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# Measuring Job Stressors and Strains: Where We Have Been, Where We Are, and Where We Need to Go

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This article examines assessment approaches and specific measures used by job-stress researchers to characterize aspects of work and the working environment (potential job stressors) and workers' reactions to these working conditions (strains). Self-report instruments, observational approaches, and physiological indicators are described. Problematic areas (e.g., the use of overlapping stressor and strain measures) and contemporary issues affecting job stress assessment (e.g., negative affectivity) are discussed. Recommendations regarding instrument selection and measurement improvements are offered. It is concluded that closer attention to measurement-related issues is critical to the advancement of knowledge in the field. Important needs include the identification and more frequent use of objective measures, the increased use of triangulation strategies, and a careful examination of the adequacy of existing constructs and measures for capturing the demands of contemporary work.

As the concept of job stress has gained popularity over the past 35 years, a plethora of questionnaires, scales, interview schedules, and other stress measurement devices have emerged and evolved. As a result, job stress researchers, concerned organizations, and occupational health practitioners can find that choosing a measurement tool poses a bewildering challenge. In this article, we describe some commonly used job stress assessment measures, explore emerging trends in job stress measurement, and suggest some areas where we believe there is a need for improvement.

It is apparent to most (although not all) researchers interested in the topic of job stress that simply asking workers the question "Is your job stressful?" results in ambiguous and impoverished information. People clearly have different conceptions of stress, and the response to the question provides little information regarding the causes and the possible consequences of these perceptions. Thus, three classes of variables have been examined under the rubric of job stress assessment: (a) job stressors, (b) strains, and (c) health outcomes. The term *job stressors* refers to a large number of work-related environmental conditions (or exposures) thought to impact on the health and well-being of the worker. *Strains* involve the worker's psychological and physiological reactions to such exposures, and *health outcomes* refers to the more enduring negative health states thought to result from exposure to job stressors. This review discusses commonly used measures of stressors and strains and, to a more limited extent, some measures that have been used to assess health status. Although they are deserving of attention in their own right, owing to their large numbers, we do not discuss measures of constructs (e.g., hardiness, social support, locus of control, coping styles) thought to moderate or mediate the relationships between job stressors and job-related strain.

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## The Origins of Job-Stress Assessment

Although measures of job-stress-relevant concepts, such as job satisfaction, can be found dating back to the 1930s (e.g., Hoppock, 1935), "modern" job-stress assessment was given tremendous impetus by research conducted at the University of Michigan in the early 1960s. One of the earliest systematic approaches to measuring job stress can be found in seminal work by French and Kahn (1962) that sought to identify factors in the working environment that play a role in mental and physical health. In this effort, self-report questionnaires were developed and used to measure such factors as role ambiguity, workload, role conflict, responsibility for persons,

responsibility for things, participation, and relations with work group. Likewise, the development of the Job-Related Tension Index (Kahn, Wolfe, Quinn, Snoek, & Rosenthal, 1964) and the Job-Related Strain Index (Indik, Seashore, & Slesinger, 1964) had far-reaching and long-lasting implications for stress assessment. Although the titles of these indexes refer to tension and strain, their component scales focus on job stressors rather than affective responses to work. Both scales in their original formulations had the same 15-item statements concerning problems at work. Each was intended to measure a wide range of job characteristics, in particular, role conflict and ambiguity, incompatibility between demands and available resources, and work overload. Measures of these constructs, and indeed the items and scales themselves, have served as a starting point for numerous self-report job-stress assessment instruments (e.g., Tension Index; Lyons, 1971; Administrative Stress Index, Tung, 1980), and they have tended to serve as a "backbone" for future efforts to assess job stress.

The measurement of pathological mental states and clinical psychosomatic conditions has a long history in psychiatric research. However, beginning in the late 1960s and early 1970s, a growing interest arose in examining less serious disorders and early indicators of lowered well-being and developing ill health. Constructs measured in this regard include anxiety, irritability, frustration, worry, depression, distraction, and inability to concentrate. In this climate, a number of indexes arose that were specifically designed to assess affective responses to the job environment. Rizzo, House, and Lirtzman (1970), for example, described their use of an anxiety–job tension scale made up of 17 items. Although not all of the items were directed specifically to tension on the job, the measure was clearly conceptualized as a reflection of job-related psychological strain. Likewise Tosi (1971) proposed a 4-item measure of job threat and anxiety, related to evaluation concerns and potential job loss. Subsequent efforts resulted in measures of factors such as tedium (Kafry & Pines, 1980) and burnout (Maslach & Jackson, 1981).

The conceptual origins of physiological approaches to job-stress assessment can be traced to Walter Cannon's (1929) research on the physiological concomitants of emotion and to Hans Selye's (1936) animal research examining physiological responses to noxious stimuli. Although later challenged by studies by Lazarus (see Lazarus & Folkman, 1984), implicit in Selye's work was the notion that physiological responses to environmental stimuli might occur without any subjective assessment of those stimuli. Hence, the proposition arose that measuring the physiological effects of social and psychological factors might allow researchers to more objectively quantify stress and identify those most susceptible to any adverse environmental influence. Early efforts to assess physiological responses to the working environment focused on parameters such as blood pressure, heart rate, serum cholesterol, catecholamines, cortisol, lipids, and insulin function (see Herd, 1988; Rowland, Ferris, Fried, & Sutton, 1988).

## Comprehensive Self-Report Measures of Job Stressors

A large number of individual self-report scales are now available to assess a wide range of specific job stressors. These stressors include temporal aspects of employment and the work itself (e.g., shift work and pacing), aspects of work content (e.g., repetitive work and unclear tasks or demands), work-group factors (e.g., social isolation and inequitable workload), supervision (e.g., lack of participation in decision making and lack of feedback), and organizational conditions (e.g., size and structure; cf. Kasl, 1991). In addition to these individual measures of specific job stressors, a number of more systematic approaches have arisen that seek to provide more comprehensive characterizations of stressors in the work environment. A number of these instruments also include measures of job strains and moderators–mediators of the stressor–strain relationship. The inclusion of such measures is acknowledged in the instrument descriptions below.

### *Stress Diagnostic Survey*

Outside of the measures resulting directly from efforts at the University of Michigan, the Stress Diagnostic Survey (SDS), developed by Ivancevich and Matteson (1984), was one of the first comprehensive job stressor assessment tools developed. Consisting of items from the Job Related Tension (Kahn et al., 1964) and other sources, the questionnaire is designed to help individual employees identify specific areas of high stress at work. In addition to the work version of the SDS, there is a nonwork version that profiles individuals' personal stressors. The work instrument consists of 80 brief statements that are responded to on a 7-point scale and yields seven macro and eight micro work dimensions, each with four items. The scales in the work version of the SDS were determined by factor analysis with data from

over 2,000 business executives, hospital nursing personnel, graduate management and engineering students, and medical technologists. Reliability data suggest that internal-consistency measures for the various subscales vary from .53 to .79 (most in the .65 to .75 range), 2-week test–retest approximately the same, and 12-month stability from .50 to .60 (Ivancevich & Matteson, 1984). Components of the SDS have been found to discriminate among managers (Ivancevich, Matteson, & Preston, 1982), nurses (Ivancevich & Matteson, 1980), and medical technologists (Matteson & Ivancevich, 1982).

### *Work Environment Scale*

The Work Environment Scale (WES; Moos, 1981) contains 90 true–false items designed to assess the general social climate of all types of work units. Because the WES specifically assesses perceptions of aspects of work climate rather than perceptions of task or job characteristics, it has been appealing to many stress researchers. The scale contains 10 subscales (e.g., Work Pressure, Control, Task Orientation, Supervisory Support, and Peer Cohesion), with internal-consistency coefficients ranging from .69 to .86 and 1-month test–retest reliabilities ranging from .69 to .83 (Moos, 1986). Norms are available for employees in representative general work groups and employees in a variety of health care work groups, and users may develop work-unit profiles to compare work units and to assess work-group changes over time. A 40-item short form (Form S) also is available.

### *Job Content Questionnaire*

Currently, the most widely used job-stress assessment instrument appears to be the Job Content Questionnaire (JCQ; Karasek, 1985). This highly popular instrument is based on Karasek's job decision latitude theory (Karasek, 1979), which postulates that stress results from the joint effects of job demands and the level of job-decision latitude experienced by the worker. The questionnaire in its original form (Framingham version) was developed to measure the risk of job-related coronary heart disease in a large-scale study. The (short) original version of the questionnaire contains 27 questions based largely on items and scales from the U.S. Quality of Employment Surveys (QES) conducted in the late 1960s and early 1970s. In the QES, researchers from the Institute for Social Research at the University of Michigan developed and tested a series of questions for use in personal interviews to assess six different job stressors (Margolis, Kroes, & Quinn, 1974; Quinn & Shepard, 1974). A longer, 49-item version of the questionnaire (the JCQ) is recommended by Karasek (1985). Scales include Psychological Job Demands (a composite of items measuring workload and role conflict), Skill Utilization, Job Decision Latitude, Coworker Support, Supervisor Support, Job Dissatisfaction, Depression, and Sleeping Problems. A still longer version of the instrument (112 items) includes scales in the areas of customer contact, social identity, and the human computer interface. The items are largely in an agree–disagree format, and the subscales have shown internal-consistency coefficients ranging from .40 to .83 and test–retest reliabilities generally greater than .90 (Karasek & Theorell, 1990). Scores obtained through its use can be compared to national average scores from the QES. The questionnaire has gained wide acceptance among those who subscribe to the Karasek model and has been translated into a number of languages. Users also have formed a network to circulate their results.

### *Occupational Stress Inventory*

Developed by Osipow and his colleagues (Osipow & Davis, 1988; Osipow & Spokane, 1980, 1983), the Occupational Stress Inventory (OSInv) provides measures of three domains of occupational adjustment: occupational stress (60 items), personal strain (40 items), and coping resources (40 items). All items are rated on a 5-point scale that gauges the frequency with which an item applies. The occupational stress domain (measured by the Occupational Environment scale) consists of six 10-item scales measuring job stressors related to role overload, role insufficiency, role ambiguity, role boundary, responsibility, and the physical environment. Internal-consistency reliability estimates for the six scales range from .71 to .90, with 2-week test–retest reliabilities ranging from .56 to .94 (Osipow & Spokane, 1983). There is evidence of associations between the various stressor measures and strain outcomes, such as job satisfaction and symptom reporting (Osipow & Spokane, 1983).

### *Occupational Stress Indicator*

The Occupational Stress Indicator (OSInd), developed by Cooper, Sloan, and Williams (1988), is based on the Cooper and Marshall (1976) stress model and has been increasingly used as a diagnostic instrument in Europe. The questionnaire consists of 167 items constituting 28 scales in six different scale domains: Job Satisfaction, Health, Type A Behavior, Locus of

Control, Sources of Pressure, and Coping Strategies. The items are responded to on 6-point Likert-type scales. The Sources of Pressure domain (reflecting job stressors) includes six scales measuring factors intrinsic to the job, the managerial role, relationships with other people, career and achievement, organizational structure and climate, and home–work interface. Work by J. S. Williams (1996), using nearly 14,500 participants in over 100 organizations, has demonstrated that these six scales are reliable (alpha coefficients ranging from .70 to .84); however, they do not seem to reflect the underlying factor structure of the data. Scales that constitute the Locus of Control domain, such as Organization Forces and Managerial Processes, which also can be conceived as measures of job stressors, appear to have rather low reliability coefficients. J. S. Williams and Cooper (1997) have reported efforts to improve these measures and present a revised version of this instrument, called the Pressure Management Indicator (PMI), in J. S. Williams and Cooper (1998).

### *Generic Job Stress Questionnaire*

The Generic Job Stress Questionnaire (GJSQ; Hurrell & McLaney, 1988) was developed by researchers at the National Institute for Occupational Safety and Health (NIOSH) to assess constructs within the domains contained in its job-stress model (Hurrell & Murphy, 1992). The instrument contains measures of 13 job stressors (e.g., workload, responsibility, role demands, conflict, skill underutilization, job control, and mental demands) as well as a number of measures of individual strain (depression, somatic complaints, job dissatisfaction, and illnesses) and modifiers–mediators of the stress–strain response (social support and self-esteem). Specific stressor, strain, and modifier–mediator variable constructs were selected for inclusion in the instrument on the basis of a content analysis of the job-stress literature, and the scales selected to measure these constructs were adapted from scales found in the literature with known reliability and evidence of construct or predictive validity. The instrument is lengthy but was designed to be modular in form, so that users can select individual scales or, where necessary or feasible, use the entire instrument. Stressor scales using mostly Likert-type response formats have shown internal-consistency reliabilities ranging from .75 to .89. The questionnaire and its components have been widely used and translated into a variety of languages (e.g., Japanese and Finnish). A recent examination of the psychometric properties of the Japanese version of the questionnaire supported the factorial validity of the 13 job-stressor scales and demonstrated acceptable internal consistency and test–retest reliability coefficients (Haratani et al., 1996).

### *Job Stress Survey*

The Job Stress Survey (JSS; Spielberger, 1994) is one of the most recently developed comprehensive job-stress assessment tools (see also Vagg & Spielberger, 1998). This 30-item instrument was designed to assess the perceived intensity (severity) and frequency of occurrence of working conditions that may adversely affect the psychological well-being of workers who are exposed to them. Questions describing stressors commonly experienced by managerial, professional, and clerical employees were selected for inclusion in this generic job-stress measure. Respondents are asked first to rate, on a 9-point scale, the relative amount (severity) of stress that they perceive to be associated with each of 30 JSS job stressors (e.g., excessive paperwork or poorly motivated coworkers) compared with a standard event (assignment of disagreeable duties), which is assigned a value of 5. To assess the state–trait qualities of the stressors, respondents indicate on a scale, ranging from 0 to 9+ days, the number of days on which each stressor was experienced during the previous 6 months. Adding together the ratings for each JSS item yields an overall severity (JSS–S) and frequency (JSS–F) score and an overall job-stress index (JSS–X), which is based on the sum of the cross products of the JSS–S and JSS–F scores. Internal-consistency coefficients for these scales range from .87 to .93 (Spielberger & Reheiser, 1995). Severity and frequency scores are also computed for 10-item Job Pressure and Organizational Support subscales, which were derived by factor analysis from the 30 JSS items. Because this instrument is relatively new, little information is available in the organizational literature to assess the validity of the scales.

### *Job Diagnostic Survey and Job Characteristics Index*

The Job Diagnostic Survey (JDS; Hackman & Lawler, 1971; Hackman & Oldham, 1975), although rising out of the job-design literature, has been widely used to measure work characteristics by stress researchers. The JDS measures five core job-characteristic dimensions (feedback, task significance, task variety, task identity, and autonomy) that were believed by Hackman and his associates to be

linked to job satisfaction and internal work motivation. These core job characteristics are assessed by 15 items (3 items each) that measure the extent to which a job is perceived to possess these characteristics by the person answering the questions. Two measures of job satisfaction (general and facet specific) as well as measures of personal and work-related outcomes also are contained within the survey. The work characteristics scales have shown good internal consistency (.70 to .80) across a number of studies (Hackman & Oldham, 1980). However the five-scale dimensionality of the instrument has been challenged by a number of empirical investigations (see Roberts & Glick, 1981), and the instrument has been criticized for having overly complex response formats for many items (Green, Armenakis, Marber, & Bedeian, 1979).

Sims, Szilagyi, and Keller (1976) developed the Job Characteristics Index (JCI) on the basis of the work of Hackman and his colleagues. This index contains 30 Likert-type items, which assess six dimensions (skill variety, autonomy, feedback, interaction with coworkers, task identity, and friendships). An analysis of the index by Brief and Aldag (1978) demonstrated convergent and discriminant validity of the scales and acceptable internal consistency.

### *Evaluation of Comprehensive Self-Report Job Stressor Measures*

Much has been written regarding the limitations in the use of self-report instruments in job-stress research (e.g., Frese & Zapf, 1988; Kasl, 1978, 1987a, 1987b). The limitations are particularly apparent (and long recognized) in epidemiologic stress research, where investigators have frequently used exclusively self-report measures of both job stressors and their strain consequences. Indeed, it has become almost pro forma for epidemiologic stress researchers to call for the use of more objective measures (particularly of job stressors). Unfortunately, these calls generally have gone unheeded because objective measures of job stressors are not often easy (or possible) to obtain. Therefore, the use of self-report methods of job-stressor assessment will quite likely continue to dominate job-stress research methodology.

As shown in Table 1, the comprehensive assessment instruments described above vary in both the number and type of job stressors that they measure. The JCQ and the JSS, for example, capture global job demands, with their constituent scales summing across items that assess specific demands such as workload or role demands. By contrast, the SDS and GJSQ provide measures of an array of specific job demands. The JDS and JCI, which originated in the job-design literature, were developed to assess job characteristics thought to be important in motivating workers and creating job satisfaction. Hence, they assess factors whose relative absence is inferred a job stressor. The WES focuses on the climate in which job tasks are performed. The instruments also vary in the

Table 1
*Summary of Comprehensive Job-Stressor Measures*

| Instrument | No. stressors measured | Types of stressors measured | Norm | Strain | Moderators–mediators |
|---|---|---|---|---|---|
| SDS | 15 | Role demands, workload, time pressure, and task demands | None | No | No |
| WES | 10 | Work climate | Limited | No | No |
| JCQ | 3 | Global demands and control | Excellent | Yes | Yes |
| OSInv | 6 | Role demands, responsibility, and physical environment | Limited | No | No |
| OSInd | 6 | Role demands, interpersonal, and climate | Excellent | Yes | Yes |
| GJSQ | 13 | Workload, role demands, task demands, control, and conflict | Limited | Yes | Yes |
| JSS | 2 | Global job pressure and organizational support | Limited | No | No |
| JDS | 5 | Task characteristics | Limited | No | No |
| JCI | 6 | Task characteristics and interpersonal | Limited | No | No |

*Note.* SDS = Stress Diagnostic Survey; WES = Work Environment Scale; JCQ = Job Content Questionnaire; OSInv = Occupational Stress Inventory; OSInd = Occupational Stress Indicator; GJSQ = Generic Job Stress Questionnaire; JSS = Job Stress Survey; JDS = Job Diagnostic Survey; JCI = Job Characteristics Index.

quantity and quality of information that is available for use in interpreting results, and a number of the instruments offer measures of strains as well as moderator–mediator variables.

The choice of a particular stressor assessment instrument is clearly dependent on the purpose of the investigation and the theoretical orientation of the investigator. Investigators seeking to link global aspects of the working environment to health, safety, and performance outcomes, for example, may be quite satisfied with questionnaires that provide measures of global work-related dimensions. The seminal work of Karasek and his colleagues linking job demands and control (as measured by the JCQ) to cardiovascular diseases perhaps best typifies this approach (see Kristensen, 1996, for a review). However, organizational investigators seeking to identify the specific stressors that might be causing decreased job satisfaction and low morale may be better served by choosing an assessment instrument that provides richer information regarding the kinds of stressors encountered by workers. This may be especially important in intervention efforts where investigators seek to identify specific stressors and target them for change.

A common problem with many of the measures described above is that they tend to focus on only one dimension of the stressor being assessed. As DeFrank (1988) and Cox and Ferguson (1994) have noted, workers evaluate their working environments not simply in terms of the existence of certain types of demands but also on the basis of the frequency, duration, and severity of occurrence of those demands. With the exception of the JSS, which assesses both the frequency and severity of the stressor, the measures described above focus generally on the frequency of occurrence of the stressor. Note also that the questionnaires described above focus on the negative features of work as predictors of health problems. Yet work by Kanner, Kafry, and Pines (1978) has suggested that strain results from both the presence of negative work features and the absence of positive features.

The measurement devices described above seek to tap global dispositions regarding chronic job stressors. As a consequence, the items included may be quite remote from the actual work experiences of a typical respondent. Thus, rather than tapping the actual experience of problematic job conditions by the worker they may simply refer the worker to general characteristics of the job environment, which may or may not be pertinent. An example of the problems attendant to this situation can be seen in efforts to examine job stressors in police work. Specifically, interview studies of police officers (e.g., Kroes, Margolis, & Hurrell, 1974) have found role conflict and role ambiguity to be major job stressors in police work, yet a questionnaire study (Caplan, Cobb, French, Harrison, & Pinneau, 1975) that used traditional role-stress measures failed to replicate these findings. On closer examination, it was evident that the Caplan et al. (1975) study used role-demand scales, like those typically used in job-stress surveys (e.g., Kahn et al., 1964), whose items tapped conflict and ambiguity within the organization. However, for police officers, conflict and ambiguity involve not only organizational but also community and societal expectations, the latter of which are missed in most questionnaire measures of these constructs.

Because many of the job-stressor measures included in the devices described above were conceptualized and validated over 25 years ago (often on white-collar male workers), it also may be reasonable for job-stress researchers to now reconsider their relative importance for current working populations. Indeed, what sorts of working conditions do workers on exposure cognitively appraise as threatening or harmful? Clearly, the threats seem to be changing. Work as it has traditionally been known has changed markedly over the past decade and continues to change at a rapid pace. The U.S. economy is no longer dominated by manufacturing, and an ever-increasing number of workers are employed in service-producing industries. Job-stress researchers may want to closely scrutinize existing measures of job-stressor constructs and consider whether they are indeed reasonable to use in emerging service occupations. Are they indeed valid and reliable measures of the demands that exist in this type of work? Likewise, intensified international competition has led to corporate restructuring, often involving mergers, takeovers, downsizing, and increasing numbers of contingent workers (Landy, Quick, & Kasl, 1994). Do existing stressor constructs and measures truly tap the conditions and uncertainties associated with these changes? Other major challenges to workers include the increased use of computer technology in the workplace and the gap between the new skills demanded by employers and the actual skills possessed by workers (Landy et al., 1994). Do existing measures truly reflect these emerging demands? Last, the face of the U.S. workforce has changed and continues to change with the fastest growing segments of the working population being women, ethnic minorities, and older workers (U.S. Department of Labor, 1992). These workers appear to

be subject to a variety of particular job demands by virtue of their group membership (Keita & Hurrell, 1994). Do existing job-stressor measures provide reliable and valid indicators of demands suitable for these burgeoning segments of the workforce? Questions such as these clearly deserve consideration.

Finally, workplace violence is an emerging job stressor that has not been traditionally considered under the rubric of occupational stress research (Driscoll, Worthington, & Hurrell, 1995). Ranging in severity from homicide to much less obvious forms of aggression, such as spreading negative rumors about coworkers, workplace violence represents a threat to both physical and psychological well-being (Vanden-Bos & Bulatao, 1996). Development of reliable and valid measures of aspects of this complex phenomenon represents a major measurement challenge.

## Observational Measures of Job Stressors

Given the numerous and widely discussed limitations of individual self-report job-stress measures (cf. Frese & Zapf, 1988; Kasl, 1978; Spector, Dwyer, & Jex, 1988), several attempts have been mounted to develop observational methods for identifying job stressors. Because an observational approach does not rely on the job incumbents' perceptions of the working environment, the approach is thought to be more objective. One of the first measures of this type was developed by Elo and Vehvilaienen (1983) at the Finnish Institute for Occupational Safety and Health. This checklist observation method was designed for use by occupational health personnel. It includes 12 stressors (e.g., responsibility for safety, repetitiveness, forced pace, and demands for complex decision making). Each stressor is given a definition that is illustrated in the user's manual by photographs from workplaces. Two different scales can be applied, one dichotomous and the other a 4-point scale. The checklist also provides the opportunity for the rater to assess physical, chemical, and other potential job stressors. Ratings are based on observations of the work and are supplemented by interviews of supervisors and workers. In a study testing this method, Elo and Vehvilaienen (1983) reported congruence in ratings between various raters and significant correlations with workers' ratings on other stress factors. Although the checklist has received considerable acceptance in Finland, it has not been used widely in other countries.

An observational job-stress analysis instrument has also been developed at the Technical University of Berlin (Greiner & Leitner, 1989). The instrument is based on action regulation theory, which describes psychological processes that are important for human action such as perception, planning, thinking, deciding, and movement execution (cf. Frese & Zapf, 1994). The original version of the instrument (for the analysis of blue-collar and white-collar stressors) assesses work barriers, monotonous working conditions, time pressure, adverse environmental factors, time binding, and constraints of physical necessities (Greiner, 1994). The instrument consists of two parts: a manual with all definitions and response sheets, which are filled out for a particular analysis. The analysis is done by worksite observation, during which the observer watches and interviews the worker after a semistandardized protocol, and may take between 2 and 6 hr of observation depending on the task (Greiner, 1994). The instrument does not include rating scales but rather requires the rater to use defined categories or time units provided in the instrument. As a prerequisite to using the instrument, the observer has to be trained, so that he or she is familiar with the theory and definitions given in the manual (Greiner, 1994). Studies using the instrument have shown associations between rated job stressors and psychosomatic complaints and accidents (cf. Greiner, 1994; Greiner, Ragland, Krause, Syme, & Fisher, 1997). Recently, Greiner et al. (1997), using a modification of the original instrument for studying transportation workers, demonstrated interrater agreement between 80% and 97%, with kappas of .46–.70, among eight observers. A validity analysis showed associations between various stressors and psychosomatic complaints, relaxation time needed after work, and smoking to cope.

The Position Analysis Questionnaire (PAQ; Mecham, McCormick, & Jeanneret, 1977), although designed as a job-analysis instrument, also has been used by a number of job-stress investigators. The PAQ is a copyrighted job-analysis inventory, containing 194 questions describing job activities and worker behaviors required by different jobs. Since its development in 1969, the PAQ has been used extensively by organizations for evaluating and classifying jobs for pay purposes. PAQ job analyses involve interviews with job incumbents and supervisors, as well as observation of work processes. On the basis of this information, analysts rate the degree to which each of the 194 job-activity questions applies to the job being analyzed. Factor analyses have identified 32 general job dimensions, and past research (McCormick, Jeanneret, & Mecham, 1972) has indicated that the PAQ has acceptable reliability (interrater $r = .78$). Extensive normative information

is available from PAQ Associates in Logan, Utah. A feature that makes this instrument appealing to job-stress researchers is that certain PAQ job dimensions have been identified as stressors in previous research. These stressors include repetitive work, shift work, physical discomfort, vigilant tasks, worker autonomy, degree of responsibility, emotional demands, and interpersonal conflict. Shaw and Riskind (1983) have reported a pattern of significant and, in many cases, quite high correlations between various PAQ scores and a variety of strain measures, whereas Murphy (1991) has found that several PAQ dimensions were associated with cardiovascular disability, including hazardous situations, vigilant work, responsibility for others, exchanging job-related information, and attention to devices.

Although appealing because of their presumed objectivity, observational approaches, as an alternative to job-incumbent self-report approaches, have a number of drawbacks. Gathering observational data on job stressors can be most reliably performed only by trained and experienced observers. Thus, considerable training may be required before observers can provide usable data. Moreover, as with self-report approaches, the measuring instruments may require adaptation to the particular job being assessed. The rating instrument used by Greiner et al. (1997), for example, was adapted from the original version of the instrument to make it applicable to service workers. Such adaptations may require considerable effort.

It is evident from the preceding review that the self-report and observational measures of job stressors have both advantages and limitations. We turn now to a review and evaluation of the self-report strain measures.

## Self-Report Measures of Strain

Self-report strain measures have been used in the job-stress literature to assess factors such as anxiety, depression, general psychological and physiological distress, and burnout. Although many of the measures of these factors were not developed specifically to gauge job-related strains, they are discussed below because of their frequent use in the occupational stress literature.

### *Anxiety Measures*

Moods (or affective states) such as anxiety and depression can have an overriding influence on those who suffer from them, and because they are felt to be, at least in part, environmentally determined, they have been of considerable interest to job-stress researchers. Spielberger, Gorsuch, and Lushene (1970) developed the Stait–Trait Anxiety Inventory (STAI), which is perhaps the most widely used self-report measure of anxiety. The 40-item instrument measures both state (i.e., transitory) and trait (i.e., stable individual tendency) anxiety and has become one of the most widely used instruments in social science and medical research. The State Anxiety subscale is particularly suited to multiple administration and thus highly useful in assessing the impact of occupational stress interventions. As a result of the extensive normative data available from literally hundreds of studies, the instrument is highly popular and often chosen over competing measures such as the Taylor Manifest Anxiety Scale (Taylor, 1953) and the Self-Rating Anxiety Scale (Zung, 1971).

As noted earlier, both Tosi (1971) and Rizzo et al. (1970) have constructed anxiety measures directly related to the working environment. The Tosi (1971) measure consists of 4 items tapping concerns regarding evaluation and threat of job loss. Although little psychometric information is available regarding the scale, it has been linked to role ambiguity, role conflict, low job satisfaction, and low job participation (Tosi, 1971). The Rizzo et al. (1970) scale comprises 17 items (some of which were selected from the Taylor Manifest Anxiety Scale). Although all of the items do not directly assess job-related tension, it is clear that the index was intended to reflect the results of exposure to job stressors. This measure has shown good internal consistency (.72) and has been found to be related to role conflict and ambiguity (House & Rizzo, 1972). Other investigators have used a 13-item (Miles & Perreault, 1976) and 18-item (Brief & Aldag, 1976) version of this scale.

Caplan et al. (1975) developed an index of job-related anxiety based, in part, on the Spielberger et al. (1970) STAI. This index consists of four items introduced by the following: "Here are some items about how people feel. When you think about yourself and your job nowadays, how much of the time do you feel this way?" The index was found to have good internal consistency (.75) and to be significantly correlated with measures of a number of job stressors (Caplan et al., 1975).

### *Depression*

A variety of depression indexes have been used by occupational stress researchers. The 21-item Beck Depression Inventory (BDI; Beck, Ward, Mendelson, Mock, & Erbaugh, 1961) was developed exclusively

to diagnose depressive symptoms. Its items, rated by the respondent on a 4-point scale, were constructed to gauge clinical manifestations of depression used by psychiatrists in making that diagnosis. The BDI has been very commonly used in both behavioral science and medical research and shows strong correlations with psychiatric ratings of severity of depression (Beck et al., 1961). Although not as widely used, the Self-Rating Depression Scale, developed by Zung (1965), has long been appealing to occupational stress researchers. The scale contains 20 items, each scored on a 4-point scale, and balances positive and negative answers to help deter acquiescence response sets. Like the BDI, it has been used on a large variety of populations. Although of more recent development, the 20-item Center for Epidemiologic Studies Depression Scale (CES–D; Radloff, 1977) has been used in many large studies seeking to determine the prevalence of depressed affect in the general population; thus, normative landmark scores are available. Factor analytic studies have found this measure to be generalizable across sexes and broadly useful in segments of the general population (Ross & Mirowsky, 1984). Because of these features, the scale has been used in a variety of occupational studies and is included as a component of the NIOSH GJSQ.

Caplan et al. (1975), using the technique described above for constructing their job-related anxiety scale, also have developed a 6-item index of job-related depression. The scale is based, in part, on items from the Zung (1965) Self-Rating Depression Scale and has been shown to be internally consistent (.83) and associated with a variety of job stressors (Caplan et al., 1975).

### *General Psychological Distress*

The Profile of Mood States (POMS; McNair, Lorr, & Droppleman, 1971) is a 65-item adjective checklist that has become increasingly popular with occupational stress researchers interested in examining mood disturbance associated with occupational stressors. The instrument measures six primary mood dimensions (derived through factor analysis) labeled *tension–anxiety, depression–dejection, confusion, anger–hostility, vigor,* and *fatigue.* On each item, respondents rate the extent to which they have experienced a feeling during the past week on a 5-point scale ranging from *not at all* to *extremely;* the measurement context is "the past week including today." The scale takes approximately 10–15 min to complete, and subscales show internal-consistency coefficients ranging from .84 to .95 (McNair et al., 1971), with 4-week test–retest reliabilities ranging from .61 to .69 (McNair & Lorr, 1964).

While less frequently used by occupational stress researchers, the Symptom Distress Checklist (SCL–90–R; Derogatis, 1977) provides a multidimensional symptom inventory that measures more chronic symptomatic psychological distress. The primary symptom dimensions on this 90-item scale are (a) somatization, (b) obsessive–compulsive behavior, (c) interpersonal sensitivity, (d) depression, (e) anxiety, (f) hostility, (g) phobic anxiety, (h) paranoid ideation, and (i) psychoticism. Each item is rated on a 5-point scale for the degree of distress that it causes. The internal consistency of the nine symptom dimensions ranges from .77 to .90, and the test–retest reliability ranges from .78 to .90. Norms are provided for nonpatient populations, and the instrument has been used in examining the effects of meditation and other relaxation techniques for stress reduction (Derogatis, 1977).

The General Health Questionnaire (GHQ; Goldberger, 1978), like the SCL–90–R, is often used as a psychiatric screening instrument and has been used by job-stress researchers. The GHQ is available in 28, 30, 36, and 60 item lengths and measures between four and eight factors (depending on instrument length). The 28-item version, for example, contains four 7-item scales, factor analytically derived from the 60-item version, that measure somatic symptoms, anxiety and insomnia, social dysfunction, and severe depression. Six-month test–retest reliability coefficients range from .51 to .90, and split-half reliability was computed at .95 for the 60-item instrument (Goldberger, 1978). Questionnaire scores have been shown to be significantly correlated with clinical assessments and other self-report measures of symptoms of anxiety and depression. Because the instrument was developed on a British population, however, some of its items may prove problematic for American researchers. For example, the instrument contains an item regarding the "need of a good tonic," which is not likely to be understood by some American respondents.

### *Burnout*

Although a number of definitions of burnout exist, Pines and Aronson's (1988) definition of burnout as "a state of physical, emotional and mental exhaustion caused by long term involvement in emotionally demanding situations" (p. 9) is widely accepted.

There are currently two popular measures of the construct: the Maslach Burnout Inventory (MBI; Maslach & Jackson, 1981, 1986) and the Burnout Measure (BM; Pines & Aronson, 1988). Both measures have been used on large numbers of people. The more frequently used MBI was designed to measure burnout in human service professionals, whereas the BM is aimed at a broader range of occupations. The MBI contains 22 items designed to assess both the frequency (6-point scale) and intensity (7-point scale) with which human service professionals experience emotional exhaustion, depersonalization, and personal accomplishment. Internal-consistency coefficients for the six resulting subscales range from .71 to .90, with 2–4-week test–retest reliability coefficients ranging from .53 to .80. A number of studies, however, have questioned the subscale structure of the MBI and have suggested that the MBI may be unidimensional (Corcoran, 1995; Lee & Ashford, 1993).

The BM contains 21 items (rated on a 7-point frequency scale) that constitute three scales (assessing physical exhaustion, mental exhaustion, and emotional exhaustion). Unlike the MBI, the items have no explicit association with work and are presented in random order. The subscales have shown good (.80 to .90 range) internal consistency (Corcoran, 1995), and the total scale has shown 1-month test–retest reliability of .89 (Pines, 1983). As with the MBI, factor analytic studies suggest that the BM is a unidimensional measure (Corcoran, 1995), and a number of studies have shown a high correlation between the total BM score and scores on the MBI Emotional Exhaustion scale (Pines, 1983).

### *Other Measures*

A number of other self-report symptom questionnaires are available for use in assessing both physical and psychological status and have been used by stress researchers. The Cornell Medical Index (CMI; Brodman, Erdmann, Lorge, & Wolff, 1949) is one of the oldest and most widely used standardized questionnaires for medical symptoms. It contains 195 yes and no questions and taps symptoms in 18 different symptom subgroups, which include both major organ systems and domains of psychological distress. Comparisons of hospital case records with the CMI responses have shown considerable agreement (Brodman, Erdmann, Lorge, & Wolf, 1951). Although there are no standard values for the total affirmative scores, there are comparative data regarding total scores for specific symptom subgroups.

It is worth mentioning that both the SCL–90–R (Derogatis, 1977) and the GHQ (Goldberger, 1978) contain scales that measure physiological complaints. Although the complaints measured by these scales may be reflections of physical disease, the intent of both scales is to capture a person's psychological tendency to somaticize feelings. Hence, these scales may not be well suited to examining the physiological responses to adverse job conditions.

One of the most detailed and individualized instruments for assessing individual strain is the Daily Log of Stress-Related Symptoms (Manuso, 1980). The log is intended as a self-assessment tool for use in a comprehensive stress management workshop. It is designed to help participants identify symptoms that have causes other than stress, to discover their own unique patterns of stress response, and to establish goals for stress management. Using the checklist, respondents record the development of any symptoms by putting a dot on the log over the time of day when the symptoms began. The symptom is rated by its intensity (vertical axis of the log) and by the extent to which it interferes with ongoing activities. The log also has space to record number of hours at work, percentage of time interacting with others, the use of medications, daily accomplishments, avoidance strategies, use of alcoholic beverages, use of relaxation and other stress control techniques, and cigarette consumption. The amount of detail limits the use of the log as a screening or group-assessment instrument. However, the amount of detail and individualization makes it a useful tool for intensive stress management workshops.

### *Evaluation of Self-Report Measures of Strain*

The limitations of self-report strain measures of all types are well documented and are particularly problematic within the context of job-stress research. In addition to shared response bias, the use of self-reports of both job stressors and strains in a study increases the potential for conceptual overlap in the measures. Such studies fall victim to what Kasl (1978) has referred to as the "triviality trap" (p. 14): a situation in which the independent and dependent variable measures, in essence, assess largely the same construct. Furthermore, stressors and strains, when measured together, can affect the person's attribution of particular symptoms.

Social desirability confounding is often a problem with self-report strain measures. Some strain indexes

assess highly personal issues (e.g., aspects of mental health) that individuals would rather not acknowledge or admit. In addition, a person's cognitive schemas also may influence symptom reporting (Cohen, Kessler, & Gordon, 1995). Some sensations may be labeled as symptoms because questionnaires trigger a schema whereby stress is associated with such symptoms.

It is widely recognized that self-reports of strain (especially affective strains) can lack predictive validity in terms of morbidity (Cohen et al., 1995). However, validity issues are of special concern in occupational stress research where measures of job-related strains have been used. An underlying (and unresolved) issue involves the extent to which measures of job-related strains (e.g., job-related anxiety or job-related depression) are predictive of well-being in life. The fact that a particular job stressor may be strongly associated with a measure of job-related strain (e.g., job-related depression), for example, may not necessarily imply that the stressor impacts some aspect of well-being in life. Such validity concerns have led many job-stress researchers, particularly those interested in epidemiologic issues, to use general (non-work-related) rather than job-related strain measures in their research designs.

Despite the measurement difficulties, strains (particularly affective strains) appear to play a central role in the job-stress process. Various occupational stress models (e.g., Cooper & Marshall, 1976; House, 1974; Hurrell & Murphy, 1992) depict the stress process by integrating work environment, psychological, and biological factors. In such models, the perception of job stressors produce negative emotional responses, which lead to physiological and behavioral response patterns and, in turn, to increased risks of psychological and physical illness. Thus, stressors are thought to affect health-related outcomes through negative affective states, and affective states are typically measured by self-reports.

Given the importance of strains to job-stress theory and research and the measurement difficulties described above, investigators are encouraged to use a triangulation strategy (Ivancevich & Matteson, 1988), which involves the use of multiple assessment modalities. For example, investigators may augment self-report measures of strain with objective indicators such as tardiness, sick days, or health care claims. However, individual privacy concerns should be carefully considered when using such data. The usefulness of self-report strain measures also can be enhanced by pairing them with physiological measures, which are discussed in the next section.

## Physiological Measures of Job Strain

Researchers of job stress increasingly have turned to physiological measures as indicators of strain.[1] Such measures may be categorized into three broad groups: cardiovascular variables, stress hormones, and measures of immune response. Cardiovascular indicators, including heart rate and blood pressure, are perhaps the most frequently studied physiological indicators. A recent review of the relationship between hypertension and self-reported versus objective stressors was conducted by Nyklicek, Vingerhoets, and Van Heck (1996). The review revealed that studies demonstrated a positive relationship between objectively derived occupational stressor measures and blood pressure levels. In contrast, studies using self-reported stressors revealed conflicting results. The researchers suggested using both objective measures and a subjective appraisal of stressors and using ambulatory assessments of blood pressure that can be taken in multiple assessments. A review of ambulatory blood pressure studies indicated that participants in high-strain jobs (characterized by high levels of demand and low levels of control) had higher blood pressure levels at work, at home, and during sleep (Schnall, Landsbergis, & Baker, 1994).

One unique study was conducted using medical students as participants in a setting in which the occupational stressor varied predictably, whereas the physical environment remained constant (Sausen, Lovallo, & Pincomb, 1992). Heart rate, systolic and diastolic blood pressures, rate–pressure product, and mood states were measured before, during, and after low-stress (lecture) and high-stress (examination) work in 44 male medical students. As anticipated, hemodynamic activity and distress reports were higher before and during examination day than on lecture day, which was characterized by stable cardiovascular activity. The researchers called for other occupational stress studies in natural settings using ambulatory blood pressure and heart rate monitoring.

Folger and Belew (1985) noted the difficulties in determining whether accelerated heart rate means increased physical exertion or general activation such as that triggered by anxiety. One way to distinguish between mental and physical load is to track short-term patterns of variability in heart rate, such as sinus arrhythmia. Note also that cardiovascular variables are strongly influenced by transient events

[1] For a comprehensive discussion of physiological measures, we recommend several excellent chapters in Cohen et al. (1995).

such as talking or being touched. As such, they may be more appropriate for the study of acute, rather than chronic, job stressors (Fried, 1988). Further, individual differences in reactivity may render the cardiovascular measures not sensitive enough for some research studies.

A second category of measures, stress hormones, including cortisol and catecholamines, has received increased attention. The use of these measures is complex, given their joint reactivity, and their collection can be invasive, using blood, urine, or saliva samples. Stress hormones reflect basic arousal and affect most systems of the body. They are particularly useful in combination with other indexes of stress (Baum & Grunberg, 1995).

A recent study illustrative of the use of these stress hormones was conducted using a sample of 109 employed women (Luecken et al., 1997). The effects of marital and parental status on daily excretion of urinary catecholamines and cortisol were examined, with urine collection performed on 2 separate workdays at three separate times (overnight, daytime, and evening). Age and caffeine consumption were used as covariates in a repeated measures analysis. Results showed that women with at least one child living at home excreted significantly more cortisol, independent of marital status or social support. Catecholamine levels were unrelated to marital or parental status or social support.

The choice of which stress hormone to measure and which measurement technique to use is complex. Urinary catecholamines, for example, are less sensitive to transient events and may be better outcomes for studying chronic stressors. Plasma catecholamines, which can change very rapidly, may be better markers for acute stressors (Fried, 1988). Researchers must match the selection to the research question, the logistics of the technique, and the time frame involved (Baum & Grunberg, 1995).

A third growing area of physiological markers of distress–strain is that of immunological changes. Studies of work-related changes in immune functioning have included plasma and salivary concentrations of immunoglobulins, counts of lymphocyte cells and natural killer cells, and antigen- and mitogen-induced lymphoproliferative responses. Overall, these studies have yielded results that support immunosuppression, although some opposite results have been found (Henningsen, Hurrell, Baker, Douglas, & MacKenzie, 1992; Meijman, van Dormolen, Herber, Rongen, & Kuiper, 1995). Many studies included catecholamine measures, because psychoimmunological effects can be mediated by neuroendocrine processes. Illustrative of this genre is a study by Meijman et al. (1995) involving 37 cargo handlers. Among their results was the finding that perceived control moderated the relationship between experienced workload and immune parameters. Higher workloads combined with low control were related to lower immune parameters, whereas higher workloads with higher perceived control was related to higher immune parameters.

The opportunity to incorporate immunological assays into job-stress research is a promising one, given that chronic stressors have been linked to longer term down regulation of immune functioning (Kiecolt-Glaser & Glaser, 1992). Collaboration with an experienced immunologist is a recommended strategy for behavioral scientists who want to incorporate immunological variables into research (Kiecolt-Glaser & Glaser, 1995).

Although the increased use of physiological measures in job-stress research represents progress, it is also important to critically evaluate the efficacy of these measures. In particular, physiological measures can suffer from validity problems in terms of both specificity and sensitivity. The extent to which a test identifies individuals with a given condition, or its sensitivity, varies widely among measures. Sensitivity, which indicates the extent to which a test identifies people with a given condition, also varies greatly among measures. Cholesterol measures, for instance, may not be particularly reactive to perceived stress. Hormonal measures differ in the extent to which they respond to stress. Whereas some respond quickly and recover slowly, other hormones may respond slowly and return to baseline levels quickly. Other variables respond quickly and recover quickly; some respond more slowly and recover slowly. The point is that these differences in responsiveness must be well understood in selecting a particular hormonal measure.

*Specificity* is the extent to which a test separates individuals with a particular condition from those who do not have the condition. The cardiovascular measures are particularly prone to problems with specificity. Heart rate, for example, is highly variable and is influenced by a host of factors other than stress. Catecholamine levels also are affected by many factors other than stress, including illness and ingestion of caffeine, drugs, and dietary influences.

Issues of specificity and sensitivity affect the validity of the physiological measures of strain, and pose challenges for researchers. Baseline measures of physiological strain are imperative for assessing changes in functioning and for the assessment of

interindividual differences. The temporal course of the indicator's response to stress must be considered, along with its role in the development of disease. Certain physiological indicators may represent a nonspecific response to stress, but others may be implicated as precursors of disease.

The need to use standardized measurement protocols and the need for substantive knowledge of the physiological measures call for collaboration between social scientists and medical researchers. Kasl (1996), using a psychosocial epidemiology framework, reviewed recent developments in the study of work and cardiovascular health. He cautioned that neuroendocrine and blood pressure reactivity are not definitive measures for studying the impact of work exposure on health and called for increased use of lipids, lipid fractions, fibrinogen, cigarette smoking, physical inactivity, and absences as indicators. These suggestions are valid ones for researchers of job stress and health as well.

## Contemporary Issues Affecting Job-Stress Measurement

There are several trends in the job-stress research literature that represent improvements in measurement, methods, and content. These include the use of occupationally specific stressor measures, creative measurement strategies, negative–positive affect, and structural equation modeling (SEM).

### *Occupationally Specific Stressor Measures*

Ganster and Schaubroek (1991) were first to note a trend in the job-stress literature for investigators to develop measures of stressors that are specific to certain occupations. Examples of such instruments include those for police officers (Evans & Coman, 1993), consultant physicians (Agius, Blenkin, Deary, Zealley, & Wood, 1996), hospital nurses (Gray-Toft & Anderson, 1981), and mental health nurses (Brown, Leary, Carson, Bartlett, & Fagin, 1995). The value of such instruments, however, seems uncertain. A examination of these measures suggest that many simply measure very common (and often the same) job stressors. For example, a factor analysis by Fagin et al. (1996) of the Dellilliers Carson Leary (DCL; 1996) Stress Scale, designed to measure the stressors of mental health nursing, yielded five factors: Patient Demands, Organizational Demands, Staffing Issues, Concerns About the Future/Changes, and Job Dissatisfaction (Fagin et al., 1996). Similarly, a factor analysis of the Consultant Physicians' Work Demands Scale yielded two factors, Academic and Clinical, and a similar analysis of the Specialist Doctor Stress Inventory found four factors, Clinical Responsibility (for patient care), Demands on Time, Organizational Constraints, and Personal Confidence (Agius et al., 1996). In general, evidence produced by these measures has not gone beyond what one might expect with the use of more general job-stressor measures.

### *Creative Measurement Strategies*

It is important to acknowledge those studies that exemplify progress in the measurement of job stressors and strains. Some welcome trends are the inclusion of objective measures, the acknowledgment of cognitive appraisal processes, and the use of unique indicators of job strain.

A growing number of studies are adding objective measures of stressors to their designs. These include studies by Roxburgh (1996) and Smulders, Kompier, and Paoli (1996), which included objective measures of average hours worked per week along with more traditional self-report measures of job stressors, and studies of diverse groups of workers by Kirmeyer and Dougherty (1988), Semmer, Zapf, and Greif (1996), and Greiner et al. (1997), which used observational approaches to stressor assessment.

Another positive trend is toward the inclusion of the cognitive appraisal process in stressor measures. Illustrative of this trend is a study by Dewe (1992), which used a method to capture the transactional nature of the appraisal process. This study was designed on the notion that the mere presence of a stressor is not necessarily a condition for strain and that the focus of measurement should be on the meaning that individuals give to events rather than the events themselves. The sample consisted of 144 employees of a large insurance company. Participants were first asked to think about a situation at work that was the most stressful for them in the past month and to write and describe that situation. They were next asked to identify the single most important factor that made the situation demanding and to write it down. Participants referred to their written situations in answering questions about coping and about secondary appraisal. Stressful situations were content analyzed into three categories: client difficulties, work overload, and individual issues. Three categories of primary appraisal were established: how individuals were made to feel (e.g., embarrassed or uncomfortable), lack of support, and lack of control. Results indicated that individuals discriminated in the way they gave meaning to the stressors and in terms of how they perceived the stressors were best coped

with. The alternative methodology used in this study allowed researchers to more effectively trace the appraisal process.

Diary approaches to measuring stress also have emerged. Exemplifying this approach is a study by Jones and Fletcher (1996), which used daily questionnaires in a sample of full-time working couples over a 3-week period. The study used both qualitative and quantitative measures. Diary approaches such as this one permit the examinations of daily fluctuations in stressors, mood, and strains and can shed light on the carryover effects of stressors from one day to the next. Results of this study confirmed the spillover effect of stress from work to home.

Some studies have explored unique indicators of strain. One study examined the relationship between occupational stress and the progression of periodontitis in employed adults (Linden, Mullally, & Freeman, 1996). Participants were 23 dental patients who were examined on two occasions approximately 5.5 years apart. Clinical measurements of periodontal status on both measurement occasions included clinical attachment level, plaque, subgingival calculus, bleeding on probing, and probing depth. Participants completed the Occupational Stress Indicator (Cooper, Sloan, & Williams, 1988) on the second examination appointment. Results indicated that periodontal disease was more severe in patients with higher levels of stress.

Another strain indicator receiving increased attention is plasma fibrinolytic activity. Parameters of blood coagulation and fibrinolysis have been implicated in cardiovascular disease. One study investigated the relationship between parameters of blood coagulation and fibrinolysis in a sample of 213 middle-aged Japanese workers (Ishizaki et al., 1996). Results indicated that high job demands were related to decreases in tissue plasminogen activator activity, independent of the traditional risk factors (i.e., age, obesity, blood pressure, elevated serum lipids, and smoking). These findings suggest that job stress may be related to the development of cardiovascular disease through changes in plasma fibrinolytic activity.

Changes in serum lipids were used by Shirom, Westman, Shamai, and Carel (1997) in a quasi-longitudinal study of 665 Israeli employees. Both objective overload and subjective overload, along with emotional and physical burnout, were examined as related to changes in cholesterol and triglyceride levels. For females, serum lipid changes were positively related to emotional burnout but negatively related to physical burnout. For males, both types of burnout (physical and emotional) were positively related to changes in total cholesterol.

A final and welcome trend is the increasing use of multiple measurement methods within job-stress studies. Carrere, Evans, Palsane, and Rivas (1991), for example, studied the relationship between job strain (excess of job demands over job decision latitude) and physiological and psychological stress in 60 urban public transit operators. Two blood pressure measurements were used (before and after the work shift) along with urinary catecholamine assays taken overnight and during the work shift. Observers recorded nonverbal indexes of stress such as automanipulative behaviors (e.g., scratching) and repetitive object play (e.g., tapping fingers on steering wheel). Self-reports of stressors and strains also were used. Results indicated that increased job strain was associated with elevated catecholamine levels, unobtrusive behavioral indexes of stress, and self-reported occupational strain.

### *Negative and Positive Affect*

Another issue that pervades discussions on job-stress assessment is the controversy surrounding the role of affect in the stressor–strain connection. Negative affect (NA) has been cited as confounding measures of both stressors and strains and exaggerating their correlations. As an individual-difference factor, NA reflects a pervasive tendency toward negative emotions and self-concept (Watson & Clark, 1984). Researchers, however, have engaged in considerable controversy about the extent to which NA constitutes a distortion in self-reports of stressors and strains.

In a study of managers and professionals, Brief, Burke, George, Robinson, and Webster (1988) found that NA explained a significant amount of variance in stressor–strain relationships and concluded that the previous literature on the stressor–strain connection should be viewed cautiously because NA had gone unmeasured. Note that Brief et al. (1988) used a life events measure of personal and work stressors in their study, which holds potential for greater confounding due to its summated nature. In contrast, Chen and Spector (1991) examined the stressor–strain connection in a study of white-collar workers using a variety of chronic, work-related stressors and found that NA did not significantly affect the stressor–strain relationship.

In a study of fire and police department employees, Schaubroeck, Ganster, and Fox (1992) tested two issues: whether NA contaminated the measurement of self-reported stressors and strains and whether NA

negatively biased reports of stressors and strains, thus producing spurious relationships between them. Confirmatory factor analysis revealed that NA did not measure a factor in common with measures of subjective stressors or strain. Latent-variable structural equation analyses found that estimating the effects of NA on strain significantly reduced the effects of work stressors. The results indicated that NA is more of a problem with self-reported strain than with self-reported stressors and that NA was not related to physiological indicators of strain (blood pressure, palmar sweat, skin temperature, heart rate, or adrenaline).

To improve on these cross-sectional studies, Schonfeld (1996) conducted a longitudinal study of teachers using neutrally worded stressor measures that were constructed specifically to minimize confounding with NA. Results of this investigation indicated that these measures were related to postemployment depression and job satisfaction and that the relationships were unchanged when NA was controlled.

Comparisons among these and other studies are difficult because of differences in stressors assessed (chronic vs. acute; occupationally specific vs. broad band), strains assessed (psychological vs. physiological; self-report vs. objective assessment), and measures of NA (neuroticism, psychophysiological symptoms, or trait anxiety). However, taken as a whole, the results seem to suggest that NA may not be as great a threat as some early studies might indicate (L. J. Williams, Gavin, & Williams, 1996). However, until the issue is resolved, it may be prudent to include an NA measure in studies that use self-reports of stressors and strains because of the *potential* for NA to affect the measurement of and substantive relationships between stressors and strains.

Positive affect (PA) also has been examined in some studies, including the Schaubroeck et al. (1992) study. In general, this and other studies (cf. Watson & Pennebaker, 1989) indicated that PA and NA are independent dispositional factors. Schaubroeck et al. (1992) found that PA did not exaggerate or diminish the stressor–strain connection and exhibited very weak relationships with both stressors and strains. These researchers suggest that PA may play more of a role in explaining intraindividual differences in responses such as coping.

### *Structural Equation Modeling*

Measurement is not the only important issue to consider when designing studies of the relationship between stress and health outcomes. In addition, strong data analytic techniques, appropriate and unbiased sampling, and study designs that maximize the ability to make causal inferences are equally important (Cohen et al., 1995). A data analytic technique that holds substantial promise for organizational stress research is SEM. Properly applied, SEM requires researchers to specify and test a measurement model before examining any structural relationships proposed by the study. Confirmation of the measurement model allows researchers to assess convergent and discriminant validity, whereas confirmation of the structural model allows assessment of nomological validity (Anderson & Gerbing, 1988; James, Mulaik, & Brett, 1982). SEM's strength is that it forces researchers to be more theoretical by examining the links among theory, data analysis, and measurement (Hurley et al., 1997).

Schaubroeck et al. (1992) used SEM to provide support for a multiple-indicator unidimensional, or congeneric, measurement model in which the NA construct correlates with perceived work stressors and subjective strain outcomes but does not affect the measurement of either. Congeneric measurement models are preferred because when each construct is defined by at least two measures and each measure is intended as an indicator of only one construct, assignment of meaning to the estimated constructs is less ambiguous. When measurement models contain correlated measurement errors or have indicators that load on more than one construct, assignment of meaning to the estimated constructs becomes problematic (Anderson & Gerbing, 1988).

Confirmation of a congeneric measurement model is a critical first step for theory testing and development. Researchers should proceed with simultaneous estimation of the measurement and structural models only after this first step has been accomplished (Anderson & Gerbing, 1988; James et al., 1982). When properly applied, statement of theory is more exact, testing of theory is more precise, and communication of theory is enhanced with SEM (Hughes, Price, & Marrs, 1986). Zapf, Dormann, and Frese (1996) recommend the use of SEM for longitudinal studies in job-stress research, citing the following (p. 151) advantages:

1. Measurement errors can be accounted for by the introduction of measurement models. Causal relationships among variables are modeled on the basis of latent constructs that are considered to be error free.
2. Multiple competing models can and should be tested.
3. Nonrecursive relationships can be introduced into the models.

4. The effects of unmeasured third variables can be accounted for.

Nonrecursive relationships among variables present a particular methodological challenge for organizational stress researchers. A nonrecursive relationship is one in which two (or more) variables are involved in two-way causation (Bentler & Chou, 1987). Although few current structural models in occupational stress research incorporate nonrecursive models, reciprocal causation among variables may be especially important to consider when studying the job-stress process. When individuals consistently experience both strains and health problems, it may be difficult to determine which came first. Obtaining an unbiased estimate of the effect of strains (and consequently stressors) on health requires partialing out the reciprocal effect of health on stress (cf. Kessler, Magee, & Nelson, 1996). Researchers should be aware, however, that nonrecursive models are not a panacea for resolving ambiguities in causal orders, especially when using cross-sectional data (Bentler & Chou, 1987; Schaubroeck, 1990).

Nonrecursive relationships require that instrumental variables be incorporated into the model. *Instrumental* variables are variables that are theoretically related to only one of the antecedent variables in the reciprocal relationship (Bentler & Chou, 1987). Frone, Russell, and Cooper's (1992) specification of a nonrecursive model in their study of stress and work–family conflict provides a good example. In their cross-sectional study, job distress and family distress functioned as the instrumental variables in the nonrecursive model of work–family conflict. Their results support the concept that the conflict relationships between work and family are reciprocal. Another example is Schonfeld, Rhee, and Xia's (1995) longitudinal study of stress in teachers. They modeled a nonrecursive relationship between depressive symptoms and school work environments using preemployment depressive symptoms as an instrumental variable.

Stone-Romero, Weaver, and Glenar (1995) analyzed 1,929 articles in the *Journal of Applied Psychology* from 1975 to 1993 and concluded that the popularity of nonexperimental studies using SEM may have increased in recent years. They boldly suggest that researchers who want to publish the results of nonexperimental studies in major journals will have to learn to use and properly interpret the results of SEM data analysis. For graduate-level training in the organizational sciences, this implies that courses in SEM might be required and that more emphasis might be placed on nonexperimental research design and strategies in research methods courses. Additionally, they suggest that journal editors, reviewers, and editorial board members will need to have sufficient familiarity with both SEM methods and nonexperimental research characteristics to provide competent evaluations of research that is submitted for review.

Bollen and Lennox (1991) demonstrated that conventional guidelines for what is considered a good measure may be flawed when differences between cause and effect indicators of a latent construct are not understood and accounted for. *Effect* indicators are indicators that depend on the latent variable, whereas *cause* indicators determine the latent variable. One particular problem with causal indicators is the inappropriate use of internal consistency as a criterion for item selection. Because equally reliable causal indicators of the same concept can have positive, negative, or no correlation with each other, reliability of casual indicators is not demonstrated by internal consistency (Bollen, 1989). Situations in which constructs have a mix of effect and causal indicators are especially complicated.

An occupational strain measure that Bollen and Lennox (1991) used as an example of inappropriate application of the conventional wisdom on measurement is the CES–D. They contended that Radloff's (1977) use of Cronbach's alpha to assess the scale's reliability was misguided. They stated that a check of internal consistency for these items would be justified if depression were hypothesized to be a single unidimensional construct that had several effect indicators with uncorrelated errors. Because the construct includes causal indicators, may be multidimensional, and may have reciprocally related indicators, inspecting item correlations, internal consistency, and reliability estimates is difficult to rationalize.

Despite its promise, SEM cannot overcome a weak study design or weak measures. For rigorous tests of the fit between theory and data, improved measures are a necessary first step (Brannick, 1995). Careful and informed use is the key to proper application of any data analytic technique, including SEM.

These trends in job-stress research represent progress and are reasons for cautious optimism. As researchers become more educated about measurement issues, techniques like triangulation become more evident in the published literature. In selecting a measure, it is important to address issues such as reliability, validity, invasiveness, feasibility, and cost. The preceding review and evaluation can serve to guide researchers in addressing these issues. Note,

however, that measurement is only one part, albeit a critical part, of the research process.

## Evaluating Measurement Issues Within a Larger Framework

In addition to selecting measures and data analytic techniques, researchers must also be concerned with representative sampling and research designs that facilitate testing of causal relationships proposed by the study. Research design may be the weak link in occupational stress research. Whereas the epidemiological perspective of occupational stress has articulated these concerns eloquently, we offer an additional consideration to complement this perspective.

### *The Epidemiological Perspective*

Kasl (1987a, 1987b) argued persuasively that from the perspective of occupational epidemiology, the primary goal of work-stress research should be to identify links between exposure to some aspect of the objective work environment and adverse (or, possibly, positive) health outcomes. Accordingly, research design and data analysis should be conducted to demonstrate the potential cause–effect relationships that such links may represent. A supplementary goal that would advance this cause would be to identify variables that explain additional variance in the health outcomes. Nearly a decade later, Kasl (1996) expressed regret that these two important design strategies remain neglected. For Kahn and Byosiere (1992), this represents an example of the considerable divergence between preaching and practice in organizational stress research.

Kasl (1987a) suggested also that research in the field of occupational stress would be better off without the stress concept. He speculated that the primary benefit that could be expected from discarding the stress-theoretic formulations would be facilitation of the identification objective environmental conditions that are linked to health outcomes.

The emphasis in this perspective is heavily weighted toward prediction of the dependent variable, health outcomes. Explicitly, this perspective implies that there is no inherent necessity, when we discard the stress concept, to give up even a single, well-formulated, testable proposition (Kasl, 1987a). It should not, however, imply that the requirement for explanation of relationships in cause–effect links is expendable.

### *Implications for Establishing Construct Validity*

The emphasis on prediction has an applied orientation (Schwab, 1980). Internal validity, the relationship between the research operations irrespective of what they theoretically represent, is fundamental (Cook & Campbell, 1979). More important, however, is construct validity, or the correspondence between a construct (conceptual definition of a variable) and the operational procedure to measure or manipulate that construct (Schwab, 1980). In the applied orientation, we cannot be confident that the hypothetical correlation between the empirical level of the independent variable and the construct level of the dependent variable approximates the relationship we are trying to estimate unless the dependent measure has extremely high construct validity (Schwab, 1980). This concept is illustrated in Figure 1.

The complement to the applied orientation is the scientific orientation (Schwab, 1980). The distinction between the two is determined by the relative importance the researcher places on independent and dependent constructs. In the scientific orientation, both receive equal importance; consequently, substantive validity depends on the construct validity of both. Another important distinction is that unlike applied research, the statement of relations between the higher order constructs (A and B in Figure 1) is necessary in scientific research.

Unfortunately, the applied orientation is problematic for the advanced data analytic techniques that researchers in occupational stress research are migrating toward. When using SEM for application or prediction, researchers must use a partial least squares (PLS) estimation approach. With the PLS approach, a congeneric measurement model is neither assumed

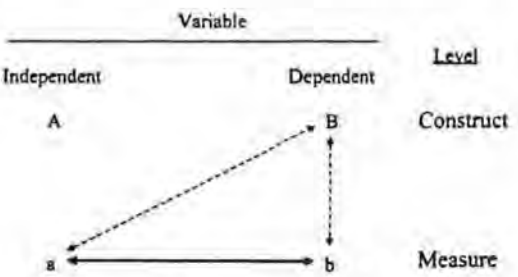


*Figure 1.* Applied prediction design. From "Construct Validity in Organizational Behavior," by D. P. Schwab, in L. L. Cummings and B. Staw (Eds.), *Research in Organizational Behavior*, 1980. Greenwich, CT: JAI Press. Copyright 1980 by JAI Press. Adapted with permission.

nor assessed, which renders the theoretical meaning imputed to the latent variables ambiguous. Also, an overall test of model fit is not available. Finally, without both a large sample size and a large number of indicators per latent variable, a PLS approach will tend to underestimate the correlations between the latent variables and overestimate the correlations between the observed measures and their respective latent variables (Anderson & Gerbing, 1988).

The scientific orientation is absolutely required for proper application of the full-information estimation approach provided by SEM. Seven of the 10 conditions that justify the use of SEM pertain to the appropriateness of a theoretical model (James et al., 1982). Condition 2 states that "an attempt must be made to separate functional relations from simple covariation by proposing a theoretical rationale for the functional relations . . . that is, an explanation of why variables covary" (James et al., 1982, p. 34).

## How Good Are Our Measures, and What Needs to Be Done?

It's abundantly clear that there is a need for new and improved measures in the field of occupational stress. For over two decades, Kasl (e.g., 1978, 1987a, 1987b, 1996) has called for the identification and use of objective measures of working conditions and has been unwavering in his belief that objective job-stressor measures are necessary to advance our knowledge regarding job-stress-related ill health. Unfortunately, his calls have been only partially heeded, and the need remains great. Although perhaps less critical, there is also a need to identify objective indicators of strain and incorporate them in our research. Although advances are being made in the use of physiological strain indicators (e.g., immunologic responses), objective measures of nonphysiological strains merit attention.

In addition to the need for objective measures, there is a need to carefully consider the adequacy of existing job-stressor constructs and the instruments that are currently used to measure them. Job-stress research over the past 35 years appears to have been dominated by investigations of a relatively few working conditions that use the same or similar measures. It seems reasonable to question the relative importance of some of these stressors in contemporary work, given that the nature of work and the nature of the workforce have changed radically and continue to change. Existing job-stressor measures do not appear to adequately capture some of the important demands of work in these new jobs and working environments. In this regard, the measurement of cognitive aspects of work seems to offer an important challenge to job-stress researchers, as do measures of demands related to gender-, minority-, and age-related working conditions and workplace violence.

All too often, it appears that job-stress researchers choose measures more on the basis of the names of the constructs of interest rather than on a careful evaluation of the requirements of the research situation, the characteristics of the measures, and the availability of alternative measures. We hope that this article helps to shed some light on the latter. It is our belief that advances in the field of occupational stress are predicated on attention to measurement issues.

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