* the individual circumstances surrounding it. In the SEPRATE, however, raters are not provided with any information that might be used to infer "vulnerability" to the effects from a given stressor. This is done to prevent vulnerability to an event from being confounded with the rating of the severity of the event itself, a frequent criticism of the LEDDS (e.g., Dohrenwend et al., 1993; Tennant, Bebbington, & Hurry, 1981). This issue can be best illustrated with an example of an individual who has experienced the death of a friend. Information interviewers would elicit regarding the circumstances surrounding the death is whether the friend was the only available confidant, the quality of the predeath relationship, or the frequency of contact in recent years. While this information would be *essential* in making the severity rating in the LEDDS, it would be intentionally excluded when making the ratings in the SEPRATE. This is because from the perspective of the SEPRATE, it is information that affects an individual's vulnerability to the loss of a friend. Wethington et al. (1995) note, however, that most events are less influenced by factors related to vulnerability than death is. For example, the SEPRATE and the LEDDS would use more similar types of information when making ratings of health events or job losses because there are more objective situational factors associated with these types of events (e.g., amount of disability, unemployment rate, etc.).

Summary of the Assessment of Major Life Events

The two primary approaches to the assessment of major life events are the checklist approach and the interview approach. Checklist measures of life events represent the traditional and dominant procedure for gathering data on event exposure, especially within large-scale studies. This is because interview measures are expensive and time consuming, as well

as taxing for the respondent. Interview measures, however, have the potential to provide far richer data than checklist measures. Thus, if the needed resources are available, assessing major life events through interview measures may be preferable to more fully document associations between different characteristics of events and circumstances and resulting disorder. However, because interview measures will be logistically difficult for most investigators interested in event-disorder relations, considering the issues that were raised with respect to checklist measures of life events will help researchers maximize the amount of useful information available to them.

The Assessment of Daily Events

Measures of daily events assess minor stressful experiences occurring on a daily basis (e.g., traffic jams, losing keys, being late for an appointment). As with the assessment of major life events using the checklist approach, researchers interested in daily events implicitly adopt the view that it is the *cumulation* of small events that places people at risk for disorder. For example, compare a person who gets a parking ticket with one who, within a 3-hour period, has an argument with a colleague, gets a call from his or her child's teacher regarding a behavior problem, misplaces a valuable piece of jewelry, catches a student cheating in class, and *then* gets a parking ticket. Intuitively, you might expect the second person to experience substantially more distress than the first. Of course, answers to the questions of how many events, what kind of events, and over what period of time they need to occur in order to place a person at risk for disorder are unknown. However, reporting increased numbers of daily events is related to reports of daily negative mood (Stone & Neale, 1982), to concurrent and future reports of increased psychological symptoms (Eckenrode, 1984; Monroe, 1983), as well as increased demoralization and distress, and decreased well-being and quality of life (Zautra, Guarnaccia, & Dohrenwend, 1986). Occurrence of daily events is also related to increased physician use (Gortmaker, Eckenrode, & Gore, 1982), reduced white blood cell counts (Kubitz, Peavey, & Moore, 1986), and higher blood glucose among diabetics (Cox et al., 1984).

What conceptual questions can an investigator address using a daily events instrument? One might document exposure to daily events to determine when and how often stressors in different domains and with different characteristics occur. One could also study the impact of daily events on daily changes in mood, distress, or psychological symptoms, or assess the extent to which daily events mediate the effects of personality and social variables on disease. One might also investigate the interrelationships between daily events over time in order to determine whether negative events have a cascading effect, or the extent to which daily

events make up the elements of chronically stressful experiences or mediate the effects of major life events (Eckenrode & Bolger, 1995). Finally, the daily event technique is especially amenable to studying causal relations between the occurrence of events and various outcomes. Since daily events occur with relatively high frequency, it is possible to study the effects of such events prospectively over short time intervals with repeated observations to identify the temporal ordering of the event–distress relation (Zautra, Guarnaccia, Reich, & Dohrenwend, 1988).

Assessing Daily Events Using Questionnaires

The method typically used to assess the occurrence of daily events is a self-report checklist measure. One of the early daily event scales, the Hassles Scale, emerged from the transactional model of the stress process (DeLongis et al., 1982; Kanner, Coyne, Schaefer, & Lazarus, 1981). This model views stress as the perceived threat and demands imposed by the environment, and hence includes both the occurrence of the event as well as the individual's response to the event (Lazarus & Folkman, 1984). The 117 items on the Hassles Scale cover the areas of work, health, family, friends, the environment, practical considerations, and chance occurrences. The scale was originally designed to be used retrospectively, with respondents rating hassles that occurred over the previous month. In particular, respondents rate the severity of each hassle that occurred on a 3-point scale, resulting in a frequency (number of hassles checked) as well as an intensity (mean severity of hassles) score. An Uplifts Scale, consisting of 135 items, was also developed to ask about positive experiences in areas similar to the Hassles Scale.

The Hassles Scale has been criticized because of the apparent confounding of items with measures of psychological distress or psychopathology (Dohrenwend, Dohrenwend, Dodson, & Shrout, 1984; Dohrenwend & Shrout, 1985; Lazarus, DeLongis, Folkman, & Gruen, 1985; Monroe, 1983). For example, items such as “thoughts about death,” “use of alcohol,” “trouble making decisions,” “being lonely,” and “not getting enough sleep” are clearly measures of distress or distress-related concepts. In fact, many of these items exist in almost the same form on measures of psychological distress. Moreover, other items on the scale look very much like major life events and are inappropriate on a measure of daily events (e.g., “laid off or out of work” and “problems with separation or divorce”), while a larger number reflect standard chronic stressors that are not likely to fluctuate over short periods of time (e.g., “not enough money for basic necessities,” “overloaded with family responsibilities,” and “difficulties getting pregnant”). A revised 53-item Hassles and Uplifts Scale (DeLongis, Folkman, & Lazarus, 1988) attempts to overcome some of these problems. Items clearly confounded with psychological distress were dropped, as were those items that did

not tap events that would be expected to fluctuate on a daily level. In addition, respondents rate each item on 4-point scales regarding the extent to which it was a hassle or an uplift, allowing items to contain both qualities. This version is also short enough to be practical for use on a daily basis.

Other self-report scales are also available to assess the occurrence of daily events (see Eckenrode & Bolger, 1995). These include the 178-item Inventory of Small Life Events (Zautra et al., 1986), the 78-item Daily Life Experiences Checklist (Stone & Neale, 1982), and the 58-item Daily Stress Inventory (Brantley & Jones, 1989; 1993). As with the Hassles Scale, these scales all have items that reflect several domains among which small events might occur (e.g., work, leisure, family and friends, financial, environmental, interpersonal), and they are all designed to gather information regarding positivity as well as negativity of experiences. The latter two scales were both developed to assess events on a daily basis (as their number of items reflect), while the Inventory of Small Life Events, like the original Hassles Scale, was developed to assess events retrospectively over a one-month period.

Conceptual and Methodological Issues in the Assessment of Daily Events

What sorts of issues should be considered when choosing a self-report checklist measure for the assessment of daily events? Several issues similar to those relevant to the assessment of major life events are important to consider. First is the valence of events. Both positive and negative experiences have been assessed in daily event research. It is, therefore, surprising that there is relatively little evidence regarding whether positive events are related to distress or coping (Reich & Zautra, 1988). Some work using the Uplifts Scale (i.e., retrospective reports of uplifts over the previous month) has indicated that uplifts do not explain anything over and above hassles in the relation between hassles and health (Lazarus, 1984). On the other hand, Stone, Reed, and Neale (1987) have demonstrated that positive events decrease in frequency 3 to 4 days prior to the onset of cold or flu symptoms. Not many other studies, however, examine the association between disorder and positive daily experiences. This is because, like studies of major life events, the focus of almost all daily event research has been on negative events. Therefore, although information has been gathered regarding the occurrence of positive events, this literature fails to adequately address potential relations with psychological distress or well-being.

Second, as with measures of major life events, the issue of items being confounded with outcomes is an important one. We already mentioned this as one major criticism of the Hassles Scale. For example, items in the original Hassles Scale such as "thoughts about death" and "fear of rejection" appear to measure similar features as scales of psychological dis-

tress. The format for asking about the occurrence of daily events in this instrument may also confound event occurrence and psychological distress. The original scale asks respondents to indicate whether each hassle happened in the last month and then go back and judge its severity. As Dohrenwend and Shrout (1985) point out, there is no response category for anything that is less than "somewhat severe." Therefore, if an event is not at least somewhat severe, it is not a hassle. If so, then endorsements on the items are limited to those individuals experiencing difficulty in coping (Dohrenwend & Shrout, 1985). As mentioned earlier, the revision of this measure attempts to overcome this problem.

The other confound that is important to consider in using measures of daily events is due to enduring mood states or stable personality characteristics. As with major life events, certain characteristics may lead an individual to recognize and recall more small events, report more events, experience more events, and report higher rates of disorder (Costa & McCrae, 1985). Again, the use of a prospective design and assessing key personality characteristics and testing for their influence are ways to avoid this potential confound.

Fourth, reporting biases also need to be considered. Specifically, psychological distress will affect concurrent reports of daily events, increasing their apparent relation. Brown (1974) referred to a distressed individual's "effort after meaning," suggesting that those with higher levels of psychological distress identify more undesirable small events to explain or justify their distress. One way to minimize the problems presented by reporting biases due to transitory mood is to delay the administration of the outcome measures to some time after the assessment of small events. Zautra, Guarnaccia, and Reich (1984), for example, found that psychiatric distress and negative affect reported five days after events reports were reliably associated with an increase in the number of undesirable small events. Of course, the most effective way to avoid these kinds of reporting biases is to assess distress at more than one time point and then to prospectively determine the association of *changes* in distress with the occurrence of daily events.

Finally, scales that can be completed on a daily basis are often used in what is called a daily diary design. A daily diary design is essentially a longitudinal design that involves repeated assessments of daily stressors over the course of a single day, over multiple days, or both (Eckenrode & Bolger, 1995). The effects of repeated assessment on event reporting (i.e., reactivity) is a primary concern when measures are completed several times over a short period of time (e.g., daily or more often). For example, event frequency declines as the number of days of diary recording increases (Bolger, DeLongis, Kessler, & Schilling, 1989), and psychological distress is higher during the first few days of recording than on later days (Bolger, 1990). Eckenrode and Bolger (1995) suggest two pos-

sible solutions to the problem of reactivity. First, where the research question of interest is the association between events and outcomes, day-of-study can be used as a control variable in the analysis phase of the study. Second, it may be feasible to discard the first few days' data, if these seem to be strongly affected by subject reactivity (Tennen, Suls, & Affleck, 1991).

Summary

Measures of daily events can be used to answer several sorts of questions regarding the stress process. Daily event measures are used to collect data retrospectively over weekly or monthly periods as well as in the daily diary technique. Daily assessment methods are, however, labor and cost intensive. Considerable effort is required to teach subjects recording tasks, collect data, and maintain low attrition. This approach also requires many hours of data entry and reduction, and complex statistical analyses to exploit the richness of the datasets (Stone, Kessler, & Haythornthwaite, 1991). Regardless, the use of daily diary methodologies has expanded our understanding of the impact of the psychosocial environment, and, because of their typically prospective designs, has facilitated causal interpretation of microprocesses underlying daily experiences. If the resources required for a daily diary technique are not available, however, the retrospective assessment of events is a viable alternative in some instances.

The Assessment of Chronic Strains

Many of the problems with which people cope are not of the magnitude of major life events, but are persistent hardships experienced by those engaged in normal or typical social roles (Pearlin & Schooler, 1978). Social roles are comprised of sets of interpersonal relationships, activities, duties, and responsibilities that are relatively easy to identify and tend to be stable (e.g., work or marital roles) (see Lepore, 1995). Difficulties functioning in these roles can be very stressful, perhaps because of the investment people make in them (Eckenrode & Gore, 1990; Lepore, 1995; Lepore, Palsane, & Evans, 1991; Pearlin, 1989). Sociologists refer to difficulties in role functioning as chronic social strain. Pearlin and colleagues (Pearlin, 1983; Pearlin, Lieberman, Menaghan, & Mullan, 1981) have suggested that the experience of life events may alter the meanings of existing strains, generate new strains, or magnify existing strains. Alternatively, the impact of recent acute events may be amplified in the presence of chronic strains (Brown & Harris, 1978; Paykel, 1978).

How are chronic stressors or role strains typically assessed? Below, we draw on Lepore (1995) and briefly discuss three primary methods, in-

cluding self-report questionnaires or checklists, interviews, and observation (i.e., reports of another observer).

Measuring Chronic Strains with Questionnaires

The majority of researchers interested in assessing chronic strains use self-report measures that tap perceptions and attitudes about potentially stressful aspects of social conditions and roles (Lepore, 1995). One 90-item measure, for example, assesses potential sources of chronic strains over multiple domains, including financial matters, work, marriage, family and children, social life, schooling, crime and legal matters, residence, religion, and health (Wheaton, 1991). Most published measures of chronic strains, however, are domain specific. The two areas receiving the most attention are the work and marital arenas. Lepore (1995) provides a list of the most commonly used available measures in each area. Among the chronic strain measures he cites are the Work Environment Scale (WES; Moos, 1981), the Occupational Stress Inventory (OSI; Osipow & Spokane, 1987), and the Job Content Questionnaire (JCQ; Karasek, 1985); and among the measures of marital role strains are the Family Environment Scale (FES; Moos & Moos, 1981), the Marital Situations Inventory (MSI; Smolen et al., 1985), and the Marital Agendas Protocol (MAP; Notarius & Vanzetti, 1983). Both the WES and FES differ from the other measures because they tap global perceptions of the work and family environments as opposed to perceptions of particular stressors (Lepore, 1995).

These measures tend to be multidimensional, allowing investigators to focus on either a specific aspect of the role stressor or the role stressor in general. For example, the work strain measures typically include items related to role conflict, work demands or overload, role ambiguity, lack of control or autonomy, lack of support or cohesion, job insecurity, interpersonal conflicts, and responsibility for others (Lepore, 1995). The marital role strain measures include items related to problems in communication, verbal and/or physical abuse, lack of emotional closeness and affection, sexual problems, excessive role demands, inequity in division of labor or decision-making power, and difficulties with relatives or friends of spouse (Lepore, 1995).

Although there are several widely used self-report questionnaires assessing different chronic strains, many problems exist with respect to their use. First, as is the case with checklist measures of life events and daily events, enduring mood states or stable personality characteristics may lead an individual to recognize and recall more chronic strains, report more strains, experience more strains, and report higher rates of disorder (Cohen et al., 1995b). Second, again akin to the issue with measures of major life events, the issue of items being confounded with outcomes is an important one. For example, items asking about inter-

personal conflicts, work overload, or lack of emotional closeness might largely reflect psychological distress. Third, Lepore (1995) notes that self-report measures confound the objective components and subjective evaluations of chronic strains, because subjects evaluate the strains in addition to describing them. Finally, Lepore (1995) raises the issue that these measures seldom directly measure duration and frequency of exposure to the stressor. To truly test the effects of chronic role strains, the variance in exposure must be systematically studied. The ideal approach for assessing duration is to take multiple measures over time, and strains that recur can be considered to be chronic.

Measuring Chronic Strains with Interviews

There are several reasons raised earlier that investigators might prefer to use interviews to assess chronic strains. First, studies suggest that interview methods are able to achieve higher test–retest reliability (Katschnig, 1986; McQuaid et al., 1992). Interviews also allow for more accurate dating of events than self-report questionnaires. Memory aids such as calendars, visual representations of important events of the preceding year, or well-timed reminders of personally salient dates improve dating accuracy (Wethington et al., 1995). The LEDES, described earlier, can explicitly assess chronic strains, although they are called long-term difficulties in LEDES parlance (Brown & Harris, 1978). Long-term difficulties are measured by applying contextual ratings to life stressors that last at least four weeks. As also mentioned earlier, however, the LEDES is very costly and time consuming to administer and code. Investigators can save time though, if they use the LEDES to focus on selective role strains, such as those in the work or marital areas.

Measuring Chronic Strains with Observations

Those interested in obtaining objective estimates of the frequency or duration of chronic strains can use observational approaches. Data collected this way are independent of subject characteristics. That is, the data are free of the biases related to the effects of mood or personality on self-reports (Lepore, 1995). Two types of observation techniques are most commonly used to assess chronic strains: naturalistic and informant-based observation. In naturalistic observation, trained observers assess exposure to stressors as persons participate in their normal role-related activities. Naturalistic observation is most feasible for studying role strains that have a high frequency and that can be readily observed (Lepore, 1995). For example, spousal division of labor at home can be estimated using naturalistic observation because it involves regularly occurring activities that are visible. However, there are drawbacks to the use of naturalistic observation, including that considerable time and labor must be expended to train observers, and long or repeated observa-

tions may be necessary to sample a sufficient number of stressful encounters involving the subject (Lepore, 1995).

Alternatively, in informant-based observation, people familiar with the subjects and their roles estimate subjects' exposure to stressors. Because informants tend to be part of a subject's everyday life, they have information about the subject's chronic stressors that are hidden from outside observers (Lepore, 1995). Lepore (1995) also notes that informants may be aware of stressors that occur in relatively low frequency because of their familiarity with the subject's role and that frequency of exposure estimates might be possible to obtain. A drawback associated with using informants, however, is that they will often have their own agendas that may bias their observations. For example, if supervisors are asked to report on the work strain of employees, they may be biased toward underestimating the amount of role ambiguity and conflict in their organization to project a more competent image of themselves.

Summary

We discussed questionnaire, interview, and observational methods of assessing chronic strains, primarily within the work and marital domains. Each of these methods has its benefits as well as drawbacks. Self-report questionnaires are easy to administer but responses to them are often biased, seldom measure duration and frequency of exposure to a stressor, and items typically confound objective and subjective characteristics of stressors. Interview methods provide relatively reliable and valid data, but are very costly and time consuming for investigators as well as subjects. Observational methods are beneficial for obtaining more objective estimates of frequency and duration of exposure to chronic strains; however, they can be intrusive, do not allow investigators to capture the full range of stressors affecting a subject, and can be very costly. Therefore, the choice of method will necessarily depend on the specific question being asked by the researcher as well as the available resources.

PSYCHOLOGICAL APPRAISAL

The transactional model of stress suggests that stress occurs when individuals perceive that environmental demands exceed their abilities to cope (Lazarus & Folkman, 1984). Those interested in the study of appraisals are, therefore, essentially asking whether the *feeling* or the cognitive representation of being "stressed" contributes to psychological distress or physical illness. Like life event measures, measures of appraisal may assess either cumulative perceptions of stress to multiple events or responses to individual events.

There are two types of appraisal often conceptually distinguished: primary appraisal and secondary appraisal. Primary appraisal occurs when individuals assess the environmental situation with regard to their well-being (Lazarus & Folkman, 1984). Primary appraisals are distinguished in terms of whether they are irrelevant, benign-positive, or stressful. Lazarus argued that a situation will result in a stress reaction if it is evaluated as involving potential harm/loss, threat, or challenge (Lazarus, 1977, 1980). Harm/loss appraisals occur in response to damage or loss to the individual; threat appraisals occur in response to anticipated or possible future damage or losses; and challenge appraisals occur in response to a possibility for growth or gain. Primary appraisal is presumed to depend on two classes of antecedent conditions: the perceived features of the stimulus situation and the psychological structure of the individual. Some stimulus factors affecting primary appraisal include the imminence of the harmful confrontation, as well as the meaning, undesirability, magnitude, intensity, duration, and potential controllability of the stimulus. Factors within individuals that affect primary appraisal include beliefs about themselves and the environment (based on personal experience), the pattern and strength of their values and commitments, and related personality dispositions.

Secondary appraisals occur when individuals evaluate whether or not they believe they can eliminate (or at least lessen) the effects of the stressful stimulus. The process involved in making secondary appraisals is complex and involves taking into account available coping options (e.g., seeking social support, relaxation), the likelihood that a given coping option will accomplish the goal, and the likelihood that one can apply a particular strategy or set of coping strategies effectively (Monroe & Kelley, 1995). If one perceives that effective coping responses are available, then the threat is short-circuited and no stress response occurs. If, on the other hand, one is uncertain that he or she is capable of coping with a situation that has been appraised as threatening or otherwise demanding, stress is experienced. It is important to note that the process of evaluating the demands of a situation and evaluating one's ability to cope does not occur only at the onset of a stressful event but will often recur during the course of the event (Lazarus, 1980). Thus, as Monroe and Kelley (1995) note, secondary appraisals feedback upon primary appraisals over time in an iterative process, and it is this interaction over time that constitutes the appraisal process and modulates the degree of stress experienced (Lazarus & Folkman, 1984).

Assessing Appraisals with Questionnaires

Currently, the most popular assessment approach to appraisals is to ask individuals to appraise particular circumstances. It is assumed that

individuals are the best source for information on appraisal, since only they have the necessary awareness of their motives, commitments, and concerns that give meaning to the situation. Subjective measures of appraisal are based on the premise that it is only from within the perceived world of the person that the true meaning of the event can be understood (Monroe & Kelley, 1995).

At least two subjective assessment approaches are commonly used. First, appraisals are assessed using single-item questions designed to measure evaluations of specific stressful events. This class of measures constitutes the largest body of evidence on measures specifically targeting appraisal (Monroe & Kelley, 1995). These measures typically require relatively immediate assessments of appraisal following exposure to a situation and are commonly used in laboratory experiments or in studies of events using daily diary designs. Monroe and Kelley (1995) provide two examples of studies using this class of appraisal measure. First, Schwartz and Stone (1993) asked subjects to answer eight appraisal questions related to the "most bothersome event or issue of the day." They found that appraisals (of control, undesirability, change, anticipation, meaningfulness, chronicity, prior experience, and stressfulness) predicted different coping strategies (e.g., seeking social support, catharsis, and relaxation). Second, Tomaka, Blascovitch, Kelsey, and Leitten (1993) examined the effects of primary and secondary appraisal in three laboratory studies. The task in these studies was counting backwards by intervals of seven. Primary appraisal was assessed with the question "How stressful/threatening do you expect the upcoming task to be?" and secondary appraisal was assessed with the question "How able are you to cope with this task?" Cognitive appraisal was operationalized as a ratio of primary to secondary appraisal and, overall, was found to predict subjective (e.g., stress experienced), physiological (e.g., cardiac reactivity), and behavioral (e.g., performance) reactions. Although these measures have basic psychometric limitations (e.g., questionable reliability, measurement bias, measurement error), they do provide useful preliminary information about appraisal with regard to the stress process as well as a useful base of reference for research on the development of more comprehensive and psychometrically sound measures (Monroe & Kelley, 1995).

The second approach to the subjective assessment of appraisals involves the use of multiple-item scales to assess stress appraisals or the dimensions of stress appraisal. These multiple-item measures have also been developed from two different perspectives. One measures a specific stressor and the associated appraisals, while the other measures appraisals that are a response to the cumulative total of life stressors facing the individual, and represent a more global appraisal (Monroe & Kelley, 1995).

The Stress Appraisal Measure (SAM; Peacock & Wong, 1990) is an example of a measure of specific stress appraisal. It is one of the few measures systematically developed and designed to assess the primary and secondary appraisal dimensions, and which explicitly attempts to distinguish coping processes from appraisal processes (Monroe & Kelley, 1995). SAM assesses three dimensions of primary appraisal (threat, challenge, and centrality) and three dimensions of secondary appraisal (controllability by self, by others, by anyone) for a specific stressor (Peacock & Wong, 1990). Preliminary data suggest that the scale has strong psychometric properties (e.g., good internal consistency for the dimensions) and predicts psychological symptoms in the way one would expect (Peacock & Wong, 1990). However, more work with this measure is needed to ensure that the information it picks up on reflects more than just mood or psychological distress (Monroe & Kelley, 1995).

An example of a measure representing more global appraisals is the Perceived Stress Scale (PSS; Cohen, Kamarck, & Mermelstein, 1983). The original 14-item scale was designed to measure the degree to which subjects found their lives to be unpredictable, uncontrollable, and overloading. More recently, a 10-item version of the PSS has been recommended for use (Cohen & Williamson, 1988). The PSS demonstrates good reliability and predicted associations with other indices of stress. Moreover, recent data have shown prospective associations between scores on the PSS and a variety of psychiatric and physical illness outcomes. For example, Cohen, Tyrrell, and Smith (1993) found that perceived stress prospectively predicted susceptibility to infection with common cold viruses.

Both multiple-item scales assessing appraisals of specific stressors and more general appraisals are well suited to a variety of research contexts, ranging from laboratory studies to field research (Monroe & Kelley, 1995). The major problem with them, however, is the potential confounding of appraisals with various antecedents of appraisal as well as with the psychological outcomes of interest. For example, appraisals may be influenced by personality variables, psychopathology, cognitive styles, beliefs, values, and current mood state (Monroe & Kelley, 1995). These factors, in turn, may be predictive of disorder in and of themselves. Personality factors, psychopathology, and mood state of the person all affect appraisal and the reporting of stress and may independently influence vulnerability to disorder (Aldwin, Levenson, Spiro, & Bosse, 1989; Cohen et al., 1988; Lazarus & Folkman, 1984). Ultimately, the question concerns whether appraisal is a reflection of underlying processes that are themselves responsible for incurring vulnerability, or whether appraisal is the determinant of vulnerability directly (Monroe & Kelley, 1995). By incorporating measures of the antecedents and components that contribute to appraisal, then, these competing views of the role of

appraisal in the stress process can be tested. Cohen and colleagues (Cohen et al., 1983; Cohen & Williamson, 1988; Cohen et al., 1993) have addressed the issue of confounding appraisals as measured by the PSS with antecedents and outcomes, by using prospective designs and controlling for other possible predictors of psychological distress (including earlier measures of psychological symptoms). Using this strategy, these investigators have demonstrated that scores on the PSS predict various outcomes independent of measures of psychological and physical symptoms assessed at baseline.

Assessing Appraisals with Interviews

Some researchers argue for an alternative approach to the assessment of appraisals that approximates the likely appraisal of the person, but avoids the potential subjective contaminants that go along with the subject-based approach (Monroe & Kelley, 1995). The LEDS, an interview technique discussed earlier in the context of major life events and chronic strains, has been suggested for use in this context. This investigator-based method uses trained raters to judge the likely impact of an event or situation on the average person living in comparable circumstances (Brown & Harris, 1978). With detailed assessment of the individual and the life situation, the approach may be sensitive to the major dimensions of relevance contributing to appraisal, yet avoid the methodological pitfalls of the subject-based approach. However, as Monroe and Kelley (1995) note, there is a cost in effort and potential sensitivity. The interview must be highly detailed and time consuming, and the raters must have sophisticated training and understanding of the measurement system involved. Even given such effort, the question remains as to whether or not such a procedure can adequately capture the theoretically essential ingredients of appraisal.

Summary

The transactional nature of the appraisal process is lost in all of the assessment approaches described. That is, as summary measures of the appraisal process, these methods represent only one point in time, and therefore do not capture its dynamic, changing features. After major life events, for example, it is common for individuals to go through phases of oversensitization, denial, and intrusive recollections (Horowitz, Bonanno, & Holen, 1993). Thus, cognitive and emotional lability is to be *expected* in some people following major events (Monroe & Kelley, 1995). So measures of appraisal need further development to tap the transactional nature of the process. In addition, because of the ever-changing nature of the process, the use of longitudinal designs should be consid-

ered in order to obtain multiple measures of appraisal over time. Moreover, we mentioned earlier in this section that three types of stressful appraisal are typically conceived of: threat, harm/loss, or challenge. Existing measures of appraisal are not refined enough to investigate the relative impact of these different types of appraisal in the stress process. This is another area where work on the measurement of appraisal is needed.

EMOTIONAL RESPONSES

Environmental demands that are appraised as stressful are generally thought to influence risk of disorder through negative emotional responses. Although this association is commonly accepted, there are many interesting unanswered questions about the role of emotion in the stress process (Cohen et al., 1995b). For example, are emotional responses *necessary* for events and appraisals to exert effects on behavioral, psychiatric, and physiological processes? Do different kinds of stressful events produce different emotions? Do the same stressful events produce different emotions in different people? Do positive and negative emotional responses have the same or opposite effects on biological responses and disease risk? Questions about the temporal characteristics of emotional responses also need to be addressed (Stone, 1995). For example, does a short-term emotional reaction have the same biological impact as a longer-term reaction? Are acute, intense, bursts of emotion especially important because they may be particularly disruptive to psychological and physiological function?

Conceptual and Methodological Issues in the Assessment of Emotional Responses

Several issues need to be considered prior to choosing the particular strategy for assessing emotions. In terms of conceptual issues, there are alternative approaches to categorizing emotions that are represented by different measurement techniques. For example, emotions can be categorized on the basis of valence (positive or negative), level of arousal, or emotional states such as anxiety, depression, and anger. Choice of the appropriate scale should be based on how close a specific categorization approximates the question about emotional response the investigator is concerned with (Cohen et al., 1995b). For example, a study of the role of stress in depressive disorder may focus on a measure of depressed mood, while a study of emotion as a pathway linking events to immunity may require an assessment of the whole range of emotions. Other dimensions upon which to categorize emotional experiences are their frequency and

intensity. Diener, Larsen, Levine, and Emmons (1985) have shown, for example, that reports of the intensity of mood are not necessarily correlated with reports of the frequency of experiencing those same moods. Data like these suggest that the intensity and frequency of emotional responses may, in fact, be two discrete components of emotion.

In terms of methodological issues, the time frame of reporting is especially critical. The problem is that it is not clear whether people are capable of reporting their moods retrospectively. If they are, over what time periods are such reports valid? Stone (1995) suggests that reports of 24-hour mood are valid, at least to some degree, but that reports of mood longer than that probably are not. This conclusion is based on research suggesting that momentary mood reports correlated with end-of-day reports in a pattern that showed that the latter captured significant information about daily mood (Hedges, Jandorf, & Stone, 1985). In addition, research comparing momentary mood reports with longer-term retrospective reports suggests that the longer-term retrospective reports are not very accurate (Thomas & Diener, 1990).

Reports of mood are prone to the same biases as other psychological constructs (Stone, 1995). Two potentially problematic biases in this respect are social desirability (e.g., the tendency to complete assessments so that subjects appear in a positive light) and response set bias (e.g., the tendency to use extreme numbers in responses). Some work has addressed the influence of these sorts of biases on associations between mood assessments and outcomes, and has demonstrated that main findings are not affected (Diener et al., 1985). However, investigators should be aware of these biases potentially affecting results.

Finally, there are several other well-documented influences on mood that should be considered prior to embarking on the study of mood, although the potential impact of these factors will vary by study design and research question (Stone, 1995). These include day of the week (and other diurnal patterns that may influence mood), behavioral effects such as caffeine, nicotine, or alcohol intake, and biological rhythms such as menstrual cycle stage (Stone, 1995). A researcher should consider which of these factors might influence mood reports and attempt to statistically or experimentally control their effects. For example, when conducting a laboratory study, having subjects abstain from caffeine for 12 hours prior to attending the experimental session would ensure that caffeine would not be a potential influence on any emotional responses assessed.

Assessing Emotional Responses

Self-Report Measures

The simplest method for assessing emotional response is to ask subjects to rate themselves on a specific mood on a multipoint scale (Stone,

1995). A variant on this approach is called a visual analog scale. Instead of using a number to indicate the degree to which a mood was experienced, a subject checks a point along a horizontal line. This approach helps to avoid some of the biases associated with the use of numerical scales (e.g., tendency not to use extreme numbers). For example, in daily studies, ratings of mood throughout the day have been assessed with a single item with "good" and "bad" as end points. Another alternative for assessing mood relies on graphical representation of cartoon-type faces with various emotions pictured on them (Lang, 1980). Subjects are asked to indicate which faces represent their moods. This technique is a particularly good one to use with children. Lang (1980), for example, has developed an assessment using two sets of faces. One set depicts the dimension of pleasure–displeasure and the other depicts arousal.

By far the most common method of assessing mood, however, is with mood adjective checklists (Stone, 1995). In these assessments, a number of adjectives describing emotional states are listed and subjects are instructed to indicate whether the adjectives reflect their feelings. There are many variations on this basic theme involving different response scales associated with adjectives and different sets of adjectives (Stone, 1995). In addition, instruction sets for responding to the adjectives differ markedly, especially in terms of the period of time that the subject is characterizing. The reader is referred to MacKay (1980), Schulz, O'Brien, and Tompkins (1994), and Stone (1995) for comprehensive descriptions and lists of mood adjective checklists. Here, we will mention a few that have been used extensively and/or illustrate different conceptions of mood.

One of the first adjective checklists used to assess mood was the Nowlis Mood Adjective Checklist (MACL; Nowlis & Green, 1957). Although the original version of the scale contained 130 adjectives, there is a more popular short form that contains 36 adjectives, as well as a 12-item version (Stone, 1981). Subjects rate how much they feel each adjective at that time by circling one of four response options (i.e., definitely felt it, slightly, cannot decide, definitely not). Twelve factors have been found for the 36-item MACL: aggression, anxiety, surgency, elation, concentration, fatigue, social affection, sadness, skepticism, egotism, vigor, and nonchalance. The 12-item version, however, has been shown to yield only two factors: positive and negative engagement (Stone, 1981).

The Profile of Mood States (POMS; McNair, Lorr, & Droppleman, 1971) is a 65-adjective checklist that asks subjects to rate how they felt during the past week. Stone (1995) notes that this instruction set has raised the possibility that the POMS is more of a trait measure than an affective state measure (Howarth & Schokman-Gates, 1981). However, instruction sets using shorter time (e.g., today, right now) have been used successfully with this set of adjectives. Six factors have been identified

using the 65 adjective checklist: tension-anxiety, depression-dejection, anger-hostility, vigor-activity, fatigue-inertia, and confusion-bewilderment (Usala & Hertzog, 1989).

The Differential Emotions Scale (DES; Izard, Dougherty, Bloxom, & Kotsch, 1974) is a shorter measure of emotional response than the two just described. There are several versions of this questionnaire, but all measure ten basic emotions identified from facial expression research (e.g., joy, surprise, sadness, anger, disgust, contempt, fear, shame/shyness, and guilt). Each adjective is rated on a multipoint scale for how the subject currently feels.

Finally, the Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988) was developed to assess two hypothesized major dimensions of mood: positive and negative affectivity (PA and NA). PA and NA are each assessed by ten items, and scores on the two dimensions are relatively independent. The PA adjectives include attentive, interested, alert, excited, enthusiastic, inspired, proud, determined, strong, and active. The NA adjectives include distressed, upset, hostile, irritable, scared, afraid, ashamed, guilty, nervous, and jittery. Subjects rate the extent to which they feel each emotion on a 5-point scale ranging from very slightly or not at all to very much. Watson et al. (1988) have used the PANAS with several different time frames for reports of mood, ranging from "right now," through "the past week," through "the past year," and "on average." Regardless of the instructional set, internal reliabilities for the scales are high and NA and PA scores are relatively independent.

Observational Methods

As with other components of the stress process, emotional responses can also be assessed using observational approaches, and there are two general methods here. First, individuals who have contact with the subject can rate the subject's mood with a modified self-report scale (Stone, 1981, 1995). While this technique moves the assessment away from self-report, it has other problems, the most important being that it is not clear how the observer is judging the subject's mood. They could be basing their judgments on the subject's behavior, what the subject is saying, or some other information concerning the expression of emotion. Stone (1995) suggests that we need further research to better understand the meaning of these assessments prior to adopting the technique more frequently.

The second observational method is based on classifying people's facial expressions. Facial expression procedures are used quite frequently because they avoid problems inherent in self-report (Stone, 1995), and reliable procedures have been developed for coding and identifying different emotional responses (cf. Eckman, 1992). There are several logistical drawbacks, however, concerning the use of facial expression assess-

ments in studies. Many of these drawbacks center around the use of resources (equipment for recording facial expressions, doing so unobtrusively, and time and resources necessary for coding the facial expressions). Nevertheless, there are times when a stress researcher working in the laboratory may benefit from using this method.

Summary

There are many conceptual and methodological issues that should be kept in mind when embarking on the study of emotional responses. These include specifying the dimensions of emotion critical to the question being asked (e.g., valence, arousal, intensity, frequency); considering the time frame associated with recall; response biases; and logistical considerations that may influence the reports of mood obtained (e.g., daily, weekly, and monthly rhythms, behavioral variables).

CONCLUSIONS

At the outset, we described stress as originating from a process whereby environmental demands tax or exceed the adaptive capacity of an individual, resulting in psychological, behavioral, and biological changes that may place persons at risk for disorder. We focused on the assessment of three environmental and psychological components of the stress process (i.e., environmental demands, psychological appraisal, and emotional response). In particular, we described the kinds of questions each approach to measuring stress is best fit to answer, specific approaches to its assessment, as well as some conceptual and logistical issues in its use. Although we did not cover all measurement approaches that might be broadly interpreted as falling in these categories, we chose those we thought would be of interest to a broad audience. For example, we did not discuss measures of physical environment such as noise and air pollution or behavior changes such as deficits in task performance. The exclusion of these measures does not imply that they are not as important as those we discussed. Rather, their importance depends on the questions one wants to pose.

Separately measuring each of these three components of the stress process (i.e., environmental demands, psychological appraisal, and emotional response) can lead to the accumulation of information that elucidates important mechanisms regarding the role of stress in psychiatric and physical disorder. Whether investigators choose to assess one, two, or several of these components in a particular study depends on the outcome of interest as well as the specific questions posed. Our hope, however, is that the information and heuristic model we presented will

encourage broader views and assessments of the stress process. Specifically, studies that integrate multiple components of the process would add greatly to the current level of knowledge. For example, do stressful events that result in perceptions of stress increase risk of disorder through negative emotional responses? Studies combining different components of the process have the potential to answer many important questions about the role of stress in disorder.

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