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# STRESS RESEARCH AND STRESS MANAGEMENT: PUTTING THEORY TO WORK

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This review of occupational stress research considers early and contemporary studies on the nature of stress at work, its effects on health and the way in which such knowledge is being applied in attempts to manage the problem. It discusses the conceptual frameworks implied in the practice of stress management at work and in health and safety legislation. In particular, it focuses on the utility of the 'control cycle' and problem-solving approaches to the management of stress at work.

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# TERMS OF REFERENCE

The review was commissioned by the Health and Safety Executive in October 1992 to provide an overview, within the conceptual framework implied by current health and safety legislation, of the scientific literature relating to the nature and health effects of work stress and to the nature and effectiveness of stress management programmes. Kasl (1992) has suggested that reviews in this area are either attempts to "paint the big picture" or detail evaluations of specific hypotheses. The former may suffer from treatments of the available literature which are too superficial or which are selective in favour of an over arching view, while the latter may suffer simply because they fail to place the hypothesis of concern in its wider context and fail to make an evaluation on the basis of the whole picture.

Sadly, much of what is currently published on occupational stress and health is *weak methodologically*. Kasl (1992) has summarised the main problem: the available evidence is, in part, based on cross sectional studies in which the key variables are measured and linked only in terms of self report. While it would be unwise to reject out-of-hand all such studies, the methodological sophistication necessary for their proper design, analysis and interpretation is often lacking. A second problem is that much of what is published is *redundant* in that it simply demonstrates well established theories. In neither case is there any significant gain in knowledge.

This review was commissioned to "paint the big picture". It is not possible, within its terms of reference, to cite and appraise all the published literature because of its vastness. It therefore focuses on that which is deemed relevant, that which is better known, and that which is more rather than less adequate both methodologically and theoretically. To this extent, this review is selective.

## ACKNOWLEDGEMENTS

The author acknowledges the support of the Health and Safety Executive in the preparation of this document, and the comments and support of Sue Cox and Dr Amanda Griffiths. The views expressed here are those of the author and do not necessarily reflect those of any other person or of any organization. However, they are consistent with earlier guidance on the control and monitoring of psychosocial and organizational hazards prepared by the author for the World Health Organization (European Region) and published in its Occasional Series in Occupational Health no. 5 (1993).

# 1.0 BACKGROUND

Over the past two decades, there has been a growing belief in all sectors of employment and in government that the experience of stress at work has undesirable consequences for the health and safety of individuals and for the health of their organizations. This belief has been reflected both in public and media interest and in increasing concern voiced by the trades unions, and professional and scientific bodies. There are three basic questions that require answering: (1) What is the nature of occupational stress? (2) Does work stress affect health and if so how? and (3) How can it be managed effectively? This review addresses these questions after having briefly examined the difficulties involved in placing work stress in context of other life stressors.

## 1.1 Work Stress in Perspective

There is evidence to suggest that work is only one of a number of possible areas or aspects of life which can give rise to the experience of stress. Largely following on from the work of Selye (1956), there has been an assumption that discrete, time limited 'life events' requiring change or adaptation are associated with the experience of stress and may contribute to a wide range of disorders. Many attempts have been made to identify and scale such stressful life events (see, for example, Holmes and Rahe , 1967; Dohrenwend and Dohrenwend, 1974; Dohrenwend et al, 1988). While psychometric research into the nature and impact of stressful life events is not without methodological problems (see, for example, Sarason et al, 1975; Perkins, 1988; Dohrenwend et al, 1988), some progress has been made in determining the relative importance of different types of events. One particular example is considered here.

Dohrenwend et al (1988) have described the careful development (and strengths and weaknesses) of the PERI[1] Life Events Scale. A list of 102 objectively verifiable life events was constructed from previous studies in New York. These events were classified according to 11 life domains: school, work, love and marriage, having children, family, residence, crime and legal matters, finances, social activities, health and miscellaneous. As in other studies (see Dohrenwend and Dohrenwend, 1974), subjects were asked to rate events against marriage which was given an arbitrary rating of 500. Subjects were grouped according to a number of criteria such as age and sex, and ethnic background, and mean sub group ratings were calculated

1 PERI: Psychiatric Epidemiology Research Interview

for each event. This avoided giving undue weight to sub groups over represented in the overall sample. However, the events were also scored according to their mean rankings: this gave equal weight to all subjects regardless of sub group. Of the 102 life events, 21 related to work. The highest ranked work event was 'suffered business loss or failure ' with a mean rating of 510. Demoted and promoted at work rated 379 and 374 respectively. The lowest ranked work event was 'changed job for one which was no better or worse than last one' (251). As far as non-work events were concerned, the highest ranked event overall was 'child died' (with a rating of 1036), with divorce at 633, married at 500 (the anchor event) and the lowest, acquired pet, at 163. These data suggest that work related life events are not trivial experiences, and are among those which have the greatest perceived impact. This conclusion is supported by a study in the United Kingdom which asked a sample of male and female employees in the East Midlands of England to identify that aspect (or domain) of their lives which presented them with the greatest problems and stress. Work was cited as the major source of problems and stress for 54% of respondents, while another 12% cited the work-home interface (Cox, Watts and Barnett, 1981).

However, it should be noted that where life event scales have included work events, the designers have been concerned only with discrete, 'acute' work-related events (such as being promoted or demoted). As will be argued in later sections of this report, it is now widely thought that the primary stressors facing most employees in the course of their working life are chronic rather than acute and are rarely mentioned in life event scales. Some studies have also suggested that rankings of life events are context dependent and can vary between different countries (Rahe, 1969) and between urban and rural communities (Abel et al, 1987). Thus, although at first sight life event scales may seem to answer the question 'How important are work stressors?', in fact they do not.

It is likely that there are interactions between stressors, both acute and chronic which do not respect the boundary between work and non-work domains. Indeed, evidence does exist to suggest (see also section 3.2) that work stress can 'spill over' to home life (Bacharach, Bamberger and Conley, 1991; Burke, 1986), and vice versa (Quick et al, in press, cited in Murphy, Hurrell and Quick, 1992), although effects may vary considerably (Kanter, 1977). The erroneous belief that work and non-work activities are unrelated in their psychological, physiological and health effects has been described as the 'myth of separate worlds' by Kanter (1977). While it is nonsensical to attempt an exact determination of the relative importance of work and non-work stressors, because they are not independent in their effects, it is sensible to explore that interaction and the carry over from one domain to the other.

| BAND | Rank (/102) | Mean of sub group ratings | EVENT |
|---|---|---|---|
| HIGHEST RANKS | 1 | 1036 | Child died |
| | 2 | 821 | Spouse died |
| HIGHEST WORK EVENT | 30 | 510 | Suffered business loss or failure (WORK) |
| MIDDLE RANKS | 48.5 (tie) | 456 | Stopped working for extended period of time (WORK) |
| | 48.5 | 336 | Start menopause |
| | 50 | 374 | Promoted (WORK) |
| | 51 | 446 | Suffered financial loss not related to work |
| | 52 | 383 | Assaulted |
| | 53 | 379 | Demoted at work (WORK) |
| LOWEST WORK EVENT | 86 | 251 | Changed job for one which was no better or worse than last one (WORK) |
| LOWEST RANKS | 98 | 221 | Was not able to take planned vacation |
| | 99 | 281 | Took up hobby |

**Table 1: Ranks and Mean Ratings for PERI Life Events**

(Adapted from: Dohrenwend et al, 1982)

Although such interaction effects exist, they are not always obvious. When an acute stressful life event occurs in work or outside of work (such as the death of a loved one, or a serious injury), the initial impact of carry over effects are often readily obvious to family, friends and colleagues or co-workers. However, when the effects of life stressors are more subtle and long lasting carry over effects are less frequently recognized and can be under estimated. Similarly, while the chronic experience of work stress may exert deleterious effects on family relationships, these may sometimes go undetected (see Gutek, Repetti and Silver, 1988; Repetti, 1987; Repetti and Crosby, 1984; Voydanoff and Kelly, 1984). A survey by the Canadian Mental Health Association (1984) found that 56% of respondents felt 'some' or 'a great deal of interference between their jobs and home lives. Of particular concern was the 'amount of time that the job demanded' and the 'irregularity of working hours' (including shift work). The interference affected family routines and events, child rearing and household responsibilities, made employees moody at home and conflicted with leisure activities and social life.

The focus in this review on work stress may suggest that work has only a negative effect on health: this is not the case. There is evidence that, under some circumstances, work may have positive health benefits, promoting psychological well-being (Baruch and Barnett, 1987) and physical health (Repetti et al, 1989). Unemployment and retirement from work are associated with excess risk of psychological ill health (for example, Cobb and Kasl, 1977; Feather, 1990; Jackson and Warr, 1984; Kasl, 1980; Warr, 1982, 1983, 1987). They may also be associated with increased risk of cardiovascular disease but the evidence here is, at best, equivocal (Kasl and Cobb, 1980). At the same time, specific work characteristics may also be beneficial to health, in particular, energy expenditure (Fletcher, 1988). Studies by Paffenbarger et al (1977, 1984) have suggested that high energy expenditure at work may be associated with reduced risks of fatal heart attacks.

The definition of work stress and its measurement are central to the question of its importance and the determination of carry over effects - positive or negative. The next section reviews both early and more contemporary theories of stress and explores their implications for measurement.

psychological disorders in RAF flying personnel, that "... stress is that which happens *to* the man, not that which happens *in* him; it is a set of *causes* not a set of *symptoms*." Somewhat later, Spielberger (1976) argued, in the same vein, that the term stress should refer to the objective characteristics of situations. According to this approach, stress was said to produce a strain reaction which although often reversible could, on occasions, prove to be irreversible and damaging (Cox and Mackay, 1981; Sutherland and Cooper, 1990). The concept of a stress threshold grew out of this way of thinking and individual differences in this threshold have been used to account for differences in stress resistance and vulnerability (see section 2.8).

## 2.2 Physiological Approach

The physiological approach to the definition and study of stress received its initial impetus from the work of Selye (1950, 1956). He defined stress as "a state manifested by a specific syndrome which consists of all the non-specific changes within the biologic system" that occur when challenged by aversive or noxious stimuli. Stress is treated as a generalised and non-specific physiological response syndrome. For many years, the stress response was largely conceived of in terms of the activation of two neuro endocrine systems, the anterior pituitary-adrenal cortical system and the sympathetic-adrenal medullary system (Cox and Cox, 1985; Cox, Cox and Thirlaway, 1983). The psychophysiology of stress is discussed in more detail in section 4.3. Selye (1950, 1956) argued that the physiological response was triphasic in nature involving an initial alarm stage (sympathetic-adrenal medullary activation) followed by a stage of resistance (adrenal cortical activation) giving way, under some circumstances, to a final stage of exhaustion (terminal reactivation of the sympathetic-adrenal medullary system). Repeated, intense or prolonged elicitation of this physiological response, it has been suggested, increases the wear and tear on the body, and contributes to what Selye (1956) has called the 'diseases of adaptation'. This apparently paradoxical term arises from the contrast between the immediate and short term advantages bestowed by physiological response to stress (energy mobilisation for an active behavioural response) to the long term disadvantages (increased risk of certain 'stress related' diseases: section 4.3).

# 2.0 DEFINITION OF STRESS

The definition of stress is not simply a question of semantics - playing with words - and it is important that there is agreement, at least in broad terms, on its nature . A lack of such agreement would seriously hamper research into stress and the subsequent development of effective stress management strategies. Given this, it is an unfortunate but popular misconception that there is little consensus on the definition of stress as a scientific concept or, worse, that stress is in some way undefinable and unmeasurable. Such belief belies a lack of knowledge of the relevant scientific literature.

It has been concluded in several different reviews of the stress literature that there are essentially three different, but overlapping, approaches to the definition and study of stress (Lazarus, 1966; Appley and Trumbull, 1967; Cox, 1978, 1990; Cox and Mackay, 1981; Fletcher, 1988). The first approach conceptualises occupational stress as an aversive or noxious characteristic of the work environment, and in related studies, treats it as an independent variable - the environmental cause of ill health. This approach has been termed the 'engineering model'. The second approach, on the other hand, defines stress in terms of the common physiological effects of a wide range of aversive or noxious stimuli. It treats stress as a dependent variable - as a particular physiological response to a threatening or damaging environment. This approach has been termed the 'physiological model'. The third approach conceptualises work stress in terms of the dynamic interaction between the person and their work environment. When studied, stress is either inferred from the existence of problematic person-environment interactions or measured in terms of the cognitive processes and emotional reactions which underpin those interactions. This final approach has been termed the 'psychological model'. The engineering and physiological models are obvious among the earlier theories of stress, while the more psychological models characterise contemporary stress theory.

## 2.1 Engineering Approach

The engineering approach has treated stress as a *stimulus characteristic* of the person's environment, usually conceived in terms of the load or level of demand placed on the individual, or some aversive (threatening) or noxious element of that environment (Cox, 1978, 1990; Cox and Mackay, 1981; Fletcher, 1988). Occupational stress is treated as a property of the work environment, and usually as an objectively measurable aspect of that environment. In 1947, Symonds wrote, in relation to

## 2.3 Criticisms of Engineering and Physiological Approaches

Two specific criticisms have been offered of these approaches: the first empirical and the second conceptual.

First, engineering and physiological models do not adequately account for the existing data. In relation to the engineering model, consider the effects of noise on performance and comfort. The effects of noise on task performance are not a simple function of its loudness or frequency but are subject both to its nature and to individual differences and context effects (see, for example, Cox, 1978). Noise levels which are normally disruptive may help maintain task performance when subjects are tired or fatigued (Broadbent, 1971) while even higher levels of music may be freely chosen in social and leisure situations.

Scott and Howard (1970) wrote, "... certain stimuli, by virtue of their unique meaning to particular individuals, may prove problems only to them; other stimuli, by virtue of their commonly shared meaning, are likely to prove problems to a larger number of persons." This statement implies the mediation of strong cognitive as well as situational (context) factors in the overall stress process (see below). This point has been forcefully made by Douglas (1992) with respect to the perception of risks (and hazards). Such perception and related behaviour, she maintains, are not adequately explained by the natural science of objective risk and are strongly determined by group and cultural biases.

The simple equating of demand with stress has been associated with the belief that a certain amount of stress is associated with maximal performance (Welford, 1973) and possibly good health. Belief in optimal levels of stress has been used, on occasions, to justify poor management practices.

The physiological model is equally open to criticism. Both the non-specificity and the time course of the physiological response to aversive and noxious stimuli have been shown to be different from that described by Selye (1950, 1956) and required by the model (see Mason, 1968, 1971). Mason (1971), for example, has shown that some noxious physical stimuli do not produce the stress response in its entirety. In particular, he has cited the effects of heat. Furthermore, Lacey (1967) has argued that the low correlations observed among different physiological components of the stress response are not consistent with the notion of an identifiable response syndrome. There is also a difficulty in distinguishing between those physiological changes

which represent stress and those which do not, particularly as the former may be dissociated in time from the stressor (Fisher, 1986).

There is now much research which suggests that if the stress response syndrome exists it is not non-specific. There are subtle but important differences in the overall pattern of response. There is evidence, for example, of differentiation in the response of the catecholamines (reflecting sympathetic-adrenal medullary activation) to stressful situations (Cox and Cox, 1985). Several dimensions have been suggested as a basis of this differentiation but most relate to the expenditure of effort of different types, for example, physical versus psychological (Dimsdale and Moss, 1980a, 1980b; S. Cox et al, 1985). Dimsdale and Moss (1980b) studied plasma catecholamine levels using a non-obtrusive blood withdraw pump and radio-enzymatic assay. They examined 10 young physicians engaged in public speaking, and found that although levels of both adrenaline and noradrenaline increased under this set of demands, the levels of adrenaline were far more sensitive. This sensitivity was associated with feelings of emotional arousal which accompanied the public speaking. S. Cox and her colleagues (1985) examined the physiological response to three different types of task associated with short cycle repetitive work: urinary catecholamine excretion rates were measured using an adaptation of Diament and Byers (1975) assay technique. She found that both adrenaline and noradrenaline were sensitive to work characteristics, such as pay scheme and pacing, but differentially so. It was suggested that noradrenaline activation was related to the physical activity inherent in the various tasks, and to the constraints and frustrations present, while adrenaline activation was more related to feelings of effort and stress.

The second criticism is that the engineering and physiological models of stress are conceptually dated in that they are set within a relatively simple stimulus-response paradigm, and largely ignore individual differences of a psychological nature and the perceptual and cognitive processes which might underpin them (Cox, 1990; Sutherland and Cooper, 1990). These models treat the person as a passive vehicle for translating the stimulus characteristics of the environment into psychological and physiological response parameters. They largely ignore the interactions between the person and their various environments which are an essential part of systems based approaches to biology, behaviour and psychology. In particular, they ignore the psychosocial and organizational contexts to work stress.

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## 2.4 Psychological Approach

The third approach to the definition and study of stress conceptualises it in terms of the dynamic interaction between the person and their work environment. When studied, it is either inferred from the existence of problematic person-environment interactions or measured in terms of the cognitive processes and emotional reactions which underpin those interactions. This approach has been termed the 'psychological model'.

The development of psychological models has been, to some extent, an attempt to overcome the criticisms levelled at the earlier approaches. There is now a consensus developing around this approach to the definition of stress. For example, psychological approaches to the definition of stress are largely consistent with the International Labour Office's definition of psychosocial hazards (ILO, 1986: see later) and with the definition of well being recommended by the WHO (1986)[2] . They are also consistent with the developing literature on personal risk assessment (see, for example, S. Cox and Tait, 1991; Cox and Cox, 1993). These consistencies and overlaps suggest an increasing coherence in current thinking within occupational health and safety.

Variants of this psychological approach dominate contemporary stress theory, and among them two distinct types of can be identified: the interactional and the transactional. The former focuses on the structural features of the person's interaction with their work environment, while the latter is more concerned with the psychological mechanisms underpinning that interaction. Transactional models are primarily concerned with cognitive appraisal and coping. In a sense they represent a development of the interactional models, and are largely consistent with them.

## 2.5 Interactional Theories of Stress

Interactional theories of stress focus on the structural characteristics of the person's interaction with their work environment. Two particular interactional theories

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[2] Well-being is a dynamic state of mind characterized by reasonable harmony between a person's abilities, needs, and expectations, and environmental demands and opportunities (WHO, 1986). The individual's subjective assessment is the only valid measure of well-being available (Levi, 1992): see section 2.11.

stand out as seminal among the various which have been offered: the Person x Environment Fit theory of French, Caplan and van Harrison (1982) and the Job Demands x Job Decision Latitude theory of Karasek (1979). Neither is, however, without criticism : see, for example, Edwards and Cooper (1990) and Warr (1990).

## Person-Environment Fit

Several researchers have suggested that the goodness of fit between the person and their (work) environment frequently offers a better explanation of behaviour than individual or situational differences (see, for example, Bowers, 1973; Ekehammer, 1974). Largely as a result of such observations, French and his colleagues formulated a theory of work stress based on the explicit concept of the Person-Environment Fit (see, for example, French, Caplan and van Harrison (1982). Two basic aspects of fit were identified:

[1] The degree to which an employee's attitudes and abilities meet the demands of the job.

[2] The extent to which the job environment meets the workers' needs, and in particular the extent to which the individuals are permitted and encouraged to use their knowledge and skills in the job setting.

It has been argued that stress is likely to occur, and well being is likely to be affected, when there is a lack of fit in either or both respects (French et al, 1974). Two clear distinctions are made in this theory, first, between objective reality and subjective perceptions, and, second, between *environmental variables* (E) and *person variables* (P). Given this simple 2 x 2 configuration of P x E interaction, lack of fit can actually occur in four different ways, and each appear to challenge the workers' health. There can be both a lack of subjective and objective P-E fit: these are the main foci of attention with particular interest being expressed in the lack of subjective fit: how workers see *their work situation*. This provides a strong link with other psychological theories of stress. There can also be a lack of fit between the objective environment (reality) and the subjective environment (hence, lack of contact with reality), and also a lack of fit between the objective and subjective persons (hence, poor self-assessment).

French, Caplan and van Harrison (1982) have reported on a large survey of work stress and health in 23 different occupations in the United States and a sample of 2010 working men. The survey was framed by the P-E Fit theory, and, in their summary, the authors commented on a number of questions of theoretical and practical

importance. In particular, they argued that their subjective measures mediated the effects of objective work on health. Their data showed that there was a good correspondence between the objective and subjective measures and that the effects of those objective measures on self-reported health could be very largely accounted for by the subjective measures. Objective occupation only accounted for some 2 to 6 percent of the variance in self-reported health beyond that accounted for by the subjective measures.

## Job Demands/Decision Latitude

Karasek (1979) drew attention to the possibility that work characteristics may not be linearly associated with worker health, and that they might combine interactively in relation to health. He initially demonstrated this theory through secondary analyses of data from United States and Sweden, finding that employees in jobs perceived to have both low decision latitude and high job demands[3] were particularly likely to report poor health and low satisfaction. Later studies appeared to confirm the theory. For example, a representative sample of Swedish working men was examined for depression, excessive fatigue, cardiovascular disease and mortality. Those workers whose jobs were characterised by heavy workloads combined with little latitude for decision making were represented disproportionately on all these outcome variables. The lowest probabilities for illness and death were found among work groups with moderate workloads combined with high control over work conditions (Ahlbom, Karasek and Theorell, 1977; Karasek, 1981; Karasek et al, 1981). The combined effect of these two work characteristics is often described as a true interaction (synergy: see section 3.0), but despite the strong popular appeal of this suggestion there is only weak evidence in its support (Kasl, 1989; Warr, 1990). Karasek's (1979) own analyses suggest an additive rather than a synergistic effect, and he has admitted that "there is only moderate evidence for an interaction effect, understood as a departure from a linear additive model". Simple additive combinations have been reported by a number of researchers, for example, Hurrell and McLaney (1989), Payne and Fletcher (1983), Perrewe and Ganster (1989), and Spector (1987).

Carayon (in press) has offered four possible explanations for the inconsistency in the evidence concerning Karasek's model. First, the model seems to be supported in

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[3] Karasek (1979) defined 'decision latitude' as 'the working individual's potential control over his tasks and his conduct during the working day'. He defined 'job demands' as 'the psychological stressors involved in accomplishing the workload'.

large, heterogeneous samples, but not in homogeneous samples: this may be due to the confounding effects of socio-economic status in heterogeneous sample or the lack of sensitivity of measures used in homogeneous samples. Second, inconsistencies may stem partly from the way job demands and decision latitude are conceptualized and measured. Karasek conceptualized decision latitude as a combination of decision authority (similar to control or autonomy) and skill discretion (similar to skill utilization). Subsequent studies have included a wide variety of measures for decision latitude, and it is therefore possible that those that have used more focused measures are testing the effects of 'control' as opposed to the effects of 'decision latitude', which is a mixture of control and job complexity. Similarly, as far as 'demands' are concerned, the original measures tapped one main construct, 'workload', but subsequent studies have tended to employ a wider range of measures. Measures have varied considerably and are often far removed from Karasek's original formulation. Third, much of the research into this model relies on self-report measures of both dependent and independent variables; 'job satisfaction' is an example where there is content overlap between the measures. A related issue concerns the predominance of cross-sectional rather than longitudinal data, limiting interpretations as to cause and effect. Fourth, Carayon suggests there may be methodological and statistical reasons for the failure to find interactive effects. However, whether perceived job demands and decision latitude combine additively or through a true interaction, it is clear from Karasek's work that they are important factors determining the effects of work on employees' health.

## 2.6 Transactional Definitions

Most transactional theories of stress focus on the cognitive processes and emotional reactions underpinning individuals' interactions with their environment and nowhere is this more obvious than in relation to theories of appraisal and coping such as those of Lazarus and Folkman in the United States (for example, Lazarus and Folkman, 1984) and of Cox and Mackay in the United Kingdom (for example, Cox, 1978; Cox, 1990; Cox and Mackay, 1981). According to transactional models, stress is a *psychological state* [4] involving aspects of both cognition and emotion. They treat the stress state as the internal representation of particular and problematic transactions between individuals and their environment.

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[4] The term *psychological stress* is ambiguous. While the experience of stress is psychological in nature, its antecedents and outcomes are not restricted to any particular domain psychological or otherwise.

Appraisal is the evaluative process that gives these person-environment transactions their meaning (Holroyd and Lazarus, 1982). Later refinements of the theory suggest both primary and secondary components to the appraisal process (Lazarus, 1966; Folkman and Lazarus, 1986). Primary appraisal involves a continual monitoring of the person's transactions with his or her environment (in terms of demands, abilities, constraints and support), focusing on the question 'Do I have a problem?'. The recognition of a problem situation is usually accompanied by unpleasant emotions or general discomfort. Secondary appraisal is contingent upon the recognition that a problem exists and involves a more detailed analysis and the generation of possible coping strategies ('What am I going to do about it?'): see section 2.7.

Stress arises when individuals perceive that they cannot adequately cope with the demands being made on them or with threats to their well being (Lazarus, 1966, 1976; Cox, 1990), when coping is of importance to them (Sells, 1970; Cox, 1978) and when they are anxious or depressed about it (Cox and Ferguson, 1991). The experience of stress is therefore defined by, first, the realisation that they are having difficulty coping with demands and threats to their well being, and, second, that coping is important and the difficulty in coping worries or depresses them. This approach allows a clear distinction between, say, the effects of lack of ability on performance and those of stress. If individuals do not have the necessary knowledge or level of skill to complete a task then their performance will be poor. They may not realise this or if they do it might not be felt to be of importance or give rise to concern. These are not 'stress' scenarios. However, if individuals (a) do realise that they are failing to cope with the demands of a task, and (b) experience concern about that failure because it is important, then this is a 'stress' scenario. The effects of such stress might then cause a further impairment of performance over and above that caused by lack of ability.

The question of 'consciousness' has been raised in relation to stress and the appraisal process (Cox and Mackay, 1981). Appraisal is a conscious process. However, in its earliest stages, changes characteristic of the stress state may be demonstrated, yet the existence of a problem may not be recognised or recognition may only be 'hazy'. It has been suggested that different levels of awareness may exist during the appraisal process. These may be described by the following sequence:

[1] Growing awareness of problem markers, both individual and situational, including feeling uncomfortable, not sleeping, making mistakes.

[2] Recognising the existence of a 'problem' in a general or 'hazy' way.

[3] Identifying the general problem area and assessing its importance.

[4] Analysing in detail the nature of the problem and its effects.

It is useful to think of the stress state as embedded in an *on-going process* which involves individuals interacting with their environment, making appraisals of that interaction and attempting to cope with, and sometimes failing to cope with, the problems that arise. Cox (1978) described this process in terms of a five stage model (see figure 1). The first stage, it was argued, represents the sources of demand faced by the person and is part of their environment. Individuals' perception of these demands in relation to their ability to cope represents the second stage: effectively primary appraisal. Consistent with Lazarus and Folkman (Lazarus, 1966; Folkman and Lazarus, 1986) and French, Caplan and van Harrison (1982), stress was described as the psychological state which arose when there was a personally significant imbalance or lack of fit between individuals' perceptions of the demands on them and their ability to cope with those demands. The psychological and physiological changes which are associated with the recognition of such a stress state, and which include coping, represent the third stage of the model. Emotional changes are an important part of the stress state. These tend to be negative in nature and often define the experience of stress for the person. The fourth stage is concerned with the consequences of coping. The fifth stage is the general feedback (and feed forward) which occurs in relation to all other stages of the model. This model has been further developed in several ways. The importance of perceptions of control and of social support have been emphasised as factors in the appraisal process, and there has been some discussion of the problem of measuring stress based on this approach (Cox, 1985a, 1990) with the development of possible subjective measures of the experiential (mood) correlates of the stress state (see Mackay et al, 1978; Cox and Mackay, 1985): see section 2.11.

The experience of stress through work is therefore associated with exposure to particular conditions of work, both physical and psychosocial, and workers' realisation that they are having difficulty in coping with important aspects of their work situation. The experience of stress is usually accompanied by attempts to deal with the underlying problem (coping) and by changes in cognition, behaviour and physiological function. Although probably adaptive in the short term, in the long term, such changes may threaten health. The experience of stress and its

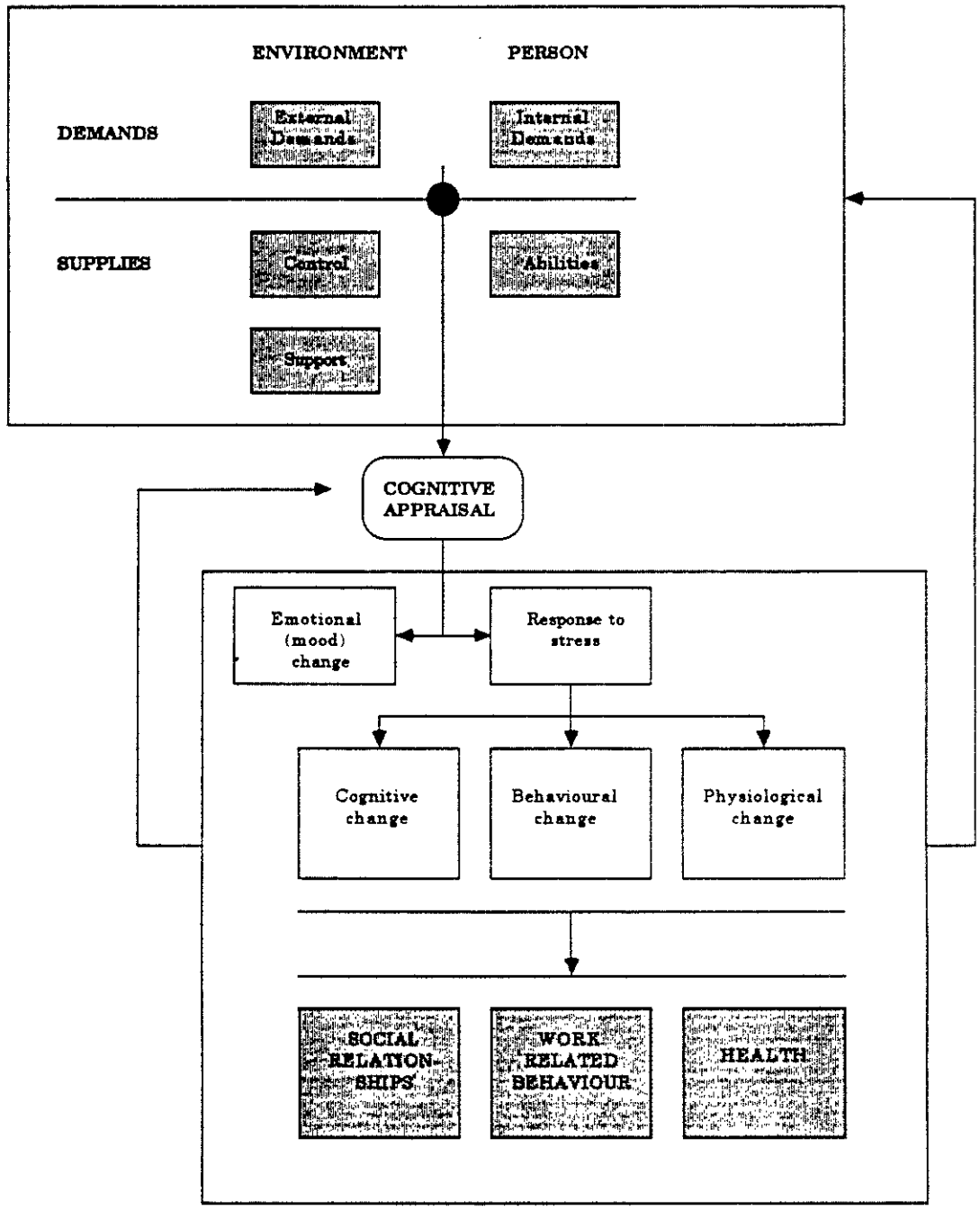


**Figure 1: Transactional model of occupational stress (adapted from Cox, 1978, and Cox and Mackay, 1981)**

behavioural and psychophysiological correlates mediate[5], in part, the effects of many different types of work demand on health. This point has been made by many authors over the last three decades (for example, Levi, 1984; Szabo et al, 1983).

## 2.7 Coping

Coping is an important part of the overall stress process. However, it is perhaps the least well understood despite many years of research. This point is widely acknowledged in the literature (see, for example, Dewe et al, 1993). Lazarus (1966) has suggested that it has three main features. First, it is a process: it is what the person actually thinks and does in a stressful encounter. Second, it is context dependent: coping is influenced by the particular encounter or appraisal that initiates it and by the resources available to manage that encounter. Finally, coping *as a process* is and should be defined 'independent of outcome'; that is independently of whether or not it was successful (see Folkman, 1984; Folkman et al, 1986a, 1986b; Lazarus and Folkman, 1984). There have been two approaches to the study of coping: that which attempts to classify the different types of coping strategies and produce a comprehensive taxonomy and that which considers coping as a problem solving process.

### Coping Taxonomies

Lazarus (1966) has argued that the person usually employs both task and emotion focused coping strategies. The former attempt some form of action directly targeted on dealing with the source of stress: adaptation *of* the environment, while the latter attempt to attenuate the emotional experience associated with that stress: adaptation *to* the environment. The perceived success, or otherwise, of such strategies feeds back into the appraisal process to alter the person's perception of the situation. Lazarus and his colleagues (Lazarus, 1966; Lazarus and Folkman, 1984) also emphasise that the importance of the situation to the individual is critical in determining the intensity of response.

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[5] The mediator of a particular relationship, for example between stress and health, is a variable which effectively supplies the link between the two variables involved: it transmits the effects of one variable to the other.

Dewe (1987), in a typical study, examined sources of stress and strategies used to cope with them in New Zealand ministers of religion. Using factor analytical techniques, he identified five clusters of coping strategies: seeking social support, postponing action by relaxation and distracting attention, developing greater ability to deal with the problem, rationalizing the problem, and drawing on support through spiritual commitment. It was possible to classify 33% of the strategies which made up these clusters as task focused and 67% as emotion focused. The most frequent source of stress experienced by the ministers related to the emotional and time difficulties associated with crisis work, and the experience of such problems appeared to be associated with coping by seeking social support and rationalizing the problem.

Pearlin and Schooler (1978) have further developed this general approach and distinguished between responses concerned with changing the situation, those concerned with changing its meaning (re-appraisal) and those relating to the management of the symptoms of stress. In a different vein, Miller (1979; Miller et al, 1988) has distinguished between two informational styles which she terms 'blunters' and 'monitors': the former tend to use denial strategies and the latter information seeking strategies in relation to stressful situations. These, and the many other, classifications available in the literature are, generally, not inconsistent nor meant to be mutually exclusive. Most authors emphasise that no one type of coping strategy is necessarily better than any other in solving a problem. People use a mixture of strategies in most situations, although certain situations may tend to be associated with particular types of strategy.

## Coping as Problem Solving

Coping can also be viewed as a problem solving strategy (Cox, 1987; Fisher, 1986). Cox (1987), for example, has described a cycle of activities, beginning with recognition and diagnosis (analysis) followed by actions and evaluation through to re-analysis, which possibly represents the ideal problem solving process. However, Schonpflug and Battmann (1988) have emphasised that by adopting the wrong actions, or by failing, a person may create further problems and stress. At the same time, Meichenbaum (1977) argues that 'catastrophizing' or reacting too strongly to such failure serves no adaptive purpose and it is often said that one of the few positive aspects to coping with stress is that the person learns from such experience. However, Einhorn and Hogarth (1981) suggest that there are at least three problems with this proposition: first, one does not necessarily know that there is something to be learned, second, what is to be learned is not clear, and third, there is ambiguity in judging

whether one has learned. Furthermore, the problem solver may be fully occupied and not have any spare cognitive capacity for learning, and the emotion associated with stress may interfere with the learning process (Mandler, 1982).

Coping may be seen as functional in its attempts to manage demands, by either changing them, redefining them (re-appraisal) or adapting to them. The styles and strategies used need to be relevant and applicable to the situation at hand. The choice and successful use of these responses will be determined by both the nature of the situation, by the personal and social resources available and also by the type of causal reasoning adopted in the appraisal process.

## 2.8 Individual and Group Differences

Most contemporary theories of stress allow for individual differences in the experience of stress, and in how and how well it is coped with. In 1988, Payne presented a series of questions, including:

[1] How do individual differences relate to perceptions of stress in the work environment?

[2] Do they affect the way people cope with stress?

[3] Do they act as moderators of the stress-health relationship?

[4] How do individual differences relate to the development of ill health?

There would appear to be two different approaches to research on individual differences based on Payne's (1988) questions. Effectively individual difference variables have been investigated as either: (1) components of the appraisal process, or (2) moderators[6] of the stress-health relationship (see Cox and Ferguson, 1991). Hence, researchers have asked, for example, to what extent are particular workers vulnerable to the experience of stress, or, for example, to what extent does, say, 'hardiness' (Kobasa, 1979; Kobasa and Pucetti, 1983; Kobasa et al, 1981, 1982) moderate the relationship between job characteristics and worker health?

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[6] A moderator of a particular relationship, say between stress and health, is a variable which may alter the strength or direction of that relationship. The technical concept of moderation implies no particular direction of effect although in every day usage it tends to imply a weakening of effect.

This distinction between individual differences as components of the appraisal process and moderators of the stress-outcome relationship can be easily understood in terms of transactional models of stress (Cox and Ferguson, 1991).

Primary appraisal is, by its very nature, subject to individual differences. First, individual differences may exist in relation to the person's perception of job demands and pressures. Kahn (1974), for example, found a modest relationship between objective and subjective measures of role conflict. The objective measure was based on the sum of pressures to change behaviour as reported by those who had formal influence on the person in the role in question. Further analyses revealed that this relationship largely resulted from those in the sample who were high on anxiety proneness. Anxiety proneness appeared to moderate the person's perception of role conflict. In the same vein, Payne and Hartley (1987) found a positive correlation between perceptions of the severity of problems facing unemployed men and a measure of locus of control. The more they believed that important life events were not under their personal control, the more severe they perceived their problems to be. Second, people vary in their ability to cope with demands, and in their perceptions of those abilities. Such variation may be a function of their intelligence, their experience and education, or their beliefs in their ability to cope (self-efficacy: Bandura, 1977). Third, people may vary in the amount of control that they can exercise over any situation, not only as a function of that situation but also as a function of their beliefs about control. Fourth, people may vary in their need for social support and the skills that they have for exploiting such support, and in their perceptions of support. Finally, the stress-health relationship is obviously moderated by individual differences not only in secondary appraisal but also in coping behaviour and emotional and physiological response tendencies, latencies and patterns.

Over the last 30 years, much attention has focused on individual vulnerability in relation to coronary heart disease and on the role of psychological and behavioural factors in reacting to and coping with stressful situations. Twenty years or so ago, Friedman and Rosenman (1974) described type A behaviour as a major behavioural risk factor for cardiovascular ill health.

## Type A Behaviour

The concept of type A behaviour was originally developed as a description of overt behaviour by Friedman and Rosenman (1974) but has since been considerably

broadened and, some have argued, weakened as a result (Powell, 1987). There are at least three characteristics which mark out type A individuals, whose risk of coronary heart disease appears, from studies in the United States, to be at least twice that of non-type A individuals:

[1] A strong commitment to work and much involvement in their job.

[2] A well developed sense of time urgency (always aware of time pressures and working against deadlines).

[3] A strong sense of competition and a marked tendency to be aggressive.

Such behaviour is probably learnt, and is often valued by and maintained through particular organizational cultures.

There is some confusion in the literature as to the status of the behaviours referred to above and their relative importance and that of related constructs. Some refer to type A behaviour as a learnt style of behaviour, others as a coping pattern, and still others as a personality trait (Powell, 1987). At the same time, there have been various suggestions as to its most important dimension. For example, Glass (1977) has argued that control is the determining factor, while Williams et al (1985) and others have argued in favour of hostility or aggression (see for example, Dembroski et al, 1985; MacDougall et al, 1985), and others for low self-esteem (Friedman and Ulmer, 1984). Various different measures have been developed not all of which strongly inter-relate (Powell, 1987) thus questioning their operational precision and construct validity.

Perhaps of the three, the two which are attracting most attention are control and anger and hostility.

Control

The issue of control is important in understanding the nature of type A behaviour. Type A individuals feel that they are always fighting to maintain control over events, which are often seen to be just beyond their grasp. Faced with these situations, they simply expend more time and effort trying 'to get events under control' - and never really feel as if they have succeeded (Glass and Singer, 1972). The issue of control, and of being in control, is an important one, and may distinguish between the vulnerability of type As and the resistance of hardy types (Kobasa, 1979; Kobasa and Pucetti, 1983; Kobasa et al, 1981, 1982). Kobasa's hardy types report feeling in control of their work and their lives. Control related issues are a recurrent theme in

stress research and stress management (see sections 2.5 and 3.2). Type A behaviour predicts cardiovascular ill health, while hardiness predicts general good health.

Anger and Hostility

Indices of anger and hostility have been validated in prospective research as predictors of cardiovascular ill health. For example, Matthews et al (1977) scored 10 responses to the Structured Interview for type A behaviour (see Jenkins, Rosenman and Friedman, 1968) of 186 cases and controls in the Western Group Collaborative Study (see, for example, Rosenman et al, 1964a and 1964b). Seven of the 10 responses discriminated between the cases and controls and the majority of these related to anger and hostility. Others have also found evidence suggesting that measures of hostility, repressed hostility or potential for hostility can strongly predict cardiovascular health (Dembrowski et al, 1985; MacDougall et al, 1985; Williams et al, 1980; Barefoot et al, 1983; Shekelle et al, 1983). Anger - hostility has also been associated with the occurrence of rheumatoid arthritis (see, for example, Cobb, 1959).

The relationship between type A behaviour and cardiovascular health is potentially moderated by a host of factors such as age, sex, socio-economic and educational status, employment status, medication and the cardiovascular outcome chosen for study (Powell, 1987). Interestingly, Kittel and his colleagues (1983) have concluded that there are also marked differences between studies in the United States and those in Europe. The results from Europe do not appear to have fulfilled the early promise of those conducted in the United States. There may be socio-linguistic and cultural differences between the two populations which affect either the validity of the measuring instruments or the validity or role of the concept in explaining the link between behaviour and cardiovascular health.

## Vulnerable Groups

Individual differences are obvious in the stress process affecting appraisal and coping mechanisms, and the stress-health relationship. Group differences - and the creation of vulnerable groups - may represent the effects of individual differences which are common to and characteristic of particular groups, and/or the effects of common patterns of exposure to hazardous work conditions (or some combination of the two). Several different reviews have identified possible vulnerable groups (see, for example, Levi, 1984; Davidson and Earnshaw, 1991) including: young workers, older workers, migrant workers, handicapped workers and women workers. Kasl

(1992) has attempted to summarise the different criteria and factors which define vulnerability as: socio-demography (for example, age and educational status), social status (for example, living alone), behavioural style (type A behaviour), skills and abilities, health status and medical history, and on-going non-work problems. Such vulnerability factors are moderators of the hazard-stress-harm relationship and probably interact in defining the high risk or vulnerable groups mentioned above.

The recognition of the vulnerability of such groups is not new and, in the United Kingdom, its origins can be traced back to the earliest health and safety legislation as, for example, in the Health and Morals of Apprentices Act of 1802.

### Selection

The individual and group differences have been highlighted in relation to the experience and health effects of stress. Such differences may be treated in a number of ways depending as much on moral and legal as on scientific considerations. Excluding particular workers or types of worker from work, which is judged to be stressful, may appear, at first sight, to be scientifically justified but may not be legally sanctionable under the Equal Opportunities legislation both in the United Kingdom or morally acceptable if other approaches are possible (see section 5.0).

Further, although individual differences can be shown to moderate the hazard-stress-health process, the evidence is not strong enough to support the design of defensible selection procedures. There appears to be little evidence of trait-like vulnerability to stress beyond that implied for psychological health by a personal or family history of related psychological disorders. Evidence for the apparent existence of any such traits may simply reflect commonly occurring patterns of person x environment interactions. Alternative strategies, focused on the design of jobs and organization of work (see section 5.0), are available and more defensible given current knowledge of the relationship between work hazards and stress. Equally approaches based on worker education and training and on enhanced support for workers are also possible, and have been tried and evaluated.

## 2.9 Implications for Measurement

It has been suggested that the available evidence supports a psychological approach to the definition of stress, and that transactional models are among the most adequate

and useful of those currently available. Within this framework, stress is defined as a psychological state (see section 2.6) which is both part of and reflects a wider process of interaction between individuals and their (work) environment. This process is based on a sequence of relationships between the objective work environment and the worker's perceptions, between those perceptions and the experience of stress, and between that experience, changes in behaviour and physiological function, and health. This sequence provides a basis for measurement, but the different measures which can be derived from the sequence cannot be easily or defensibly combined into a single stress index (see below).

The measurement of the stress state should be based primarily on self-report measures which focus on the appraisal process and on the emotional experience of stress (Cox, 1985a). Measures relating to appraisal need to consider workers' perceptions of the demands on them, their ability to cope with those demands, their needs and the extent to which they are fulfilled by work, the control they have over work and the support they receive in relation to work. Dewe (1991) has argued that it is necessary to go beyond simply asking workers whether particular demands (etc) are present (or absent) in their work environments and measure various dimensions of demand (etc) such as frequency, duration and level. Furthermore, such measures need to be used in a way which allows for the possibility of interactions between perceptions, such as demand with control (Karasek, 1979; Warr, 1990 ) or demand and control with support (Payne and Fletcher, 1983; Cox, 1985a; Karasek and Theorell, 1990). The importance to the worker of coping with particular combinations and expressions of these work characteristics needs also to be taken into account (Sells, 1970; Cox, 1978).

Triangulation

Despite their obvious centrality and importance, self-report measures of appraisal and the emotional experience of stress are, on their own, insufficient. While their reliability can be established in terms of their internal structure or performance over time without reference to other data, their validity cannot. Therefore data from other domains are required, and triangulation[7] is a recommended process for both reliability testing and/or validation in many different disciplines. Applying this principle would require data to be collected from at least three different domains

[7] The concept of triangulation in measurement relates to the strategy of fixing a particular position or finding by examining it from, at least three, different points of view. The degree of agreement between those different points of view gives some indication of the reliability of the finding, and/or depending on the measures used its concurrent validity.

(Cox, 1990). This can be achieved by considering evidence relating to [1] the objective and subjective antecedents of individuals' experience of stress, [2] their self-report of stress, and [3] any changes in their behaviour, physiology or health status[8] which might be correlated with [1] and/or [2]. The influence of moderating factors, such as individual and group differences, may also be assessed.

Bailey and Bhagat (1987) have recommended a multi-method approach to the measurement of stress which is consistent with the concept of triangulation. they have argued in favour of balancing the evidence from self-report, physiological and unobtrusive measures. Their unobtrusive measures relate to what Folger and Belew (1985) and Webb et al (1966) have called non-reactive measures, and include: physical traces (such as poor house keeping), archival data (such as that on absenteeism), private records (such as diaries), and non-intrusive observation and recordings. Bailey and Bhagat (1987) also point up the problem that obtrusive measures often change the very nature of the behaviour or other response being assessed.

Triangulation would require evidence drawn from an audit of the work environment (including both its physical and its psychosocial aspects: see section 3.0), from a survey of workers' perceptions of and reactions to work, from the measurement of workers' behaviour in respect to work, and their physiological and health status (see section 4.0). It is not possible here to offer a comprehensive review of the plethora of measures which might be used in such audits and surveys. However, section 3.0 suggests the various physical and psychosocial antecedents of stress that might be measured in the workplace, while the measurement of the stress state has been outlined above. Measures of the third domain (behaviour, physiology and health status) are well established in the general literature on occupational psychology and psychophysiology. The use of any measure must be supported by data relating to its reliability and validity, and its appropriateness and fairness in the situation in which it is being used. The provision of such data would conform to good practice in both occupational psychology and psychometrics but may also be required if any subsequent decisions are challenged in law. Preferably such data collection would take the form of continuous monitoring (see section 6.0) and thus be capable of mapping work related changes in all three domains.

Ideally, the principle of triangulation should be applied both within and between domains. This should help overcome the problem of missing data and help resolve

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[8] The changes in behaviour, physiology and health status which may be correlated with the antecedents and/or experience of stress are discussed in section 4.0.

inconsistencies in the data given that these are not extreme. Its use between domains has been briefly discussed above. Within domains, several different measures should be taken and preferably across different measurement modalities to avoid problems of common method variance. This may be most relevant and easiest to achieve in relation to the measurement of changes in the third domain: behaviour, physiology and health status. There are no available studies to suggest that the various measures from the different domains can be statistically combined into a single and defensible 'stress index'.

What is being measured is a process: 'antecedents - perceptions and experience (and moderating factors) - immediate outcomes - health status'. This approach underlines both the complexity of measurement, when approached scientifically, and the inadequacy of asking for or using single one-off measures of *stress* (however defined). This process can be simplified conceptually to 'work hazards - stress - harm', and this is the framework used to structure the evidence relating to work stress and health in the following sections of this report. This has the practical advantage of placing the issue of occupational stress within a framework familiar to those working with health and safety problems. The following sections of this report consider work hazards and stress (section 3.0), and stress and health (section 4.0). They also discuss the literature on stress management at work (section 5.0) and offer a possible framework for the translation of research into practice (section 6.0). Finally, they offer a brief overview and make recommendations for future action (section 7.0).

## 2.10 Summary

Stress can be defined as a psychological state which is part of and reflects a wider process of interaction between individuals and their work environment. It is concluded that there is a growing consensus around the adequacy and utility of the psychological approach to stress. Several overview models have been offered as summaries of the stress process, the most notable is that of Cooper (see, for example, Cooper and Marshall, 1976; Arnold, Robertson and Cooper, 1991), as presented in Figure 2 below. Cooper's model usefully focuses on the nature and detail of work stressors and their individual and organizational outcomes.

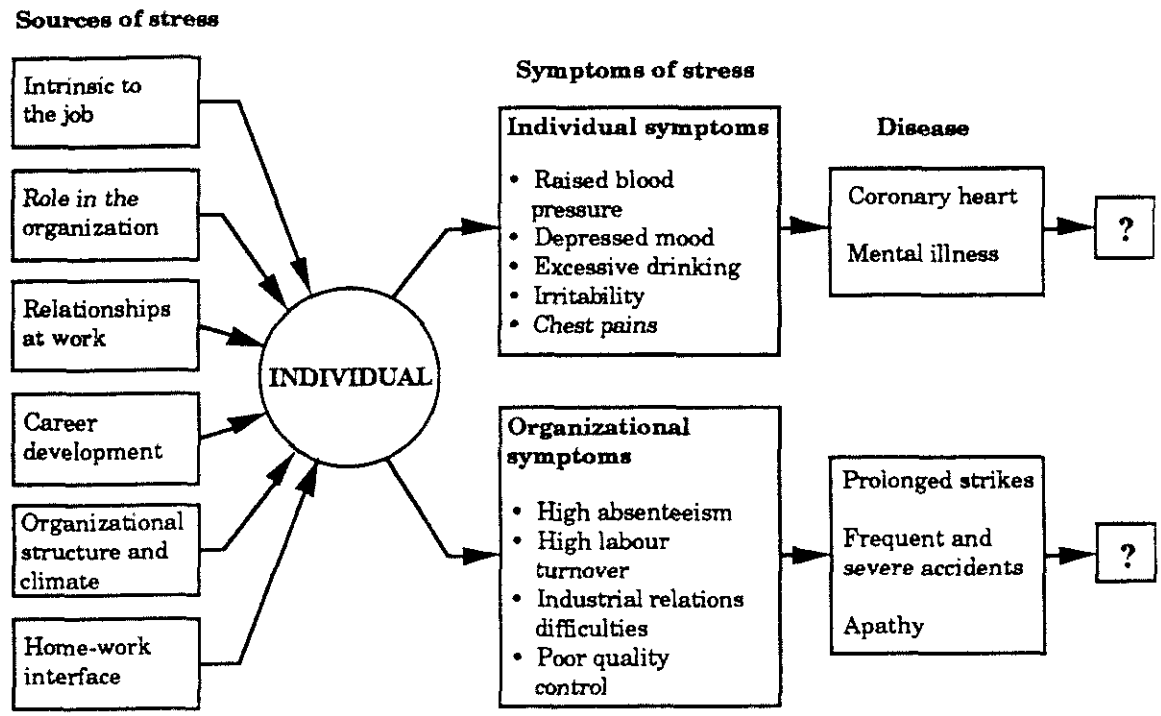


**Figure 2 : Cooper's model of the dynamics of work stress**

(adapted from Cooper and Marshall, 1976)

The stress state is a conscious state but the level of awareness of the problem varies with the development of that state. Part of the stress process are the relationships between the objective work environment and the employee's perceptions of work, between those perceptions and the experience of stress, and between that experience and changes in behaviour and physiological function, and in health. Coping is an important component of the stress process but one which is relatively poorly understood. Stress may be experienced as a result of exposure to a wide range of work demands and, in turn, contribute to an equally wide range of health outcomes: it is one link between hazards and health.

# 3.0 WORK HAZARDS AND STRESS

Work hazards can be broadly divided into the *physical*, which include the biological, biomechanical, chemical and radiological, and the *psychosocial*. The concept of a psychosocial hazard may be difficult to grasp. The International Labour Office (ILO, 1986) has defined such hazards in terms of the interactions among job content, work organization and management and environmental and organizational conditions, on the one hand, and the employees' competencies and needs on the other. Those interactions which prove hazardous influence employees' health through their perceptions and experience (ILO, 1986). While this definition is consistent with transactional models of stress, it associates exposure to psychosocial hazards too strongly with the experience of stress. It is argued here that psychosocial hazards may also have direct effects on the person, effects which are not mediated by the experience of stress. As a result, a more satisfactory definition of psychosocial hazards might be: aspects of job content, work organization and management, and of environmental, social and organizational conditions which have the potential for psychological and physical harm.

Exposure to physical and psychosocial hazards may affect psychological as well as physical health. The evidence suggests that such effects on health may be mediated by, at least, two processes: first, a direct physical mechanism, and second, a psychological stress-mediated mechanism. These two mechanisms do not offer alternative explanations of the hazard-health association; in most hazardous situations both operate and interact to varying extents and in various ways (Levi, 1984; Cox and Cox, 1993). Levi (1984) has noted that both additive and synergistic interactions[9] are possible.

Many of the existing discussions of the hazard-*stress*-health relationship have focused on psychosocial hazards and have tended to omit reference to physical work hazards (Levi, 1984). The psychological effects of physical hazards reflect not only their direct action on the brain and their unpleasantness but also the worker's awareness, suspicion or fear that they are being exposed to harm. It is the latter which can give rise to the experience of stress. For example, exposure to organic solvents may have a psychological effect on the worker through their direct effects on the

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[9] The outcome of effects which interact additively is simply the sum of the separate effects; however, the outcome of effects which interact synergistically is other than the sum of the separate effects. It may be greater, where one set of effects facilitates or enhances another, or it may be smaller, where one set attenuates or weakens another.

brain, through the unpleasantness of their smell and through the worker's fear that such exposure might be harmful (Levi, 1981; Kasl, 1992). Such fear may have consequences for task performance as well as for health [10]. The psychological effects of similar agents, carcinogens and toxic materials, appear dependent on the information available to and the awareness of workers (Houts and McDougall, 1988).

Concern for occupational stress therefore focuses on two scenarios: first, the stress associated with exposure to the physical hazards of work (section 3.1) , and, second, the stress which arises from exposure to psychosocial hazards (section 3.2).

## 3.1 Physical hazards

A wide variety of physical hazards have been extensively studied for their effects on the psychological experience of stress and on health (see, for example, USDHHS, 1980; Holt, 1982; Neale et al, 1983). Most can be measured objectively, and with some degree of reliability and validity, and are therefore relatively easily monitored in the workplace. In some cases, standards exist which can be used in the regulation of exposure to these potential sources of harm. Particular attention has been paid to noise as a source of stress and threat to health (Holt, 1982), and this is taken here as an exemplar of physical hazards.

### Noise

Noise can act as a physical and a psychological stimulus (Kryter, 1972; Kasl, 1992). Smith (1991) suggests that "the (non-auditory) health effects of noise may often reflect psychological reactions to the noise - stress - as well as objective exposure levels". High levels of noise directly damage the middle and inner ears with consequent

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[10] While low levels of anxiety and fear may have a motivating quality, higher levels can impair task performance (see, for example, M. Eysenck, 1983; Idzikowski and Baddeley, 1983) as well as impairing the quality of life. Deterioration in performance can be expected in tasks involving manual dexterity and sensory-motor coordination, such as tracking, in complex cognitive tasks and in secondary tasks. Some of these effects may be mediated by impairments of memory processes, and some by an increase in task-irrelevant and intrusive thoughts. The performance effects of anxiety and fear may increase with task difficulty. A deterioration in secondary task performance is likely to occur before performance of the primary task is affected. Baddeley (1972) has suggested that dangerous situations which are emotionally arousing may affect performance by a narrowing of attention which may cause peripheral stimuli to be missed. Together these different effects may interfere with the safeness of working practices.

impairment of hearing (Jones, 1983). Less severe noise may interfere with speech perception and communication and, particularly if it is prolonged, may give rise to the experience of stress, and to anxiety, irritability and tension, increase fatigue and impair performance efficiency (see, for example, Cohen, 1969, 1974; Glass and Singer, 1972; Miller, 1974; Cohen, 1980). However, Jones (1983) has concluded that evidence of relationship between noise and psychological and physical health (beyond damage to the ear and hearing impairment) is equivocal : while health effects have been found in a number of studies they cannot be unequivocally linked to exposure to high levels of noise. He argues that in most studies the effects of noise are confounded with those of other hazards: noisy work is often hazardous in other respects. While such arguments are valid, they do need to be placed in perspective given the complexity of all work design and the availability of other data. Smith (1991) has concluded that there is considerable evidence that acute noise exposure produces physiological responses which if prolonged could have harmful effects on health. He has also argued that the available epidemiological data suggest that noise is a risk factor for health. Furthermore, intervention studies suggest that noise can have harmful effects on health (see, for example, Cohen, 1976). As with most occupational health issues, it is a case of integrating different types of evidence in reaching a balanced conclusion.

Cohen (1974) examined the effects of noise on absence from work due to illness, on accidents and on diagnosed medical problems over a five year period in two major plants. Data were collected from plant records. One plant manufactured large boilers and the other manufactured electronic missile and weapon components. Workers drawn from high noise areas (95 dBA or more) were compared to workers drawn from low noise areas (80 dBA or less). Those from the high noise areas exhibited a higher incidence of problems on all measures. Especially prevalent in those exposed to high noise were allergies, respiratory and gastrointestinal disorders and complaints associated with musculo-skeletal and cardiovascular conditions. However, larger differences in the incidence of these problems appeared when they were compared by job type (rather than noise), and although attempts were made to control for job type in the analysis of noise effects these were not entirely successful (Jones, 1983). If noise was of aetiological significance then its effects appeared to be less than or secondary to those of job design and work organization. However, the noise effects were not insignificant and a follow up study by Cohen (1976) found evidence of a reduction in accident rate and incidence of medical problems as a result of introducing ear defenders.

### Other Physical Factors

Overall, there is much evidence to suggest that poor physical working conditions, in general, can affect both workers' experience of stress and their psychological and physical health (Warr, 1992). What is lacking are studies which directly establish the hazard-stress-harm pathway. Some studies have suggested that the effects of physical hazards on the experience of stress and on health are not related. Althouse and Hurrell (1977), for example, compared 486 coal miners in the United States with 452 workers in jobs of similar status. Despite a difference in the levels of physical dangerousness of the two types of work (exposure of workers to possible injury and death), there were no differences in experience of stress although miners did report significantly more symptoms of ill health such as irritation and somatic complaints.

In the case of some hazards, such as temperature and humidity (Biersner et al, 1971), it is the extremes of physical work conditions which are associated with the experience of stress and with effects on health: workers are often able to adapt to mid-range conditions without effort or attention (Holt, 1982; Szabo et al, 1983). In the case of others it is more simply the presence of the hazard or even the perceived threat of its presence which is associated with the experience of stress. An example is provided by doctors' and nurses' reports of anxiety in relation to dealing with patients who might be infected with the human immunodeficiency virus (Kegeles et al, 1989; Cox et al, 1993).

Physical hazards not only interact with one and another in producing their effects, but may also interact with psychosocial hazards. Broadbent (1971) has described how noise and sleep loss might interact in relation to task performance, while there is other evidence that exposure to poor equipment and work station design, in conjunction with poor task design and work organization give rise to work related upper limb disorders (Chatterjee, 1987, 1992: HSE, 1990a).

## 3.2 Psychosocial Hazards

Psychosocial hazards may affect both psychological and physical health directly or indirectly through the experience of stress. Most attention has been paid to their possible indirect - stress mediated - effects. It is this literature which is reviewed below.

Work situations are experienced as stressful when they are perceived as involving important work demands which are not well matched to the knowledge and skills (competencies) of workers or their needs, especially when those workers have little control over work and receive little support at work (see sections 2.4-2.7). Levi (1984) has grouped the various psychosocial characteristics of work under four headings which can be derived from this model: quantitative overload, qualitative underload, lack of control over work and lack of social support. Each aspect of such work situations carries a potential for harm and thus represents a hazard. These are the fundamental dimensions of psychosocial hazards in that they underpin the person's perception of the stressfulness of any work situation. They may, however, find 'surface' expression and combine in different ways for different hazards depending on the type of work and work environment .

There is a reasonable consensus among the various attempts to review and summarise the literature on those psychosocial hazards of work which are experienced as stressful and/or otherwise carry the potential for harm (Baker, 1985; Blohmke and Reimer, 1980; Cooper and Marshall, 1976; Cox, 1978, 1985b; Cox and Cox, 1993; Frankenhaeuser and Gardell, 1976; Karasek and Theorell, 1990; Kasl, 1992; Levi, 1972, 1984; Levi et al, 1986; Loher et al, 1985; Marmot and Madge, 1987; NIOSH, 1988; Sauter, Murphy and Hurrell, 1992; Sharit and Salvendy, 1982; Szabo, Maull and Pirie, 1983; Warr, 1987, 1992). This consensus is summarized in Table 2 which outlines nine different characteristics of jobs, work environments and organizations which are hazardous. These include organizational function and culture, career development, decision latitude/control, role in organization, inter personal relationships, work-home interface, task design, workload/work pace and work schedule. It has been suggested (Hacker, 1991; Hacker et al, 1983) that such characteristics of work might be usefully conceived as relating to the *context* to work or the *content* of work. Under certain conditions each of these nine aspects of work has proved stressful and harmful to health: these conditions are also noted in Table 2. Much of the evidence relates to psychological health and to the risk of cardiovascular disease (see section 4.0).

**Stressful Characteristics of Work**

| WORK CHARACTERISTICS | CONDITIONS DEFINING HAZARD (Demands, Control & Support) |
|---|---|
| **CONTEXT** | |
| ORGANIZATIONAL FUNCTION & CULTURE | Poor task environment and lack of definition of objectives<br>Poor problem solving environment<br>Poor development environment<br>Poor communication<br>Non-supportive culture |
| ROLE IN ORGANIZATION | Role ambiguity<br>Role conflict<br>High responsibility for people |
| CAREER DEVELOPMENT | Career uncertainty<br>Career stagnation<br>Poor status or status incongruity<br>Poor pay<br>Job insecurity and redundancy<br>Low social value to work |
| DECISION LATITUDE/ CONTROL | Low participation in decision making<br>Lack of control over work<br>Little decision making in work |
| INTERPERSONAL RELATIONSHIPS AT WORK | Social or physical isolation<br>Poor relationships with superiors<br>Interpersonal conflict and violence<br>Lack of social support |
| HOME/WORK INTERFACE | Conflicting demands of work and home<br>Low social or practical support at home<br>Dual career problems |
| **CONTENT** | |
| TASK DESIGN | Ill defined work<br>High uncertainty in work<br>Lack of variety or short work cycles<br>Fragmented or meaningless work<br>Underutilization of skill<br>Continual exposure to client/customer groups |
| WORKLOAD/WORK PACE Quantitative and Qualitative | Lack of control over pacing<br>Work overload or underload<br>High levels of pacing or time pressure |
| WORK SCHEDULE | Shift working<br>Inflexible work schedule<br>Unpredictable work hours<br>Long or unsocial work hours |

**Table 2 : Stressful Characteristics of Work**

## Context of Work

The following section describes those psychosocial hazards which are related to the context of work and which are experienced as stressful and/or otherwise carry the potential for harm.

## Organizational Function and Culture

The very fact of working within an organization, as do most workers in Europe (Cox, Leather and Cox, 1990) can be perceived as a threat to individual freedom, autonomy and identity (Hingley and Cooper, 1986). Recent studies on employees' perceptions and descriptions of their organizations suggest that these are organized around three distinct aspects of organizational function and culture: the organization as a task environment, as a problem solving environment and as a development environment (Cox and Howarth, 1990; Cox and Leiter, 1992). The available evidence suggests that if the organization is perceived to be poor in respect of these environments then this is likely to be associated with increased levels of stress. On the other hand, if the organization is perceived to be good in these respects then the relationship between the experience of stress and the report of symptoms of ill health is attenuated (Cox and Kuk, 1991).

Kasl (1992) has listed various aspects of organization which he believes may be hazardous; for example, organizational size and structure (having a flat structure with relatively few levels of organization), cumbersome and arbitrary procedures, and role-related issues. The latter are dealt with below. Much of the effect of organization and function and culture on workers will be transmitted through the behaviour of managers and supervisors. There is evidence, for example, that management behaviour and supervisory styles have a substantial impact on the emotional well-being of workers (Landy, 1992; Corey and Wolf, 1992). Such an influence may be partly a reflection of their handling of the job context and job content issues listed in Table 2 . Following this argument, any effect of style might be largely a reflection of more general issues of inter personal relationships.

## Role in Organization

The evidence that 'role in organization' is a potential psychosocial hazard relates largely to issues of role ambiguity and role conflict (Kahn et al, 1964; Kahn and French, 1970; Kahn, 1973; Jackson and Schuler, 1985). However, other potentially

hazardous aspects of role have been identified including role overload, role insufficiency and responsibility for other people. French, Caplan and van Harrison (1982) have concluded that such variables are among the most powerful predictors of psychological health. Measures of all five aspects of role were used in a recent study of white collar workers by Bhalla, Jones and Flynn (1991). They were related to workers' reports of strain, job satisfaction and organizational commitment. The data suggested that overall role ambiguity, role conflict and role insufficiency were more strongly related to the outcome variables than were role overload or responsibility.

Role Ambiguity

Role ambiguity occurs when a worker has inadequate information about his or her work role. As Warshaw (1979) has stated, "the individual just doesn't know how he or she fits into the organization and is unsure of any rewards no matter how well he or she may perform." A wide range of events can create role ambiguity, many of them relating to novel situations and change (see Ivancevich and Matteson, 1980).

Role ambiguity manifests itself in a general confusion about appropriate objectives, a lack of clarity regarding expectations, and a general uncertainty about the scope and responsibilities of the job. Kahn et al (1964) found that workers who suffered from role ambiguity were more likely to experience lower job satisfaction, a greater incidence of job-related tension, greater feelings of futility and lower levels of self-confidence. French and Caplan (1970) found that role ambiguity was related to a similar cluster of symptoms. They also showed that role ambiguity was related to increased blood pressure and higher pulse rates. Later research by Margolis et al (1974) found a number of significant relationships between role ambiguity and symptoms of depression and low job motivation and intention to leave the job. Cooper and Marshall (1976) have pointed out that in all these studies, although the correlations reported were significant and together paint a consistent picture, they were not particularly strong (only accounting for about 2-5% of the data variance). Furthermore, many of the measures of ill health were based on self-report.

Role Conflict

Role conflict occurs when individuals are required to play a role which conflicts with their values, or when the various roles that they play are incompatible with one another. Kahn and his colleagues (1964) have shown that the greater role conflict in men, the lower job satisfaction and the greater job-related tension. French and

Caplan (1970) found that mean heart rate was strongly related to perceived level of role conflict. It may also be related to increased risk of cardiovascular ill health (Ivancevich and Matteson, 1980). For example, Shirom et al (1973), in a large study of Israeli men drawn from a range of occupations, found that there was a significant relationship between role conflict and incidence of coronary heart disease but only for white collar workers. Cooper and Smith (1986) concluded that white collar workers are more prone to role conflict than are manual workers.
Kahn et al (1964) have suggested that those in 'boundary roles' (links between organizational levels or departments), such as foremen, are particularly prone to experience stress. Such roles have a high potential for conflict, and Margolis and Kroes (1974) found that foremen were seven times more likely to develop ulcers than shop floor workers.

Role Insufficiency

Role insufficiency refers to a failure of the organization to make full use of the individual's abilities and training (for example, O'Brien, 1982). Such insufficiency has been reported to lead to feelings of stress (Brook, 1973) and be associated with psychological strain and low job satisfaction and organizational commitment (Bhalla et al, 1991).

Responsibility for People

Responsibility for people has been identified as a potential role-related source of stress associated with role issues. Wardell et al (1964) showed that responsibility for people, compared to responsibility for things, was likely to lead to greater risk of coronary heart disease. French and Caplan (1970) found that responsibility for people was significantly related to heavy smoking, raised diastolic blood pressure and elevated serum cholesterol levels. The literature on burn out (see Leiter, 1991) also suggests that, in the caring professions at least, responsibility for people is associated with emotional exhaustion and the depersonalization of relationships with patients. There is also evidence from the study of mental health referrals, by occupation, that those occupations involving continual contact with and responsibility for people are high risk (Colligan et al, 1977).

## Career Development

The lack of expected career development may be a source of stress, particularly in organizations which emphasise the relationship between career development and competence or worth. Marshall (1977) identified two major clusters of potential sources of stress in this area: first lack of job security and obsolescence (fear of redundancy and forced early retirement); and, second, status incongruity (under or over promotion, and frustration at having reached the career ceiling). These have been related to adverse psychological effects as well as poor physical health (Kasl and Cobb, 1982; Margolis et al, 1974). These two sources of stress probably interact. Cooper (1978) has suggested that fear of obsolescence and failure resulting in demotion is likely to be strongest in those who believe they have reached their career ceiling, and that most will experience some erosion of status before they retire. Roberston and Cooper (1983) believe that these fears may give rise to stress if workers are unable to adapt their expectations to the reality of their situation. Not surprisingly, older workers are particularly vulnerable as they tend to place a high value on stability (Sleeper, 1975).

### Job Insecurity and Poor Pay

Job insecurity and fear of redundancy can be major sources of anxiety, particularly if organizations expect, at the same time, commitment from their employees. The sense of inequity may exacerbate the experience of stress (Porter, 1990). Poor pay may be hazardous to health. While most workers will complain about levels of pay, the extremes of poor pay clearly have an effect on the worker's ability to remain healthy (Warr, 1992). Method or schedule of payment may also be a source of stress (for example, piece work) may interact in its effects with the rate of working (Kasl, 1992).

### Status Incongruity

The cost of status incongruity has been well researched in the United States. For example, Arthur and Gunderson (1965), in a study of naval personnel, claimed that promotional lag was significantly related to psychiatric illness. Interestingly, the literature on status incongruity also suggests a strong effect of non-work factors. For example, Kasl and Cobb (1967) demonstrated that incongruities between father's and mother's education and/or occupation was related to frequency of rheumatoid arthritis and anger-irritation in their daughters. The daughters of 'over educated'

mothers, defined by father's occupational group, showed high anger - irritation and excessive frequency of rheumatoid arthritis. On the basis of this and other evidence, Kasl and Cobb (1967) concluded that stress related to parental status had 'strong long term effects on physical and mental health of adult offspring'. Shekelle et al (1969) found that the men in their sample (from the United States) whose present social class was substantially different from that of their childhood ran a significantly higher risk of coronary heart disease than men whose present social class was not.

## Decision Latitude and Control

Decision latitude and control are important issues in job design and work organization. They are often reflected in the extent to which employees can participate in decision making affecting their work. However, there are other aspects to participation such as status which may also affect health and behaviour.

### Participation

Research suggests that where there are greater opportunities for participating in decision making, greater satisfaction and higher feelings of self-esteem are reported (French and Caplan, 1970, 1972; Buck, 1972; Margolis et al 1974; Spector, 1986). Non-participation appears related to work-related stress and overall poor physical health (Margolis and Kroes, 1974). French, Caplan and van Harrison (1982) have reported that lack of participation shows a strong relationship to job dissatisfaction but that this effect may be mediated by other variables relating to the overall person-environment fit.

### Decision Latitude and Control

The experience of low control at work or of loss of control - low decision latitude - has been repeatedly associated with the experience of stress, and with anxiety, depression, apathy and exhaustion, low self-esteem and increased incidence of cardiovascular symptoms (Ganster and Fusilier, 1989; Sauter, Hurrell and Cooper, 1989; Karasek and Theorell, 1990). Interestingly, in a study of 244 occupations in Sweden, men consistently reported higher levels of control than women, even within female stereotyped jobs (Hall, 1991).

Following on from the work of Karasek, among others, it is often implied that increasing workers' control is universally beneficial. For example, Cox (1990) and

Warr (1992) have argued that workers should, ideally, be empowered to plan their work, and control their workloads, make decisions about how that work should be completed and how problems should be tackled. However, it has been argued by Neufeld and Paterson, (1989) that control can also be a double-edged sword: the demands implied by the choices involved in controlling situations can themselves be a source of stress.

## Interpersonal Relationships at Work

It has been argued strongly that good relationships between workers and members of work groups are essential for both individual and organizational health (Cooper, 1981). A survey by the Ministry of Labour in Japan (1987) revealed that 52% of the women interviewed had experienced anxiety and stress, the main cause being unsatisfactory interpersonal relations at work (61%). Three important sets of relationships have been identified: relationships with superiors, relationships with subordinates and relationships with colleagues (Sauter, Murphy and Hurrell, 1992). Low interpersonal support at work has been found to be associated with high anxiety, emotional exhaustion, job tension and low job satisfaction and increased risk of cardiovascular disease (for example, Beehr and Newman, 1978; Davidson and Cooper, 1981; Pearse, 1977; Warr, 1992).

Social relationships both at work and outside the workplace are most commonly viewed as playing a moderating role, and adverse effects of exposure to other psychosocial hazards are more likely or more pronounced when relationships provide little support (Cobb and Kasl, 1977; Cohen and Willis, 1985; House and Wells, 1978). Karasek and colleagues (1982) in a study of over 1,000 male workers in Sweden, showed that support from supervisors and co-workers buffered the effects of job demands on depression and job satisfaction. However, other research suggests a more direct effect of social support in offsetting the adverse effects of working conditions (Ganster, Mayes and Fusilier, 1986).

Buck (1972) has reported that the 'considerate' behaviour of superiors appears to contribute inversely to workers' feelings of job pressure. Workers' participation in decision making results in them reporting greater job satisfaction and stronger feelings of self-esteem (Buck, 1972; French and Caplan, 1970, 1972; Margolis et al, 1974). However, Donaldson and Gowler (1975) consider that pressure on managers to 'manage by participation' actually places them under increased pressure, and may cause feelings of resentment and anxiety. Robertson and Cooper (1983) discuss how

competition at work, particularly among managers, may inhibit problem sharing and increase stress.

Violence at Work

There is a small but growing literature on violence in the workplace (see Cox and Leather, 1994) and on the related issue of post traumatic stress disorder (see Figley, 1985). There is strong evidence that exposure to violence in the workplace can cause damage to psychological as well as physical health[11].

## Home-Work Interface

The concept of the work-home interface relates not only to domestic life and the family but also to the broader domain of life outside of work. Most research has focused either on the relationship between managers and their spouses (Cooper, 1981) or on the use of leisure time (Gardell, 1973; Cox, 1980).

Work and Family

Hingley and Cooper (1986) have argued that problems relating to the interface between work and the family either involve resolving conflicts of demands on time and commitment, or revolve around issues of support. Much of the former literature focuses on women workers (see, for example, Davidson and Cooper, 1983) although commentary has been offered on men and particularly young managers (Beattie et al, 1974). The difficulties faced in resolving conflicts between work and family appear enhanced if the family has young children; again this may be particularly so for women workers (Larwood and Wood, 1979; Bhagat and Chassie, 1981). Early research suggested that most middle class wives appear to see their role, in relation to their husbands job, as primarily 'supportive and domestic' (Pahl and Pahl, 1971). Some years later Cooper and Hingley (1985) found a similar pattern in the wives of

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[11] There are three main issues here: first, the accurate recording of data on violence at work and its aftermath so that an informed judgement can be made on the size of the problem; second, understanding the nature of such violence both from an individual and an organizational perspective; and third the development and evaluation of interventions designed to reduce the likelihood of violence occurring or reduce its impact on staff. Recommendations on the management of violence at work have been published by a variety of bodies, including the Health and Safety Executive (Mackay, 1987), the British Psychological Society (1992) and the Tavistock Institute of Human Relations (1986). Post traumatic stress disorder is mentioned briefly in section 4.0.

their sample of executive men in the United Kingdom although attitudes appeared to be changing. Failure to resolve adequately the conflicting demands between work and family may damage the support available from spouses, in particular, and the family in general.

Handy (1975) has explored the nature of a number of possible 'marriage-role' combinations in a study of executives in the United Kingdom. Consistent with other research, the most frequent combination was the 'thrusting male-caring female' which was most beneficial to the working husband. Another increasingly common combination was what was effectively the dual career couple. In this combination, traditional role expectations appear to be challenged with the possibility of either or both partners experiencing feelings of threat and anxiety (Hingley and Cooper, 1986).

Wasted Leisure Time Syndrome

Spill over effects from work might account for the possible wasting of constructive leisure time among some groups of employees (Gardell, 1973; Cox, 1980). The 'wasted leisure time syndrome' has been described by Gardell (1973) in terms of employees not finding time out of work to do more than potter about the home, skim through newspapers, watch television, and eat and sleep. Lundahl (1971) had observed in her Swedish study that those employed on heavy fatiguing jobs showed less involvement in leisure than those who were not. Both Gardell (1973) and Cox (1980) have suggested that more is involved than physical exertion, and the latter author has linked wasted leisure time to employees psychological and behavioural adaptation to the demands of short cycle repetitive work.

Wilensky (1960) has offered an explanation of the work-leisure relationship in terms of compensation, and this concept has also been used to account for the effects of repetitive work on the use of leisure time. Consistent with Wilensky's (1960) hypothesis, Strauss (1974) has suggested that employees can adjust to non-challenging work by lowering their expectations, changing their need structure and making the most of social opportunities on and off the job. However, Kornhauser (1965) offered a similar explanation but with a more negative emphasis consistent with the hypotheses of Gardell (1973) and Cox (1980). He suggested that "the unsatisfactory mental health of working people consists in no small measure of their dwarfed desires and deadened initiative, reduction of their goals and restriction of their efforts to a point where life is relatively empty and only half meaningful".

## Change

Change is often cited as a psychosocial hazard. However, it is not clear from the literature whether change per se is stressful or hazardous, or whether its possibly stressful nature is due to the uncertainty and lack of control which it often represents.

## Job Content

The following section describes those psychosocial hazards which are related to the content of work and which are experienced as stressful and/or otherwise carry the potential for harm.

## Task Design

There are several different aspects of job content which are hazardous: these include low value of work, the low use of skills, lack of task variety and repetitiveness in work, uncertainty, lack of opportunity to learn, high attentional demands, conflicting demands and insufficient resources (Kasl, 1992).

### Semi-skilled and Unskilled Work

Such work is often characteristic of semi skilled and unskilled jobs (Kornhauser, 1965; Caplan et al, 1975; French, Caplan and van Harrison, 1982; Smith, 1981; Salvendy and Smith, 1981; Cox, 1985b). Cox (1985b) has reviewed the physical and psychological health effects of such work. Exposure to repetitive and monotonous work is often associated with the experience of boredom, and, in turn, with anxiety and depression, resentment, and generally poor psychological health (see: Kornhauser, 1965; Gardell, 1971; Laville and Teiger, 1976; Caplan et al, 1975; Broadbent and Gath, 1981; O'Hanlon, 1981; Smith, 1981). For example, Kornhauser (1965) showed that among production workers in a car manufacturing plant in the United States, under-utilization of skill was a particularly strong predictor of poor psychological health. There may also be an increased incidence of postural and musculo-skeletal problems, including work related upper limb disorders (see, for example, Kuorinka, 1979; Chatterjee, 1987, 1992; HSE, 1990a), disorders of the digestive system (Laville and Teiger, 1976; Nerell, 1975) - although these disorders may be associated with shift working in such jobs (Rutenfranz, 1982) - and various changes in health-related behaviours, such as smoking and drinking (Ferguson,

1973). Exposure to noisy heavy repetitive work may also give rise to 'wasted leisure time' (Gardell, 1973; Cox, 1980) (see below).

Uncertainty

Uncertainty in work, in the form of lack of feedback on performance, is also a source of stress particularly when it extends across a long period of time (Warr, 1992). Such uncertainty may be expressed in ways other than lack of performance feedback, and may partly underpin the effects of other hazardous job characteristics; for example, uncertainty about desirable behaviours (role ambiguity) and uncertainty about future (job insecurity and redundancy).

## Workload and Work Pace

Kornhauser (1965), from his study of Detroit car workers, suggested that "poor mental health was directly related to unpleasant working conditions, the necessity to work fast and to expend a lot of physical effort and to excessive and inconvenient hours". These various points, and others, are dealt with below.

Workload was one of the first aspects of work to receive attention (Stewart, 1976), and it has long been clear that both work overload and work underload can be problematic (Frankenhaeuser, 1975; Frankenhaeuser and Gardell, 1975; Lundberg and Forsman, 1979; Szabo et al, 1983). French and his colleagues, among others, have made a further distinction between quantitative workload and qualitative work load (French and Caplan, 1970; French, Caplan and van Harrison (1982). Both have been associated with the experience of stress. Quantitative workload refers to the amount of work to be done while qualitative workload refers to the difficulty of that work. The two dimensions of workload are independent and it is possible to have work which involves quantitative overload and qualitative underload. Much short cycle repetitive assembly work is of this nature, and there is strong evidence that it offers a threat to both physical and psychological health (see above). Kahn and Byosiere (1990) have extended this line of argument by suggesting that workload is a function of quality, quantity and time.

Managers often cope with work overload by working longer hours (Uris, 1972), and although this may offer a short term solution to the immediate problem, if sustained long working hours may in themselves become problematic (see below).

Workpace and Time Urgency

Workload has to be considered in relation to work pace; that is the speed at which work has to be completed and the nature and control of the pacing requirement - self-paced, systems paced or machine paced. Within limits, control may be the decisive factor in determining health (Sauter, Hurrell and Cooper, 1989). There is strong evidence that machine and systems paced work, particularly if of high rate, is detrimental to both psychological and physical health (Bradley, 1989; Cox, 1985a, 1985b; Smith, Hurrell and Murphy, 1981; Smith, 1985). There is also recent evidence that electronic performance monitoring, for computer based work, can produce a similar pattern of effects (see special edition of Applied Ergonomics, February, 1992).

Schriber and Gutek (1987) have identified a number of temporal dimensions that can be measured in organizational settings. Time urgency is usually treated as a property of the person (for example, in relation to type A behaviour) but it may well also be a property of the job. Johansson and Aronsson (1984) have suggested that VDT workers experience more time urgency in their work than do other occupational groups. Furthermore, Gael (1988) and Landy (1989), using task analysis, have demonstrated that differences in time demands of tasks can be readily identified with large and homogeneous samples of industrial workers.

## Work Schedule

There are two main issues which relate to the effects of work scheduling on health: shift working and long work hours (see, for example, Canadian Mental Health Association, 1984). Work often involves both these factors (see, for example, Folkard and Monk, 1985; Work & Stress, 1989, special number: 3).

Shift work

Much of the literature relates to shift (and night) working and has been adequately reviewed elsewhere (see, for example, Harrington, 1978; Johnson et al, 1981; Rutenfranz et al, 1977, 1985; Monk and Tepas, 1985; Waterhouse, Folkhard and Minors, 1992). Harrington (1978) concluded that "whereas good evidence exists to show that shift work, particularly night work, causes disruption of circadian rhythms and sleep patterns, the evidence for there being any major effect on health is slim." He did, however, also conclude that there may be a link between night work and digestive disorders, and between shift work in general and fatigue. He also

commented that whatever effects did exist, they were likely to be greater in those who had difficulty in adapting to such forms of working or who had existing digestive or sleep related problems. Monk and Tepas (1985) reached broadly similar conclusions.

Long Work Hours

Long hours of work, from extended work days of 12 hours (see, for example, Rosa, Colligan and Lewis, 1989) to sustained working over several days with sleep loss (see, for example, Stampi, 1989; Patton et al, 1989; von Restorff et al, 1989), has been shown to increase fatigue. Much of the evidence, especially in the later area, has come from studies on military work and performance.

Compressed work weeks, with 12 hour working days, have been associated with feelings of increased fatigue (Rosa and Colligan, 1986). Rosa et al (1989) have shown that after seven months adaptation to a 3-4 day /12 hour rotating shift schedule there were reductions in sleep and decrements in subjective alertness compared to previous work on a 5-7 day /8 hour schedule. However, there was a trade-off in effect between longer work days and shorter working weeks. Compressed work weeks are clearly a complex issue. Perhaps it is only with excessively long working days that this issue become simpler.

Sustained working can cause or be otherwise associated with sleep loss and perceived exertion or fatigue (for example, Ryman, Naitoh and Englund, 1989). Performance can be severely compromised by accumulation of sleep debt (Stampi, 1989). The upper limit of human performance for working intensively and continuously is 2-3 days (Haslam, 1982; Naitoh et al, 1983). Performance effects can be detected in vigilance tasks and those involving cognitive and verbal performance (Angus and Heslegrave, 1983; Haslam, 1982). Physical performance, particularly if of moderate intensity appears more resistant to impairment (for example, Patton et al, 1989).

Outside the military context, Spurgeon and Harrington (1989) have reviewed the effects of long working hours on the performance and health of junior hospital doctors. In the United Kingdom, particular work rotas can mean that junior doctors are working spells of around 102 hours. Spurgeon and Harrington (1989) concluded that a number of studies have shown that a significant proportion of newly qualified doctors develop some degree of psychological ill health. They argue that this may be

related to sleep loss which probably increases doctors' vulnerability to other work hazards. Research in this important area is continuing.

Control over work schedules is an important factor in job design and work organization. Such control may be offered by flexitime arrangements (Landy, 1989). It is interesting to note that although the introduction of flexitime arrangements may be associated with little change in behaviour (Ronen, 1981), they nonetheless can have a positive effect on workers (Narayanan and Nath, 1982; Orpen, 1981). In this case it is likely that it is the perceived control offered by such arrangements rather than the actual exercise of control that is important (Landy, 1992). Lack of control over work schedules may represent a source of stress to workers.

## 3.3 Animal Studies

Generally, the literature on animal behaviour has not been incorporated into this review. However, such studies have also suggested the characteristics which define stressful situations for many different species (Turkkan, Brady and Harris, 1982). Most relate to acute and well-defined stressors in the workplace. These include: the interval between aversive events, the availability of warning signals, the availability of avoidance or escape contingencies, changes in established procedures, and the duration of exposure to the aversive event and its severity. While the importance of these characteristics has been established through studies on animal behaviour, largely within a conditioning paradigm, they do have face validity in relation to the workplace, and some map easily onto the characteristics listed in Table 2.

There appear to be critical temporal dimensions involved with most aversive tasks largely defining the interval between aversive events, and such intervals are not always the shortest possible. They vary with task and outcome (see, for example, Brady (1958) and Rice (1963) for the effects of avoidance schedule timing on ulceration in laboratory animals). The availability of a warning signal appears to attenuate the physiological response to an aversive event (for example, Weiss, 1972; Miller et al, 1978) as do the availability of avoidance or escape contingencies (for example, Anisman et al, 1980; Sklar and Anisman, 1981). Changing established or learnt procedures produces extensive endocrinological changes (for example, Brady, 1975). Short exposures to aversive stimuli may not have cumulative effects, and animals appear to adapt to long exposures. Medium range durations of exposure may therefore be most effective in producing physiological responses to aversive

stimulation (for example, Forsythe and Harris, 1970). Generally, the greater the intensity of the aversive event, the stronger the physiological and pathological responses (Turkkan, Brady and Harris, 1982), although this is not always the case (see, for example, Ulrich and Azrin, 1962).

## 3.4 Distribution of Psychosocial Work Hazards

There is little good evidence relating to the distribution of psychosocial hazards across different types and levels of work and across different countries. There have been few, if any, surveys which provide an adequate comparison of a wide range of different types and levels of work.

A recent survey has attempted to map the physical and organizational constraints of work [12] in the twelve member states of the European Community and in former East Germany (European Survey on the Work Environment 1991-1992). Briefly, organizational problems affected a higher proportion of workers than did physical problems. The main organizational problem areas were 'lack of influence over one's work' (35-40%), 'involvement in short cycle repetitive work' (about 25%) and 'long working hours'. 16% of men and 7% of women reported working over 50 hours per week.

Broad comparisons can be drawn between, say, manual and managerial work. Warr (1992) has suggested that much manual work tends to be associated with extremes of workload (overload or underload), low levels of decision making and participation, and low task variety. Where the work is deemed to be semi-skilled or unskilled, there is also the problem of low use of skill or skill potential. Managerial work, in stark contrast, is more often associated with work overload, role related problems and uncertainty. French, Caplan and van Harrison (1982) have provided some support for this suggestion. In their survey in the United States, manual workers reported having low job complexity and low requirement for concentration (and an underutilization of their skills), low participation and low support. Professional workers, by comparison, reported having high job complexity and no under utilization of their skills, and good participation and support.

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[12] The organizational constraints referred to in the European Survey on the Work Environment 1991-1992 are equivalent to the psychosocial hazards referred to in this report.

Marmot and Madge (1987), reporting on the Whitehall study, offer data which compare the work characteristics of men of different grades in the Civil Service in the United Kingdom. The work of the lower grades was characterised by under use of skills and by low social contact with others at work. To a somewhat lesser extent, it also involved low control and lack of task variety. Interestingly, within this particular organizational context, the work of the higher grades was also characterised by low social contact and under use of skills but to a lesser extent. The most obvious differences between lower and higher grades related to the former's lack of control and variety in work.

Our knowledge of how the distribution of psychosocial hazards relates to occupational risk is somewhat complicated by suggestions that it is particular synergistic combinations of such hazards that carry the greatest threat to health (Levi, 1984: see above). Evidence of such synergy is claimed from the work of Karasek (see section 2.6). For example, a representative sample of the male Swedish workforce was examined for depression, excessive fatigue, cardiovascular disease and mortality. Those workers whose jobs were characterised by heavy workloads combined with little latitude for decision making were represented disproportionately on all these outcome variables. The lowest probabilities for illness and death were found among work groups with moderate workloads combined with high control over work conditions (Ahlbom, Karasek and Theorell, 1977; Karasek, 1979, 1981; Karasek et al, 1981). Another example is provided by Martin and Wall (1989) who have described a case study where the introduction of computer based technology into the workplace resulted in a high level of stress reflecting the *combination* of increased cost responsibility with increased attentional demands.

## 3.5 Summary

It is possible from the available literature to explore the effects of the more tangible hazards of work on the experience of stress and on health and, at the same time, begin to identify those psychosocial hazards which pose a threat to employees. Further research and development is required to translate this information into a form which can be used in the auditing and analysis of workplaces and organizations.

# 4.0 STRESS AND HEALTH

Over the past two decades, there has been an increasing belief that the experience of stress necessarily has undesirable consequences for health. It has become a common assumption, if not a "cultural truism" (Leventhal and Tomarken, 1987), that it is associated with the impairment of health. Despite this, the evidence is that the experience of stress does not *necessarily* have pathological sequelae. Many of the person's responses to that experience, both psychological and physiological, are comfortably within the body's normal homeostatic limits and, while taxing the psychophysiological mechanisms involved, need not cause any lasting disturbance or damage. However, it is also obvious that the negative emotional experiences which are associated with the experience of stress detract both from the general quality of life and from the person's sense of well being. Thus the experience of stress, while necessarily reducing that sense of well-being, does not inevitably contribute to the development of physical or psychological disorder. For some, however, the experience may influence pathogenesis. Stress may affect health. At the same time, however, a state of ill health can both act as a significant source of stress, and may also sensitise individuals to other sources of stress by reducing their ability to cope. Within these limits, the common assumption of a relationship between the experience of stress and poor health appears justified (Cox, 1988a).

This section presents a brief overview of the broad range of health and health-related effects which have been variously associated with the experience of stress. More detailed discussions are available elsewhere (for example, Cox, 1978; Cincirpini et al., 1984; Stainbrook and Green, 1983; Millar, 1984, 1990). It focuses on changes in health and health - related behaviours and physiological function which together may account for any linkage between that experience and psychological and physical health (Cox, Cox and Thirlaway, 1983).

## 4.1 Effects of Stress: An Overview

The experience of stress can alter the way individuals feel, think and behave, and can also produce changes in their physiological function (Cincirpini et al., 1984; Stainbrook and Green, 1983). Many of these changes simply represent, in themselves, a modest dysfunction and possibly some associated discomfort. Many are easily reversible although still damaging to the quality of life at the time. However, for some workers and under some circumstances, they might translate into poor performance at work, into other psychological and social problems and into

poor physical health. Overall, however, the strength of the relationship between the experience of stress, and its antecedents, on one hand, and health, on the other, is consistent but moderate (Baker, 1985; Kasl, 1980, 1984).

It is convenient to summarise the possible health and health-related effects of stress under two headings: psychological and social effects, and, physiological and physical effects. Some of the effects listed in this table may have implications at the organizational level (see section 5.5).

## 4.2 Psychological and Social Effects

The psychological effects of stress may be expressed in a variety of different ways, and involve changes in cognitive-perceptual function, emotion and behaviour. Some of these changes may represent attempts to cope, including changes in health-related behaviours. There is evidence that some health-promoting behaviours, such as exercise and relaxation, sleep and good dietary habits, are impaired by the experience of stress, while other health-risk behaviours, such as smoking and drinking, are enhanced. Other behaviours, such as sexual behaviour, which may be health-neutral, can also be impaired and that impairment become a secondary cause of stress. Similarly, increases in health - risk behaviours can also become secondary causes of stress if sustained. Particular reference may be made to psychological dependency on alcohol or smoking. Social behaviour, and interpersonal relations, may be impaired by the experience of stress, possibly reflecting more fundamental psychological changes in, for example, irritability, attention span, and memory. Stress-related impairments of social relations may both create secondary problems and reduce the availability of social support (see section 3.2).

Interestingly, the literature which describes the translation from a normal psychological reaction to events to *psychological* illness is not well formed, except in the case of post traumatic stress and related disorders (see, for example, Figley, 1985; Hillas and Cox, 1987). A variety of psychological sequelae have been related to exposure to extremely threatening situations such as catastrophies and disasters (Logue, 1980; Logue, Melick and Struening, 1981), war (Blank, 1981; Milgram, 1982) and terrorism (Bastiaans, 1982).

Psychological ill health has also been associated with work stress. One of the classical studies in this area is that by Colligan, Smith and Hurrell (1977). They

conducted a survey, by occupation, of all first admissions to 22 of the 27 community mental health centres in Tennessee, United States, from January 1972 through June 1974. 8,450 cases were considered from 130 different occupational groups. Occupations were ranked according to estimated admission rate per 1000 workers and by z scores. Z scores were calculated for observed against expected frequencies of admission on the basis of the relative frequency of members of the groups in the population. These rates were then compared and the top 30 ranks reported. The group with by far the highest rate was health technology technicians, and five others in the top 30 were relatively low status health care occupations. Many of the occupations which were represented in the top 30 also involved continual interaction with others (patients, clients, customers etc) including human service occupations. It has been argued that the presence of so many health care occupations in the top 30 is an artefact and simply reflects their better knowledge of psychological health issues and of appropriate health care facilities. However, this criticism cannot be so readily applied to the personal service groups represented in the survey. Operatives ranked 28th (out of 130).

## 4.3 Physiological Change and Physical Health

Contemporary research into physiological and physical health correlates of stress began in the 1920s and 1930s with the work of Cannon (1929, 1931) and Selye (1936). Since then much has been published in this area.

### Mechanisms of Stress-related Physiopathology

Zegans (1982) has suggested that there are three different ways in which the physiological changes associated with the experience of stress occur: as a concomitant physiological response to an appraisal of threat or a failure of coping; as a physiological response to an appraisal of threat when active coping is not possible; and, as a non-specific response during the initial orientation-alarm state. Zegans (1982) has also suggested a number of ways in which such physiological responses might contribute to pathology. The acute response may itself cause damage, particularly if an already compromised organ system is involved. If this is not the case, then repeated occurrence of that insult might cause more permanent damage. The experience of stress and the physiological insult it causes might become chronic and again cause more permanent damage. Together these three cover the often cited conditions for increased wear and tear on the body (Selye, 1950): exposure to stressors

which is severe, frequent or of long duration. However, Zegans (1982) has also argued that there are other mechanisms which might contribute to the translation of a normal transient physiological response into one of pathological significance. Most appear to relate to the interaction between stress responses and other physiological systems particularly control systems. First, the experience of stress might result in an inappropriately severe response because either a deficiency in relevant control systems or the stress response might stimulate other less benign reactions, again because of the lack of control elsewhere.

Zegans (1982) has also argued that the potentially pathogenic effects of the stress response express themselves by challenging the various body systems which integrate and defend physiological function, and which underpin its link with behaviour. These systems include the hypothalamic-pituitary-adrenal cortical axis, the autonomic nervous system-adrenal medullary axis, the immune system, the reticular activating system, and the cognitive-affective centres of the brain (Zegans, 1982). Much attention, in the past, has been focused on the role of the adrenal glands in stress physiology and there are several reviews available (for example, Selye, 1950; Levi, 1972; Cox and Cox, 1985; Szabo et al, 1983). Stress can cause endocrine hypoactivity and hyperactivity (Lipton, 1976) and alter the balance of autonomic control altering function in the cardiovascular, respiratory, secretory and visceral systems (Lisander, 1979). It appears to impair or distort the immune response (Stein, Keller and Schleifer, 1981). It can distort visceral perception (Brener, 1978), alter sleep patterns with knock-on effects on a variety of other activities (Weitzman et al, 1975), and induce changes in other behaviours, some of which have significance for health (Antelman and Caggiula, 1977).

There have been a small number of studies which have exposed subjects to stressful situations and measured a wide range of physiological, largely biochemical, responses and subsequently factor analysed these data. Given that such studies require much control and resources, it is often difficult to capture sufficient data (by case) to satisfy the requirements of factor analytic procedures (see, for example, Ferguson and Cox, 1993). However, these studies are of interest, and those that have been reported have similar findings. Rose, Poe and Mason (1967) analysed circulating hormone levels in 46 men undergoing basic military training. They found five factors: a cortisol factor, a catecholamine factor, two factors related to androgens and oestrogen, and one related to thyroid function. A study of 115 military trainees by Ellertsen, Johnsen and Ursin (1978) identified three factors: a cortisol factor, a catecholamine factor and a testosterone-free fatty acid factor. Ryman and Ursin (1979) studied 31 American Navy company commanders in stressful

conditions and again reported a factor model of their physiological responses consistent with that reported by Ellertsen et al (1978). Ursin (1979) has suggested that these three physiological response factors might be differentially related to pathology. Subjects who respond with a predominant cortisol response might be more prone, according to the model of Henry and Stephens (1977), to depression, disorders of the immune system and gastric or duodenal ulcers. Using the same argument, Ursin (1979) linked catecholamine responders to cardiovascular problems and possibly renal conditions.

Turkkan, Brady and Harris, (1982) have reviewed the available evidence from animal studies and have come to a conclusion not inconsistent with that expressed by Zegans (1982). From the animal evidence, there appear to be four physiological systems which are particularly vulnerable to stress. The four are: the cardiovascular system (for example, Brady and Harris, 1977; Schneiderman, 1978); endocrine system (for example, Mason, 1968; Stone, 1975); gastro-intestinal function (see Turkkan et al, 1982) and immune system (for example, Monjan, 1981). Stress related dysfunction in these systems is potentially significant for physical health.

Given this consensus, it is not surprising that the literature on stress and physical health largely focuses on a number of particular conditions although a large number of others are commonly cited as being, to some extent, stress-related (see, for example, Cox, 1978; Millar, 1984). It has been suggested (Cox, 1978) that, under certain circumstances, *all* physical conditions are potentially susceptible to stress effects. If this is true then questions must be asked about which are the more susceptible or the most directly susceptible, and how that susceptibility is affected by the nature of work and the workplace. The more susceptible conditions appear to be those relating to the cardiovascular and respiratory systems (for example, coronary heart disease and asthma), the immune system (for example, rheumatoid arthritis and possibly some forms of cancer), the gastro-intestinal system (for example, gastric and peptic ulcers), and those relating to the endocrine, autonomic and muscular systems. Among this group, most attention is currently being focused on the immune system. There are several reviews available concerning the general relationship between stress, emotion and immune function (for example, O'Leary, 1990) but few, if any, overviews of the effects of work-related stress on that function.

## Work-related Psycho Immunology

There are now a number of studies, many of them Norwegian, which demonstrate a link between the experience of work stress and changes in immune system activity, both cellular and humoral. Vaernes et al (1991) have reported a study of Norwegian airforce personnel in which they showed significant correlations between perceived work stress and immunoglobulin levels, and also complaints related to immune system activity. Levels of complement component C3 (humoral immunity) appeared particularly sensitive to variations in perceived work stress, and 31% of the variance in this measure could be accounted for by three work stress items relating to: taking the job home, having to lead other people, and problems with subordinates. Interestingly, levels of IgM and IgG (cellular) did not correlate in any substantial way with the work stress measures. There was weak evidence of a linkage between IgA (cellular) and some aspects of perceived work stress. The immunological measures correlated with the measures of health complaints related to immune system activity.

Endresen et al (1991) have reported a somewhat similar study of Norwegian bank workers. Their data suggested that T-cell number (not examined in the Vaernes et al (1991) study) and C3 (both cellular), and also IgM (humoral), were sensitive to both perceived work stress and associated emotional distress. There are a number of other studies from the Norwegians which support the finding of a linkage between the experience of work stress and immune system activity. These include studies on: offshore divers (Bergan et al, 1987), submarine officers (Vaernes et al, 1987), nursing (Endresen et al, 1987; Arnestad and Aanestad, 1985), primary school teachers (Ursin et al, 1984) and shift workers in the processing industry (Vaernes et al, 1988). While it may be safe to conclude that such a linkage exists, particularly in relation to cellular mechanisms, the direction of this relationship is not yet clear - the data are correlational - nor is its significance for health. Animal studies do, however, suggest that environmental stimuli (stressors) can alter the effectiveness of the immune system and reduce, in some circumstances, its ability to defend against both external infective agents and tumour growth. Much of this evidence has been usefully summarised in reviews of the role of psychosocial factors and psychophysiological processes in cancer(s) (Ader, 1981; Fox, 1981; Sklar and Anisman, 1981; Cox and Mackay, 1982; Irwin and Anisman, 1984; Cox, 1984).

Mechanisms

Work by Riley (1981) provides one possible account of the way the experience of (work) stress may influence the development of cancers. Riley (1981) has argued that stress-associated pathologies will not be observed, despite the presence of stress, if there is no disease process already in existence. He is arguing here for a role for stress in the development of existing cancers rather than in the aetiology of new cancers. Second, even if there is an existing latent pathology, the effects of stress will not be observed unless the disease is under the control of the immune system. This may account for stress effects on the development of some cancers and not others. Third, the effects of stress will only be observed if there is some functional balance between the individual's defences and the developing cancer. Where one or other is obviously dominant, any additional effects of stress may be impossible to detect. This means that the effects of stress may not be detectable in the early and terminal stages of cancer development. This model was largely developed from Riley's studies on rodents to account for cancer development (see Riley, 1979, 1981; Riley et al, 1981) but might be usefully applied to other diseases which involve the immune system activity (see, for example, Cox, 1988b).

## Other Pathologies

A considerable variety of different pathologies, both psychological and physical, have been associated with the experience of stress through work (Holt, 1982). Those disorders usually cited as being stress-related include: bronchitis, coronary heart disease, mental illness, thyroid disorders, skin diseases, certain types of rheumatoid arthritis, obesity, tuberculosis, headaches and migraine, peptic ulcers and ulcerative colitis, and diabetes (Cox, 1978; Cooper and Marshall, 1976; Kroes, 1976, Selye, 1976).

According to Selye (1956) repeated, intense or prolonged elicitation of this physiological response, it has been suggested, increases the wear and tear on the body, and contributes to what he has called the 'diseases of adaptation'. This apparently paradoxical term arises from the contrast between the immediate and short term advantages bestowed by physiological response to stress (energy mobilisation for an active behavioural response) to the long term disadvantages (increased risk of certain 'stress related' diseases).

Furthermore, the general occurrence of physical ill health has also been related to the experience of stress. For example, Nowack (1991) has reported on the relationship

between perceived stress and coping style, on the one hand, and self-reported ill health, on the other. The frequency and severity of physical ill health (Wyler et al, 1968) were measured. After controlling for demographic variables and for psychological well-being, perceived stress was shown to be a strong predictor of both the frequency and severity of physical ill health. About 30% of the variance in the latter was accounted for by perceived stress. However, there is the problem of the direction of effect given that the study was correlational in nature as many in this area are.

Attention focused, in earlier years, on peptic ulcers as the prototypical work stress disease (Holt, 1982). For example, Kahn and French (1970) suggested, on the basis of their studies on job status and peptic ulcers that the relationship between job status and ulceration may be mediated by its effects on self-esteem and the relationship between self-esteem and serum pepsinogen. However, a comparison of executives and foremen had showed that while self-esteem was lowest and ulceration highest in the foremen, serum pepsinogen levels were lowest in the executives (Dunn and Cobb, 1962). Normally, serum pepsinogen is positively related to ulceration. In 1979, House and his colleagues reported a link between work stress - particularly stressful relations with others - and ulcers, after controlling for seven possibly confounding variables. Despite this, opinion has been divided on whether or not the condition is stress related. In 1967, Susser concluded, from a review of the literature, that there is a link, while somewhat later Weiner (1977) stated that no such link had yet been proved.

Much attention has also been focused on cardiovascular diseases, especially coronary heart disease. The origin of coronary heart disease, like many chronic degenerative conditions, is multifactorial but work factors and stress have clearly been indicated (see, for example, Cooper and Marshall, 1976; House, 1974; Jenkins et al, 1976). However, the evidence is not completely unequivocal and negative findings have been reported (see, for example, Haynes et al, 1978a, 1978b). One well-established and frequently replicated finding is the link between type A behaviour pattern and cardiovascular disease (see, for example, Jenkins, Rosenman and Friedman, 1968; also section 5.4).

There has been evidence for a long time that psychosocial factors and the experience of stress can contribute to an acceleration of the disease process in at least one particular type of rheumatoid arthritis (see King and Cobb, 1958; Cobb and Kasl, 1966; Genest, 1983, 1989). Rimon and Laakso (1985) have suggested that there are two separate types of rheumatoid arthritis: one, a disease form less connected with

genetic factors and potentially more influenced by stress, and a second form more associated with heredity disposition and less influenced by psychosocial processes. These groups may overlap with those described by Crown, Crown and Fleming (1975). These authors distinguished between patients on the basis of the presence or absence of rheumatoid factor (RF). The sero-positive group, with RF, showed a more negative psychopathological profile than those without RF. Such findings have been replicated by other workers such as Gardiner (1980) and Vollhardt et al (1982). Early work by Cobb (for example, King and Cobb, 1958, 1959; Cobb, 1959; Cobb and Kasl, 1966) suggested that resentment in the form of contained or unexpressed hostility might act as a mediating factor between familial sources of stress and the occurrence of rheumatoid arthritis. For example, King and Cobb (1958, 1959) found that rheumatoid arthritis was associated with a discrepancy between income and education; that is, the onset of the disease was more likely among people whose education would have led to an expected income higher than that actually received. They also reported a relatively high prevalence of the disease among women who experienced some discrepancy between the requirements of their familial role and their own sense of identity. Cobb and Kasl (1966) showed that the disease was more frequent among women who had mothers with education inappropriately high for the social stratum defined by their fathers' occupation. Moreover anger - irritation was also more common among the daughters of such 'over educated' women and the data demonstrated such emotion to be associated with an excessive frequency of the disease.

## 4.4 Extent of the Problem

Some estimation needs to be made of the extent of stress-related health problems at work. Most countries routinely collect data on work days lost due to sickness, injury and disability. In the United Kingdom, such data have been collected by the Department of Health and the Department of Social Security. Figures exist, for example, for the number of work days lost due to certified incapacity for a variety of illnesses and disorders. Table 3 presents figures for men and women of days lost due to mental disorder and also diseases of the cardiovascular system.

Such data are, however, for a number of reasons, imprecise and are not reliable in terms of describing trends due to changes in the recording methods used (see, Marmot and Madge, 1987; Fletcher, 1988; Jenkins, 1992). For this reason, they can only be used as a basis for 'educated guesses' in relation to the extent or cost of occupational stress. For example, it has been variously suggested that upwards of 40

million working days are lost each year in the United Kingdom due to stress-related disorders (Kearns, 1986; HSE, 1990b). Furthermore, Kearns (1986) has suggested that up to 60% of all work absence is caused by stress-related disorders.

| **Work days lost (million)** | **Mental Disorder** | | **Diseases of the Cardio-vascular system** | |
|---|---|---|---|---|
| YEAR | Men | Women | Men | Women |
| 1985/86 | 35.6 | 20.1 | 67.6 | 8.1 |
| 1986/87 | 37.2 | 20.3 | 68.0 | 8.4 |
| 1987/88 | 39.3 | 23.1 | 73.6 | 10.1 |
| 1988/89 | 43.9 | 26.7 | 77.3 | 11.1 |
| 1989/90 | 48.0 | 31.7 | 81.4 | 12.5 |

**Table 3: Work days lost through certified incapacity due to mental disorder and diseases of the cardiovascular system 1985-1990.**

More adequate data exist on the relative architecture of stress-related ill health from general population surveys and from smaller scale studies of defined occupational populations (see, for example, Colligan et al, 1977; Eaton et al, 1990). Projections from the National Health Interview Survey, 1985, suggested that 11 million workers in the United States could report 'health endangering' levels of stress at work (Shilling and Brackbill, 1987). Only loud noise was reported to be a more prevalent workplace hazard. The Health and Safety Executive added a supplementary questionnaire to the 1990 Labour Force Survey in the United Kingdom which asked whether respondents had, in the last 12 months, suffered from any illness, disability or other physical problem that was caused or made worse by (their) work. Follow up questions established the nature of the illness and the job that was thought to have given rise to it, whether the work was thought to have caused the condition or simply made it worse; and the number of days' sick leave in the year due to the complaint (Health and Safety Commission, 1992). Stress and depression together were among the conditions with the greatest number of absolute cases (about 100,000 per annum). Interestingly, about 57% of these cases thought that their condition was *caused* by work. In the same vein, Cooper and Davidson (1982) have reported that 71% of their sample of managers in the United Kingdom felt that their psychological health problems were related to stress at work.

## 4.5 Organizational Effects

If significant numbers of workers are experiencing and expressing the effects of stress at work then the problem assumes organizational proportions. There has been some (unsupported) suggestion that if (about) 40% of workers in any group (department or organisation) are facing stress related problems, then that group or organization can also be said to be unhealthy in some way. From the literature, there appear to be several effects of stress which may be of more direct concern to organizations. The most frequently cited appear to be: reduced availability for work involving high turnover, absenteeism and poor time keeping (all essentially 'escape' strategies), impaired work performance and productivity, an increase in client complaints (cf: Jones et al, 1988) and an increase in employee compensation claims (Barth, 1990;Lippe, 1990; Neary et al, 1992). For some, escapist strategies may not be personally or professionally acceptable: people may continue to turn up for work under stress but perform poorly: presenteeism[13].

## 4.6 Summary

There is evidence that the experience of stress at work is associated with changes in both behaviour and physiological function which may both be detrimental to employees' health. Much is known about the possible mechanisms underpinning such effects, and particular attention has been paid to pathologies possibly associated with impaired immune activity as well as those more traditionally linked to stress, such as ulcers, coronary heart disease and rheumatoid arthritis.

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[13] Presenteeism is a term used in 'Handling Stress at Work', Industrial Relations Review and Report, Health and Safety Information Bulletin, May, 1986, to refer to "being physically present at work but mentally absent". It is contrasted with absenteeism.

# 5.0 STRESS MANAGEMENT

There is a growing literature on stress management[14] in organizations. Much of it is descriptive, but there is also a developing examination of the effectiveness of such programmes although the relative lack of evaluation remains one of the main short comings in this literature. This section considers the nature and effectiveness of stress management programmes.

The section begins by describing the nature of stress management in organizations. In one of the early papers in this area, Newman and Beehr (1979) suggested that stress management can be classified in terms of [1] its objectives and strategies, and [2] its focus or target, and [3] the agent through which it is carried out.

## 5.1 Objectives

While only a minority of organizations appear to be directly and deliberately addressing the management of occupational stress, those actions which are being taken can be classified in terms of their implied objectives. There are, at least, three distinct sets of objectives which have been adopted by organizations in managing work stress and its health effects (Cox, Leather and Cox, 1990):

[1] *Prevention*, often control of hazards and exposure to hazards by design and worker training to reduce the likelihood of those workers experiencing stress.

[2] *Timely reaction*, often based on management and group problem solving, to improve the organization's (managers') ability to recognise and deal with problems as they arise.

[3] *Rehabilitation*, often involving offering enhanced support (including counselling) to help workers cope with and recover from problems which exist.

Within this model, many authors make a distinction between those objectives which concern or focus on the *organization* (organizational stress management) and those that concern and focus on the *individual* (personal stress management) (for example, De Frank and Cooper, 1987; Ivancevich and Matteson, 1986; Ivancevich et

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[14] The term 'management' is used in its broadest sense to refer to the full spectrum of control strategies used to deal with the problem of stress in the workplace, including both individual and organizational focused interventions, and prevention, reaction, rehabilitation and cure. It is not used in its narrow sense to refer only to individually focused interventions.

al, 1990; Keita and Sauter, 1992; Matteson and Ivancevich, 1987; Murphy, 1984, 1988; Murphy and Hurrell, 1987; Newman and Beehr, 1979; Quick and Quick, 1984; Quick, Murphy and Hurrell, 1992; Schwartz, 1980) . While equal attention is now being paid to both in the literature (and in legislation), much practice is biased towards the personal (and more clinical) approach. At the same time, while attention is being paid to preventive and rehabilitative strategies, less attention is being focused on reactive strategies. One exception is that of Cox and Cox (1992) who describe a 'stress tool kit' for line and specialist managers to help them recognise and deal with employees problems which are stress-related.

The above model can be contrasted in its detail with that outlined by Quick, Murphy, Hurrell and Orman (1992) and phrased in terms of the *individual* (see Table 4). The two schemes do not exactly coincide, but as Last (1988) has pointed out most authorities do not agree on the precise nature of, and boundaries between, levels in such schemes. Where there is a major conceptual difference is in the application of the term 'prevention'. Quick and his colleagues (1992) refer to *all* levels as contributing to prevention, while Cox, Leather and Cox (1990) refer only to the first level as prevention and distinguish it from reaction and rehabilitation. However, the terms primary, secondary and tertiary are useful descriptors of the three levels or categories.

## 5.2 Agency and Target

Given that a clear distinction is made between the different possible objectives, Cox, Leather and Cox (1990) have suggested that the issues of agency and focus or target , as raised by Newman and Beehr (1979), can be paired and effectively dealt with in terms of three questions:

**Organization as agent and target:**
what can the organization do to put its own house in order ?

**Organization as agent and workers as target:**
what can the organization do to enhance the support it offers workers?

**Employee as agent and target:**
what can individual workers do to better manage their work and any associated experience of stress?

It was pointed out by Cox, Leather and Cox (1990) that the second and third questions overlap. In reality, they question whether the organization can help the individual to help themselves. This is often the explicit goal of employee support programmes.

Logically, there is a fourth pairing - worker as agent and organization as target which describes the involvement of workers in organization development.

| LEVEL | INDIVIDUAL<br>Quick, Murphy, Hurrell and Orman (1992) | ORGANIZATIONAL<br>Cox, Leather and Cox (1990) |
|---|---|---|
| PRIMARY | To reduce the risk factor or change the nature of the stressor | To remove the hazard or reduce employees' exposure or its impact on them |
| SECONDARY | To alter the ways in which individuals respond to the risks and stressors | To improve the organization's ability to recognise and deal with stress related problems as they arise |
| TERTIARY | To heal those who have been traumatized or distressed at work | To help employees cope with and recover from problems at work |

**Table 4: Primary, Secondary and Tertiary Stress Management Strategies**

## 5.3 Common Interventions: Their Effectiveness

To recap, there are three common types of intervention to be found in the literature on stress management (see, for example, Murphy, 1988): [1] primary: some form of organizational or work development which attempts to reduce stressors - control hazards - (including work design and ergonomics), [2] secondary: worker training (either in the form of health promotion or psychological skills) and [3] tertiary: employee assistance (largely focused on the provision of counselling). These are described more fully below. However, despite a burgeoning literature on the subject,the relative effectiveness of such programmes has been difficult to determine, largely because of methodological deficiencies inherent in much of the relevant research and lack of adequate evaluations (see also section 6.4). Murphy et al (1992),

for example, consider that evaluations should include cost benefit analyses and assessments of employee satisfaction, job stressors, performance, absenteeism and health status. However, they rarely do so.

Beehr and O'Hara (1987), for example, have reviewed the difficulties involved in design and evaluation of stress management interventions. Most designs are either 'pre-experimental' or 'quasi-experimental' (true experiments being difficult to conduct in organizations) and vary considerably in their ability to control for the various 'threats' to validity. For example, in the study of the effects of counselling on employees' anxiety levels, anxiety scores may appear to return to normal over repeated testing but, if employees were initially selected (or volunteered) on the basis of extreme scores, this may simply reflect a regression to the mean. Since most secondary and tertiary stress management programmes are voluntary, selection effects may operate: the characteristics of participants and non-participants may be quite different. Selection effects have been discussed in detail in the evaluation of employee fitness programmes (see, for example, Jex, 1991). One of the advantages of stressor reduction interventions is that they attempt to change stressors common to all, thereby sidestepping selection effects. Further, many studies claim to show improvements as a result of interventions that may in fact be due to non-specific effects such as treatment credibility, expectations or even just sitting quietly. On the rare occasions that control groups have been included in occupational stress interventions, it is not uncommon for both treatment and control groups to show improvements. Similarly, where different types of stress management programmes have been compared it is not unusual for all to produce similar improvements (for example, Sallis et al, 1986, cited in Hart, 1987). These reservations and others have been echoed in recent publications by Keita and Sauter (1992) and Quick, Murphy and Hurrell (1992). With the paucity of sound data on the outcomes of such interventions, it is not surprising that it has been very difficult to make judgements concerning the cost benefits (the merits of an intervention in financial terms) or cost effectiveness (merits in comparison with available alternatives). This issue is also referred to in the next section on employee assistance programmes.

Many reviews (for example, Murphy, 1988; Ivancevich et al, 1990) find most stress management interventions are individually focused, designed for managerial and white-collar workers and concerned with changing the worker as opposed to work or the work environment. This may be a reflection of the nature and influence of management views in some countries. Surveys in the United States among management and union groups have revealed clear differences in their views of stress (for example, Singer et al, 1986). Whilst management emphasize individual

(secondary and tertiary) interventions, seeing personality, family problems or lifestyle as being prominent sources of stress, union groups consider social and organizational factors such as job design and management style as being both more responsible and more suitable targets for intervention. It has been suggested that in Scandinavia, where responsibility for working conditions is shared equally between labour and management groups, organizational approaches to stress management are generally more common than elsewhere (Landsbergis, 1988). The dominance of management views, particularly in the United States has contributed to the development of Employee Assistance Programmes and Stress Management Training ahead of Stressor Reduction - Hazard Control - techniques.

## Employee Assistance Programmes

Employee assistance programmes (EAPs), whose origins can be seen in organizations' concerns over the cost of alcoholism in the workplace, have flourished in the United States and, more recently, are becoming popular in the United Kingdom. In their narrower form, such programmes focus on 'picking up the pieces' (with counselling and helplines) for the 'troubled employee', addressing drug abuse, personal crises, and marital and family problems. Some have broader embracing concerns such as impending retirement and relocation. In effect, the range of benefits that could be offered is infinite. The service may be provided in-house, by consortiums or by specialist EAP contractors.

For example, Cooper et al (1992a, 1992b) have described the evaluation of a pilot scheme for individual based stress counselling in the United Kingdom Post Office. The evaluation was based on a simple pre-/post test design which compared the psychological health and absence behaviour of those using the scheme with a broadly matched control group of non-participants. Measures of job satisfaction and organizational commitment were also taken. While the authors recognized weaknesses in the design, the data suggested that counselling was effective in improving self-reported psychological health and absence from work, but not job satisfaction and organizational commitment.

Murphy et al (1992) point out that the provision and management of such programmes is not as straightforward as it may appear at first sight: there is a delicate balance between assisting individuals and protecting and promoting the interests of organizations. Berridge and Cooper (1993) refer to this as an "uneasy alliance" where "the balance of interests may well only be maintained because of the lack of

fundamental analysis of either group's function and activities on the part of the other". As far as stress management is concerned, data from an EAP (with individuals' anonymity guaranteed) could be a useful source of information, enabling an organization to identify 'high stress' departments or procedures (Murphy et al, 1992) and perhaps to plan organizational interventions.

There has been much interest in the legal implications of EAP provision in the United States. Whilst some commentators view EAPs as a reflection of a general 'helping' trend in labour relations, and some question how far EAP provision would have progressed without compensation legislation and the union movement (Berridge and Cooper, 1993), others suggest that EAPs represent a "legal expedient of providing employees with a chance, so that the employer who follows EAP to the letter meets arbitration criteria when firing becomes inevitable" for problem employees (Nobile, 1991). Some have argued that EAP provision may actually *increase* an organization's legal liability by, for example, opening itself up to accusations of incorrect assessment of a problem, of inadequately trained or qualified service providers or of unequal access.

Although such programmes have been limited by methodological difficulties and by issues of confidentiality, there have been claims for considerable financial advantages. In the United States, the GM programme, which assists some 100,00 employees each year, has been said to save the company $37 million per year (Feldman, 1991). A study by the Paul Revere Life Insurance Company claims to show a saving of $4.23 for ever dollar spent (Intindola, 1991). Reviewing this area, Berridge and Cooper (1993) point out that there has been much criticism of the basis of such claims and much argument as to the most appropriate method of evaluation: cost benefit analysis, cost effectiveness analysis, utility analysis, peer review, employee attitude surveys or statistical case sampling. "In all such evaluation the independence of the evaluator needs to be combined with the maintenance of confidentiality and the integrity of programme data. The reconciliation of these requirements, along with the demands of management, renders the evaluation of EAP's extremely problematic and open to criticism from all concerned" (Berridge and Cooper, 1993).

One component of broadly based EAPs is often stress management training. However, such interventions are usually offered without any link in to counselling or other forms of employee assistance.

## Stress Management Training

In 1984, Murphy reviewed thirteen published and unpublished studies on personal stress management for NIOSH. Although the programmes varied considerably in terms of the work groups involved, the nature of the techniques and the outcome measures used, Murphy (1984) was able to make several general observations on those programmes and their effectiveness.

The majority of the programmes focused on training in techniques such as relaxation and other behavioural skills, meditation, biofeedback, and cognitive restructuring. All the studies reviewed involved some form of relaxation training, and in all but one case (Peterson, 1981) in combination with cognitive or behavioural skills training. This generally consisted of a mixture of several different techniques including assertiveness and personal effectiveness training, cognitive restructuring and the reshaping of personal perceptions by logical reasoning. All techniques seemed to involve, to some degree, strengthening the person's self-esteem or sense of personal worth. Of the 32 outcome measures used in the thirteen studies, 27 clearly related to the individual and only 3 to the organization.

Murphy (1984) concluded that a number of significant benefits accrued to individuals including reductions in physiological arousal levels, in tension and anxiety, in sleep disturbances and in somatic complaints. A number of workers also reported an increased ability to cope with work and home problems following completion of their programme. Not all of these effects were maintained at follow up testing which was usually between 3-9 months later.

Many of these studies are solely reliant on self-report measures and there has been a relative paucity of more objective data in evaluation studies. A study by Ganster et al (1982) employed both self-report measures of psychological and somatic complaints and measures of adrenaline and noradrenaline levels. In that study, a stress management training program was evaluated in a field experiment with 79 public agency employees who were randomly assigned to treatment (n = 40) and control (n = 39) groups. The training program consisted of 16 hours of group exposure distributed over 8 weeks. Using procedures based on those developed by Meichenbaum (1977), treatment subjects were taught to recognize and alter their cognitive interpretations to stressful events at work. Subjects were also taught progressive relaxation techniques to supplement this process. Dependent variables were adrenaline and noradrenaline excretion at work, anxiety, depression, irritation and somatic complaints, all measured three times (pre-test, post-test and 4 months after treatment). Treatment

subjects exhibited significantly lower adrenaline and depression levels than did controls at the post-test, and 4 month follow up levels did not regress to pre-test levels. However, treatment effects were not replicated in a subsequent intervention on the original control group. The authors did not recommend the general adoption of such stress management training programmes.

However, a more recent study by Jones et al (1988), which focused on the number of malpractice complaints received by a medical practice, produced more positive results. Four studies were conducted to examine both the relation between stress and medical malpractice and the impact of stress management programs in reducing malpractice risk. 76 hospitals and more than 12,000 individuals participated. In study 1, hospital departments with a current record of malpractice reported higher levels of on-the-job stress than did matched low risk departments. In study 2, workplace stress levels of 61 hospitals correlated significantly with frequency of malpractice claims. In study 3, a longitudinal investigation was conducted to evaluate the impact of an organization-wide stress management programme on the frequency of reported medication errors. Results suggested a significant drop in average monthly medication errors as a result of the program. Study 4 was a 2 year longitudinal investigation that compared the frequency of medical malpractice claims. 22 hospitals that implemented an organization-wide stress management programme had significantly fewer claims compared with a matched sample that did not participate.

Murphy (1984) also listed a number of advantages to adopting personal stress management programmes, beyond those to individual participants:

[1] They can be established and evaluated quickly without major disruption to work routines.

[2] They can be tailored to individual workers' needs and also contribute to the control of non-work problems.

[3] They can link in to worker assistance programmes (counselling).

He concluded that the *major* disadvantage of such programmes is that they are not designed to reduce or eliminate sources of stress at work but only to teach workers more effective coping strategies.

The cost benefit considerations of personal stress management programmes was not directly addressed by Murphy in 1984, although he did point up the delivery costs of the various techniques considered. He concluded that biofeedback was probably the most

expensive while meditation was probably the least expensive. A cost benefit ratio has been attempted for such techniques by Manuso (cited in Schwartz, 1980). He calculated that every dollar spent on personal stress management programmes might realise 5.52 dollars in benefits for the organization as a result of decreased symptom activity and increased performance.

## Stressor Reduction (Hazard Control) Interventions

Murphy (1988) identified and reviewed several interventions which addressed the nature and design of the work environment or organization (Jackson, 1983; Wall and Clegg, 1981; Pierce and Newstrom, 1983). His interpretation of these studies was framed by the concept of control in relation to stress and health (see Averill, 1973; Miller, 1979; Thompson, 1981; Cox and Ferguson, 1991). The issue of control is a pervasive one throughout the stress literature.

The study by Wall and Clegg (1981) manipulated worker control over significant aspects of the work process; the manipulation in the Jackson (1983) study produced modest increases in worker control; the manipulation in the study by Pierce and Newstrom (1983) - introduction of flexitime systems - could also be said to increase workers' control over some aspects of their work. All three studies demonstrated the effectiveness of the control related manipulations in reducing workers' report of stressors and aspects of their experience of stress.

Jackson (1983) has reported a well designed evaluation of an intervention study conducted amongst staff working in 25 outpatient clinics in hospitals in the United Kingdom and designed to reduce role ambiguity and conflict. The hypothesis under test was that increased participation in decision making would decrease the experience of role problems. Clinic supervisors were given appropriate training on participation and the number of staff meetings held in the clinics were increased. The effects of these interventions was evaluated against a number of outcome measures using a Solomon 4 group design. Significant reductions in role ambiguity and role conflict were observed in the intervention clinics after 6 months follow up.

Unfortunately, other than the studies mentioned at the beginning of this section, there are very few such interventions available in the literature to date which are well designed and evaluated. Nonetheless, Murphy et al (1992) conclude that "job redesign and organizational change remain the preferred approaches to stress management because they focus on reducing or eliminating the sources of the

problem in the work environment". However, they also point out that such approaches require a detailed audit of work stressors and a knowledge of the dynamics of organizational change if unwelcome outcomes are to be minimised. Further, such interventions can be expensive and more difficult and disruptive to design, implement and evaluate - factors which may make them less popular alternatives to secondary and tertiary interventions. Nonetheless, Landy (1992) has summarized a number of possible interventions focused on the design of the work environment, and Murphy (1988) notes that given the varieties of work stressors that have been identified, many other types of action relating to organizational and work development should be effective in reducing work stress.

MacLennan (1992), for example, presents several problem situations facing institutions in the US and details some of the organizational remedies instituted to tackle them. Although these interventions were not evaluated, they provide useful examples of the type of approach considered promising. The First American Bank Corporation of Nashville, Tennessee (which has 150 banks) experienced problems with high turnover, sickness absence and low productivity. They formed 'action teams' from each area of operation who were trained in problem identification and problem solving. Employees rotated on and off the teams with the result that many people had the opportunity to participate. In the first year, turnover was cut from 50% to 25%. MacLennan details several interventions undertaken by other US banking institutions designed to reduce work-family conflicts including on-site day centres for preschool and school children, maternity leave arrangements, job protection schemes, arrangements for part-time work for returning mothers and fathers, flexitime and working at home, the provision of 'family sick days' and unpaid leave to be used for children, spouses or elderly parents. Other organizational interventions (MacLennan, 1992) concerned sexual harassment and work flow problems in government and stressors facing long distance lorry drivers, air traffic controllers and AMTRAK (railway) engineers. In the latter case, for example, management had reduced the number of engineers driving fast trains from two to one, with no consideration given to the fact that most of the drivers had been used to working in pairs for some time, nor that the seating and instrumentation in cabs may have needed alteration. Following complaints of increased levels of stress,the union hired consultants to identify the relevant stressors facing solitary drivers of high speed trains, many of which could be tackled by organizational interventions.

Murphy and Hurrell (1987) describe the development of a worker-management 'stress reduction committee', as a possible first step in any stress management intervention. In their study, the results of a stress management workshop provided

the information required for an employee survey. The committee then reviewed and prioritized the identified sources of stress, planned organizational interventions designed to address them and presented them to management, recommending an annual audit. Such approaches acknowledge the importance of the process as well as the content of interventions by the involvement of employees.

## 5.4 Summary

There have been a wide variety of different interventions which have been advanced as 'stress management', and many others which could have been so labelled but which have not been. A basic distinction can be made between those targetted on the organization and those targetted on individual workers, and among the latter interventions concerned with white collar and managerial workers are more common than those concerned with blue collar workers. Various explanations, largely focused on economic and political issues, have been advanced to account for this difference.

Evaluation data are relatively rare. What there is suggests that stress management programmes may be effective in improving the quality of working life of workers and their immediate psychological health, albeit self-reported. The evidence, largely for methodological reasons, relating such interventions to improvements in physical health is weaker. There have been several authoritative reviews of organizational and personal stress management programmes in the last five years reaching broadly similar conclusions. The publication by the International Labour Office in 1992, although titled 'Preventing Stress at Work', reviews a wide range of different interventions, both completed and in progress, and summarises them in terms of Karasek's (1979) model of job demands/job decision latitude.

In summary, it must be concluded that the jury is still out on stress management training: whilst it seems logical that such interventions should promote employee health, there are not yet sufficient data to be confident that they do. The evidence for employee assistance programmes, particularly those broadly conceived to include health promotion in the workplace may be more encouraging, although that which relates to counselling alone is weak. The provision of counselling is largely designed to assist employees who are already suffering a problem, and is, in that sense, post hoc. Stressor reduction/hazard control is, for several reasons, the most promising area for interventions, although again, there is not yet sufficient information to be confident about the nature and extent of their effectiveness. To date,

such conclusions are based more on moral and strategic reasoning than on empirical data, although the data that do exist are supportive. What can be firmly concluded, however, is that there is still a need for further and more adequate evaluation studies.

What is not clear from the evaluation literature is the exact mechanism by which such interventions, and particularly those focused on the individual, might have their effects on health. Often, where different types of individually focused interventions have been compared, there is no evidence that any one or any combination is better than any other. This indicates that there may be a general, non-specific effect of intervening. The fact of an intervention may be beneficial rather than its exact content. Interviews with managers responsible for introducing such interventions suggests that they are aware of such effects (see, for example, Cox et al, 1988). It is therefore possible that at least part of the effects of stress management programmes is due to the way they alter workers' perceptions of and attitudes to their organizations, and hence organizational culture. In section 3.0, it was argued that poor organizational culture might be associated with an increased experience of stress, while a good organizational culture might weaken the effects of stress on health. Whatever, there is sufficient evidence on the effectiveness of stress management interventions to support their continued use in organizations. The next section presents a framework for addressing the control of the relevant workplace hazards.

# 6.0 A FRAMEWORK FOR INTERVENTION

*Putting Theory to Work*

There is an increasing interest in the use of stress management programmes in the workplace (see section 5.0). However, it is widely recognised that there are difficulties with current practice, theoretical, methodological and practical. These have been widely commented on (see, for example, Keita and Sauter, 1992). In particular, there is a lack of an adequate framework for good practice in addressing stress-related problems in the workplace. This section attempts to provide such a framework drawing on successful practice elsewhere in health and safety.

What has come to pass in the United Kingdom as practice in relation to the management of occupational stress is subject to a number of criticisms.

First, too narrow a view has been taken of what constitutes stress management and there has been too strong a focus on 'caring for or curing' the *individual*. Second, much of what has been offered, even in this narrow respect, has either a weak theoretical base or has been developed from theory outside occupational stress research. Third, there has been a tendency to treat the application of stress management strategies as a self-contained action and to divorce that application from any preceding process of problem diagnosis. Fourth, stress management strategies often focus on single types of intervention and rarely are multiple strategies offered. Last, such interventions are rarely offered for evaluation beyond participant's immediate reactions or measures of face validity. There are several over arching reasons why the practice of stress management has been so poor: most relate to the lack of impact of contemporary stress theory on practice. Theory informs practice, and without progress in the development of theory there cannot be a strong logical development of practice. The lack of impact, in turn, may be accounted for partly by the stagnation of theory referred to in section 1 and partly by the lack of a framework which allows the translation of theory into practice.

Organizations' responsibilities for the health and safety of their workers are set within a framework of national and international law which is itself scaffolded by a particular terminology and set of concepts and assumptions about practical action. In particular, these relate to concepts such as those of hazard, harm, risk and risk management. Such a framework has been made explicit in the Management of Health & Safety at Work Regulations 1992 and in previous United Kingdom legislation such as the Control of Substances Hazardous to Health Regulations 1988. Although much of what has passed within this framework has focused on the direct

effects of the more tangible hazards of work, it has been argued that this framework can be extended to encompass psychosocial hazards, stress and stress management (Cox and Cox, 1993).

## 6.1 The Control Cycle

The Health & Safety at Work etc Act 1974[15] provided a spur to contemporary thinking about the need for and nature of hazard control and risk management in the United Kingdom (see, for example, S. Cox and Tait, 1991). The systematic problem solving approach, which is implicit in much of that thinking, is being further extended through the EC Framework Directive 89/391/EEC. This is implemented in the United Kingdom through the Management of Health & Safety at Work Regulations 1992 (Regulation 3). However, the approach is also made explicit in the Regulations for the Control of Substances Hazardous to Health 1988 (COSHH) and the subsequent Amendment (1990). These regulations imposed an obligation upon all employers to undertake an assessment of health risk for activities associated with substances hazardous to health used at work, and in parallel to assess the effectiveness of existing control systems. The essence of the COSHH regulations is to ensure a proactive approach to the assessment and prevention or control of exposure. The requirements of COSHH are set out in six steps:

[1] Identification of hazards.
[2] Assessment of associated risk.
[3] Implementation of appropriate control strategies.
[4] Monitoring of effectiveness of control strategies.
[5] Re-assessment of risk.
[6] Review of information needs, and training needs of workers exposed to hazards.

Steps [1] through [5] are recursive and describe a cycle of activities which it was hoped would ensure the continuous improvement of occupational health and safety in relation to hazardous substances.

The control cycle begins with problem recognition and hazard identification. These must be based on a thorough analysis of the work situation. This must include consideration of the tasks and people involved, of procedures and work organization, and of the work environment and relevant technology. Research into the nature and effects of a hazard is not the same as assessment of the associated risk, although the

[15] The Health and Safety at Work Act *is* concerned with both psychological and physical well-being. For example, it defines "personal injury" as "any decrease and any impairment of a person's physical or mental conditions".

two are related. For example, research studies which explore psychosocial hazards and the effects of stress in particular jobs (for example, Turnage and Spielberger, 1991; Nordhus and Fleime, 1991) do not usually provide the necessary risk data for use in the control cycle. What is needed is dedicated risk assessment. (S. Cox and Tait, 1991). Risk assessment should both offer an explanation of and quantify the hazard-harm relationship, and together these should provide a basis for the logical design of control strategies.

It has been argued that not only is the problem solving approach to health and safety management, as represented in the notion of the control cycle, an effective way of dealing with the more tangible hazards of work but that it can also be effective in relation to psychosocial hazards and the experience of stress (Cox and Cox, 1993) both at the individual level (see, for example, Cox, 1987) and at the organizational level (see, for example, Arroba and James, 1990; Cox, Leather and Cox, 1990). A particular account of the control cycle can thus be elaborated in relation to the experience of stress at work, as shown in Table 5.

| Control Cycle and the Management of Stress | |
|---|---|
| [1] | Acceptance that employees are experiencing problems or stress at work. |
| [2] | Analysis of the possibly stressful situation, with the identification of the psychosocial and other hazards involved, the nature of the harm that they might cause and the possible mechanisms by which the hazards, the experience of stress and the harm are related. |
| [3] | Assessment of the risk to health associated with those hazards and the experience of stress. |
| [4] | Design of reasonable and practicable control strategies. |
| [5] | Planned implementation of those strategies. |
| [6] | Monitoring and evaluation of the effects of those strategies feeding back into a re-appraisal of the whole process. |

**Table 5 : The Control Cycle and the Management of Stress**

Each step in the control cycle can itself be conceptualised as a further cycle of activities, thus a hierarchy of activities can be built up to support the management of stress at work. For example, Schott (1992) has described a socio-technical systems (or purpose orientated) approach to project management which could be applied to each aspect of the control cycle but particularly to the design and implementation of appropriate control strategies. There are seven steps to Schott's (1992) approach:

[1] Identify the overall goal (mission).
[2] Identify the critical success factors.
[3] Scan and describe the environment.
[4] Identify gaps (between things as they are and as they should be).
[5] Set objectives.
[6] Develop action steps and implement.
[7] Monitor performance.

Although not pointed out by Schott (1922), the results of performance monitoring should feedback to the earlier stages in the process and establish secondary cycles of activities.

Information relevant to several different steps in the control cycle have been described in earlier sections of this review. For example, the identification and analysis of hazards could usefully draw on sections 3.0 and 4.0, while the estimation of risk would also draw on section 4.0. These steps essentially involve the analysis of potentially hazardous and stressful situations. Following such an analysis and the decision to intervene, information in section 5.0 provides information on, among other things, the design of stress management programmes. However, what is still required is information on the implementation of stress management programmes, and on their monitoring and evaluation. These are briefly dealt with below.

## 6.2 Implementation of the Control Cycle: Stress Management

Ivancevich and his colleagues (1990) have argued that there is a need to capture the support of top management for stress management interventions. This, they argue, can only be achieved if practical organizational issues are addressed by these interventions. For example, what is their scope and what will be accomplished? How much will they cost and will such interventions be cost-effective? What outcome measures can be used in the assessment of future risk? They also note that sometimes management concerns to maximise benefits will make the use of control groups difficult.

Several other authors and organizations have discussed and provided guidance on the goals which need to be secured in the successful implementation of stress management programmes and other occupational health and safety interventions. They include: policy formation, visible support from top management, unions and staff associations, and key opinion formers within the organization, adequate

resources (time and people as well as finance and technology), realistic expectations (within organization), good access to both workers and information, good communication, and an effective steering or consultative group. Examples of such guidance are the publications by the Health and Safety Executive (1991) on Successful Health and Safety Management (general guidance in the broad area of health and safety management) and by the Health and Safety Commission (1990) on Managing Occupational Stress: A Guide for Managers and Teachers in the Schools Sector (guidance specific to the management of schools and in particular the work experience of teachers). DeFrank and Cooper (1987) have also discussed several important issues in relation to the further development of stress management programmes in the workplace, and have emphasised the need to develop procedures to overcome organizational resistance to change and to maintain change in relation to stress management.

The formulation of policy at both national and organizational level is an important early step in developing stress management interventions. The International Federation of Commercial, Clerical, Professional and Technical Employees (FIET: 1992) has suggested a number of policy-shaping points in relation to the management of work stress in salaried employees. These are presented in Table 6 (below). They place an emphasis on the role of prevention in stress management.

## 6.3 Monitoring

Monitoring and evaluation are essential for the development of effective stress management and for the continuous improvement of occupational health. Organizations achieving success in these respects have measured and evaluated their performance and that of their stress management strategies against pre-determined plans and standards assessing not only outcomes but also the processes involved both in the implementation of those plans and in compliance with standards.

**Limitation of work-related stress and pressure affecting salaried employees**

[1] Preventive health protection starts with the way work is organized.

[2] Trade union representatives must be involved in a comprehensive and timely fashion in deciding how work is organized and carried out.

[3] This involvement also includes staffing requirements (personnel planning), as well as the introduction or modification of personnel information and performance evaluation systems.

[4] Work schedules which cause great strain (eg. night and shift work) are to be eliminated or reduced.

[5] Work is to be organized in such a way that the individual worker can have independence and responsibility.

[6] Measures to prevent, alleviate or compensate work-related pressures must not be subordinate to purely economic considerations.

[7] Initial and further training opportunities must be offered which take the current and future qualification requirements of employees into consideration. This also includes a role for the trade unions in determining the contents of training courses in order to ensure that preventive health protection is included.

[8] Individuals' rights to more self- and co-determination at and about work must be revised.

[9] Legislators are called on to take into account the increase of stress-related illnesses by further developing social legislation (recognition of stress-related illnesses as occupational illnesses).

[10] As an accompaniment to the above-named measures, environmental measures at the workplace must be further developed in collective and company agreements.

**Table 6 : Recommended policies to reduce occupational stress**

(Source : FIET, 1992)

The Health and Safety Executive's (1991) publication, 'Successful Health and Safety Management', distinguishes between *active* and *reactive* monitoring systems, and emphasises the importance of active monitoring. However, the distinction that is made in that publication is somewhat confused (Cox and Cox, 1993): it is argued here that it is more useful to focus on the measurement criteria involved, and to relabel the distinction: *process* and *outcome* orientated. To construct a complete picture of the effectiveness of stress management strategies both types of measurement system are

required and these should be properly integrated into a coherent system of monitoring and evaluation.

## 6.4 Evaluation

Evaluation has been variously defined. Nutt (1981) has talked of it in terms of the *measurement of the degree to which objectives have been achieved*, and Green (1974) as the comparison of an object of interest against a standard of acceptability. In contrast to basic research, evaluation implies and requires from the onset criteria and procedures for making judgements of merit, value or worth (Scriven, 1967).

There are three common purposes for evaluations of stress management programmes. The first is to ask whether the programme is effective; specifically whether the programme objectives are being met. A second purpose is to determine the efficiency or comparative effectiveness of two or more programmes or methods within a programme. The third purpose is to assess the cost-benefit or the cost-effectiveness of the programme. There are relatively fewer cost-benefit and cost-effectiveness studies compared to studies on the overall effectiveness of programmes or the relative effectiveness of their component parts. This is an area of research which needs more attention. Some relevant information is given in section 5.3.

## 6.5 Standards and Targets

One of the important points concerning monitoring and evaluation is that such measurement has to be made against standards or targets. Much of the United Kingdom and EC legislation in health and safety, particularly in relation to inspection and enforcement, sets out minimum acceptable standards, while other organizations and agencies, through research or general concern, provide insight into standards of excellence and set wider targets (for example, Sauter, 1992; Sauter, Murphy and Hurrell, 1992). Together these two different sets of criteria define a *zone of achievement*, its lower limit being what is tolerable/minimally acceptable and its upper limit what is desirable/ideal. The issue of what is reasonably practicable is important both at the boundary between what is tolerable or minimally acceptable and within the zone defined by this boundary and what is desirable/ideal. The concept of reasonable practicality implies that there is a strong context dependency in the issues to which it relates. That is the details of intervention and control, while possibly

specified in principle or by broad guidelines, need to take into account local circumstances, perhaps even be negotiated at that level.

It is the responsibility of the individual organization to move from what is tolerable/minimally acceptable to what is desirable /ideal (intra zonal development) and that of the wider occupational health community and over arching agencies to move the limits of the zone upwards defining ever better standards (zonal development). There are difficulties involved in designing standards and targets in relation to occupational stress, and particularly in relation to psychosocial standards. However, some progress is being made with reviews such as the present one and with feedback from current guidelines and legislation. However, more research is required of a standards/target -setting type. The issue of targets is discussed below.

## 6.6 Targets: Processes and Outcomes

Logically, given the arguments advanced by the Health and Safety Executive, (1991) there are, at least, two different types of target which can be developed: those which relate to processes and systems of compliance, and those which relate to outcomes. Elements of both are discussed below.

In the United States, data on the experience of stress at work, and on absenteeism among other things, have spurred the development and publication of a series of national 'health' strategies, such as that for the protection of the mental health of workers (Sauter, Murphy and Hurrell, 1990). The influence of these has reached beyond the United States (see, Sauter, 1992)[16].

In Sweden, recent legislation (1991), in the form of amendments to the Swedish Work Environment Act 1990, has detailed how organizations might ensure that work is not only safe and stress free but also provides opportunities for involvement, job satisfaction and personal development. To promote practical work towards these goals, the Swedish government has established the Swedish Working Life Fund which employers can draw on to support relevant initiatives. Similar legislation has been passed in the other Nordic countries. Several of the recent EC Workplace

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[16] The general framework of the mental health strategy has, for example, been adopted by the Ministry of Labour's Task Force on Occupational Stress in Ontario, and published by the Industrial Safety and Health Association in the Republic of China (Taiwan) (1990)

Directives have implicated stress-related factors in the aetiology of ill health, for example the display screen directive, in relation to new technology and repetitive work. At an international level, concern over occupational stress has been expressed and guidance offered in several World Health Organization (WHO) and International Labour Office (ILO) publications (for example, Levi, 1984; ILO, 1986). In the United Kingdom, the Health and Safety Commission has published explicit guidance on the management of stress in schools (HSC, 1990) and research notes and guidance on a range of relevant issues across a variety of occupational sectors.

While much of what has been discussed in this report has focused on the negative aspects of work, and while minimum acceptable standards can be set in terms of avoiding or reducing those negative aspects of work, more positive approaches are possible and have been reflected in some of the guidance referred to above. In a review of the literature on job satisfaction, Locke (1976) characterized desirable conditions of work as follows:

[1] Work represents mental challenge (with which the worker can cope successfully) and leads to involvement and personal interest.

[2] Work is not physically tiring.

[3] Rewards for work performance are just, informative and in line with expectations.

[4] Working conditions are compatible with physical needs and facilitate work goals.

[5] Work leads to high self-esteem.

[6] Agents in the workplace help with the attainment of job values.

Kasl (1992) has commented that together these conditions "represent an admirable summary which in a creative and responsible fashion goes beyond the immediate evidence to paint a 'conservatively ideal' picture of desirable work conditions". They are echoed in the recommendations put forward by Landy (1992) on behalf of the APA/NIOSH Panel on Work Design and Stress. He recognizes several major design variables - control, uncertainty, conflict and job demands - and offers a series of standards for each of them based on the available evidence (see Table 7).

**Selected Recommendations of APA/NIOSH Panel on Work Design and Stress.**

**Control**

[1] Workers should be given the opportunity to control various aspects of their work and workplace. A way of accomplishing such control is through participative decision making.
[2] Systems should have optimal response times or optimal response ranges.
[3] Performance should be monitored and such monitoring should be used as a source of relevant feedback to individuals.

**Uncertainty**

[1] Employees should have information in as timely and complete a form as possible.
[2] Work assignments should be clear and unambiguous.
[3] Organizations should make clear policy statements and apply those policies in a consistent manner.
[4] Employees should have easy access to information sources.

**Conflict**

[1] Participative decision making should be used to reduce conflict.
[2] Job descriptions and task assignments should be clear and stable.
[3] Mechanisms should be introduced for the management of conflict.
[4] There should be open discussion of potential and real conflicts in organizational settings.
[5] Supervisors should adopt supportive styles to reduce conflict.
[6] Demands should not exceed resources.

**Task/Job demands**

[1] A variety of knowledges, skills and abilities should be required by a job.
[2] Workers should receive feedback about performance.
[3] Organizations should not pay people to endure boring work.
[4][ Service work should not be patterned after the assembly line.
[5] Feedback should be provided to service workers.
[6] Information based jobs should be enlarged rather than reduced in scope.

**Table 7: Selected Recommendations of APA/NIOSH Panel on Work Design & Stress** (based on APA/NIOSH Panel Recommendations, Keita and Sauter, 1992).

## 6.7 The Role of Legislation

The Norwegian Working Environment Act 1977 paved the way for legislation directly relating the design of work and working environments, stress and health. This approach was also developed in the Swedish Work Environment Act 1977 and in similar Acts of Parliament in the other Nordic countries. Perhaps the clearest and

most authoritative statement in law of both what to avoid and what to achieve has been offered in the current Swedish Work Environment legislation. The amendments to the Swedish Work Environment Act 1976, (see Table 8) passed in late May 1991, stated that:

**Amendments to Swedish Work Environment Act 1991**

[1] Working conditions are to be adapted to people's physical and psychological conditions.
[2] Employees are to be given opportunities of participating in the arrangement of their own work situation, its transformation and development.
[3] Technology, the organization of work and job contents are to be designed so that the employee is not exposed to physical or mental loads that may lead to ill health or accidents.
[4] Forms of remuneration and work schedules that involve an appreciable risk of ill health or accidents are not to be used.
[5] Strictly controlled or tied work is to be avoided or restricted.
[6] Work should afford opportunities for variety, social contacts, cooperation and a connection between individual tasks.
[7] Working conditions should provide opportunities for personal and occupational development, as well as for self-determination and professional responsibility.

**Table 8 : Amendments to Swedish Work Environments Act 1991**

The Swedish legislation is admirable in that it unequivocally states the importance of stress related issues in workplace design, and in doing so makes particular reference to psychosocial factors. It has provided a stimulus to organizational thinking in this area. However, careful consideration has to be given to the role of legislation in ensuring the health and safety of workers and in promoting stress management at work. Three points should be taken into account. First, legislation in this area has to reflect our current state of knowledge and be scientifically defensible. Second, it should recognise and allow for national and local differences in context. Third, it should not make requirements which are difficult to monitor and enforce. These points are briefly discussed below.

The extent and limits of current knowledge are the subject of much of this review.

There are real differences between countries in Europe based not only in language and culture but also in long established constitutional and legal thinking and practice. For example, the United Kingdom differs from many other European

countries in not having a written constitution and in not having a legal system derived from the Napoleonic Code. Such differences are important in that they frame perceptions of and reactions to legislation in general and attempts at legislative control in particular. More local differences also exist not only by region and ethnicity and religion, but also by sector of industry and by organization. These also need to be taken into account.

The passing of laws, the requirements of which cannot be enforced either through government inspection or worker led action in the courts, will undoubtedly led to apathy about the subject of those laws. Poor legislation may therefore prove counter-productive. In the United Kingdom, this may have been the scenario before 1974.

Providing guidance to educate workers and organizations, within the framework of legal policy and encouragement, may prove a more effective strategy than legislative control. This is the approach implicit in much of the Nordic legislation: that legislation provides the policy and framework for education and guidance. In Finland, for example, the Institute of Occupational Health has published guidance on the 'Assessment of Psychic Stress Factors at Work' in the form of a checklist for workplace inspections (Elo, 1986). This checklist concerns working conditions, work organization, job content, and social factors and covers many of the hazards discussed in section 3.0.

In the United Kingdom, the importance of stress as a workplace issue has been recognized by the Health and Safety Commission and Executive, but these bodies do not regard it as an issue that lends itself readily to legislative controls. To date, action by the Health and Safety Executive has focused on (i) establishing, through research, an understanding of the causes and nature of stress in various occupational settings, (ii) providing published guidance for employers about mental health at work, and (iii) raising awareness about the importance of effective workplace mental health policies.

In 1988, the Health and Safety Executive published a guidance booklet, 'Mental Health at Work', examining the factors affecting mental health in the workplace and including advice as to what employers can do to develop and promote effective policies, as well as a leaflet, 'Mental Distress at Work' (1993), which sets out 'first-aid' measures which can be taken if employees develop signs of acute mental distress at work. The Health and Safety Executive is currently considering updating or expanding this guidance to provide more information on mental health problems likely to be encountered at work, but which may not be necessarily caused by work.

The Commission has agreed that the Health and Safety Executive needs to consider further action directed specifically at the issue of work stress, particularly to the extent that such stress may pose a significant risk to health.

## 6.8 Summary

It is concluded that most of what has passed in the United Kingdom in relation to the management of occupational stress is subject to a number of criticisms, in terms of its focus on the individual, its lack of theoretical base, its failure to consider context, its narrow focus and its lack of evaluation. Part of the problem may be the lack of a suitable framework to translate theory into practice. It is argued that the framework that has been made explicit in the Management of Health & Safety at Work Regulations 1992 and in the Control of Substances Hazardous to Health Regulations 1988 can be extended from the more tangible hazards of work to encompass psychosocial hazards, stress and stress management. Various factors have been suggested which may encourage successful implementation of stress management programmes within organizations. Also required at both organizational and national levels are monitoring, evaluation, the setting of appropriate standards and targets and clear policy statements on the nature of desirable working conditions. In the short term, these goals can probably be best achieved by means of good general advice on the measures that can be taken to ensure compliance with the existing legal requirements to assess and control the risks to health.

# 7.0 CONCLUSIONS AND RECOMMENDATIONS

There is a growing consensus on the definition of stress as a psychological state with cognitive and emotional components, and on its effects on the health of both individual employees and their organizations. Furthermore, there are now theories which can be used to relate the experience and effects of work stress to exposure to work hazards and to the harmful effects on health that such exposure might cause. Applying such theories to the understanding of stress at work allows an approach to the management of work stress through the application of the notion of the control cycle. Such an approach has proved effective elsewhere in health and safety. It offers a systematic problem solving system for continuous improvement in relation to work stress.

What can conclusions can be drawn from this review of the literature on stress research and stress management?

In relation to the current state of our knowledge about stress and related issues, it can be concluded that there is a strong and useful literature concerning theories and definitions of stress, and the psychological and physiological effects of stress. The strength of the literature on the physical health effects of stress is continuing to develop: that on its psychological health effects lag somewhat behind.

There are two distinct areas in which more research is required.

First, knowledge of the architecture and effectiveness of coping remains inadequate despite many years of research. This inadequacy is widely recognised. It is suggested here that a more radical approach is required as the present research paradigm may not be capable of providing the necessary progress. Could for example, the concept of coping be replaced in the literature by, say, that of control? Is all coping an attempt to establish perceived control within one or more domains of experience - cognition, emotion, physiology or behaviour?

Second, more research and development is required in relation to the measurement of the experience of stress and the overall stress process. The inadequacy of single one-off measures is widely recognised in the literature but despite this they continue to be used, and across studies focused on different aspects of the stress process. This diversity may account for much of the disagreement within stress research. Part of the solution to this problem lies with agreeing the theoretical framework within which measurement is made, but part lies with the development of a more adequate

technology of measurement based in 'good practice' in a number of areas including psychometrics, knowledge elicitation and knowledge modelling. A forced standardisation of measurement is not being argued for here and should be resisted for its effects on scientific progress. What is being argued for throughout is better measurement processes, conforming to recognised good practice in relevant areas, and applied within a declared theoretical context.

In relation to our knowledge of stress management, the literature is less strong and less useful. The 'jury is still out' on stress management training, the evidence for broadly conceived employee assistance programmes is more encouraging, whilst that for stressor reduction may be more encouraging still There is an obvious need to encourage theoretically exciting and methodologically adequate research in this area of practice. The main problems, which again are widely recognised, relate to: the lack of application of theory to practice, the lack of a framework for practice, the lack of adequately designed and meaningful evaluation studies, and the lack of balance between the number of individually focused and organizationally focused interventions. None of these problems pose insoluble difficulties, and it would be informative to ask why they have not yet been addressed.

What can be usefully concluded for future policy development?

The first conclusion must be that knowledge is not yet sufficient to support comprehensive and detailed legislative controls.

There are at least two ways in which legislation might be used to change behaviour at work and related organizational practices. Legislation could prescribe comprehensive and detailed controls relating to what workers should and should not do in their workplaces. Alternatively, legislation could set out general principles of behaviour at work and related organizational practices, and supporting guidance could be provided on the application of those principles. In some areas, where the evidence warrants it, guidance could be strengthened and minimal acceptable standards specified.

The first approach to stress and stress management would be, at this point in time, difficult to defend on scientific grounds. There is not yet sufficient scientific evidence to allow the comprehensive and detailed prescription of what workers should and should not do at work in relation to the potential experience of stress. Furthermore, the evidence is equivocal that such legislative control is the best method of changing the behaviour of individuals or organizations.

The alternative approach is more defensible. It should now be possible to formulate general principles for stress management and related hazard control, and guidance on their application. However, to be effective, such an approach would require the publication of a clear policy statement on stress at work to demonstrate the government's recognition of the problem and commitment to its active management. All this, it has been argued here, would be best achieved within the framework provided by existing health and safety Regulations and related guidance. The formulation of similar policies within organizations should also be encouraged. This approach is not dissimilar to that adopted in some Nordic countries (see above).

Policies could usefully focus on the legitimisation of concern for work stress, its status as a health and safety issue, the provision of guidance on good practice in the process of intervention, and reasonably practicable intervention strategies, the education of managers and other employees, and the training of government advisers and inspectors.

The second conclusion is that, at the European level, differences between countries need to be recognised and given their full weight.

Such differences have been variously noted in the literature and are of scientific importance. They concern not only linguistic and cultural differences but also differences in constitutional and legal thinking and practice. Therefore, while it is useful to reach broad agreement at a European level, on the general framework for measuring and managing stress at work and on related good practice and guidance, it is not sensible, given the international differences which exist, to standardise all aspects stress management. Room must be left for local context to be taken into account, and for interventions (etc) to be tailored to those conditions. Agreement on a general framework might be best achieved at European level, as at national level, within the health and safety domain. Again, this should, however, only be used to legitimise the area of concern, flag commitment, provide broad guidelines on good practice (see earlier) and set, where possible, scientifically defensible, minimum acceptable levels of exposure to stress producing hazards. However, neither research nor policy formulation will be effective in its translation into actual practice unless a European network of competent practitioners is developed. It can therefore be recommended that international action be taken to identify and coordinate a Europe wide network of researchers and competent practitioners in health and safety, and occupational health specialising in the control of psychosocial and other stress related hazards and/or the management of work stress.

Overall three key actions can be recommended. First, the formulation and publication of a national policy on stress at work which will both legitimise concern and place it firmly within the domain of health and safety at work and which will outline good practice. Second, the continued support of research, but focused on issues of measurement and the application of theory particularly in relation to organizationally focused interventions such as workplace design. Third, the education and training of key 'agents' for the promotion of legitimate concern and the application of good practice in meeting that concern as a health and safety issue.

# 8.0 REFERENCES

Abel, T.M., Metraux, R., and Roll, S. (1987) Psychotherapy and Culture. University of New Mexico Press, Albuquerque.

Ader, R. A. (1981) Psychoneuroimmunology. Academic Press, New York.

Ahlbom, A., Karasek, R.A., and Theorell, T. (1977) Psychosocial occupational demands and risk for cardio-vascular death. Lakartidningen, 77, 4243-4245.

Althouse, R., and Hurrell, J. J. (1977) An Analysis of Job Stress in Coal Mining. Department of Health, Education and Welfare (NIOSH) publication no: 77-217, US Government Printing Office, Washington DC.

Angus, R. G., and Heslegrave, R. J. (1983) The effects of sleep loss and sustained mental work: implications for command and control performance. In: J. Ernsting (ed) Sustained Intensive Air Operations: Physiological and Performance Aspects. NATO-AGARD Cp - 338. Technical Editing & Reproduction Ltd., London.

Anisman, H., Pizzion, A., and Sklar, L.S. (1980) Coping with stress, norepinephrine depletion, and escape performance. Brain Research, 191, 583-588.

Antelman, S.M. and Caggiula, A.R. (1977) Norephinephrine-dopamine interactions and behaviour. Science, 195, 646-653.

Appley, M. H., and Trumbull, R. (1967) Psychological Stress. Appleton-Century-Crofts, New York.

Arnestad, M., and Aanestad, B. (1985) Work environment at a psychiatric ward: stress, health and immunoglobulin levels. Unpublished PhD thesis, University of Bergen, Bergen.

Arnold, J., Robertson, I.T. and Cooper, C.L. (1991) Work Psychology. Pitman, London.

Arroba, T., and James, K. (1990) Reducing the cost of stress: an organizational model. Personnel Review, 19, 21-27.

Arthur, R. J., and Gunderson, E. K. (1965) Promotion and mental illness in the Navy. Journal of Occupational Medicine, 7, 452 - 456.

Averill, J.R. (1973) Personal control over aversive stimuli and its relationship to stress. Psychological Bulletin, 80, 286-303.

Bacharach, S. B., Bamberger, P.B., and Conley, S. (1991) Work-home conflict among nurses and engineers: mediating the impact of role stress on burnout and satisfaction at work. Journal of Organizational Behaviour, 12, 39-53.

Baddeley, A. D. (1972) Selective attention and performance in dangerous environments. British Journal of Psychology, 63, 537-546.

Bailey, J. M., and Bhagat, R. S. (1987) Meaning and measurement of stressors in the work environment. In: S. V. Kasl and C. L. Cooper (eds) Stress and Health: Issues in Research Methodology. Wiley & Sons, Chichester.

Baker, D. B. (1985) The study of stress at work. Annual Review of Public Health, 6, 367-381.

Bandura, A. (1977) Self-efficacy: towards a unifying theory of behavioural change. Psychological Review, 84, 191-215.
Barefoot, J. C., Dahlstrom, W. G., and Williams, R. B. (1983) Hostility, CHD incidence, and total mortality: a 25 year follow up study of 255 physicians. Psychomatic Medicine, 45, 83-90.

Barth, P.S. (1990) Workers' compensation for mental stress cases. Behavioural Sciences and the Law, 8, 358.

Baruch, G. K., and Barnett, R. E. (1987) Role quality and psychological well-being. In: F. J. Cobb (ed) Spouse, Parent, Worker: On Gender and Multiple Roles. Yale University Press, New Haven, Conneticut.

Bastiaans, J. (1982) Consequences of modern terrorism. In L. Goldberger and S.Breznitz (eds) Handbook of Stress: Theoretical and Clinical Aspects. Free Press, New York.

Beattie, R. T., Darlington, T. G., and Cripps, D. M. (1974) The Management Threshold. British Institute of Management Paper, no: OPN 11., BIM, London.

Beehr, T.A. and Newman, J.E. (1978) Job stress, employee health, and organizational effectiveness: a facet analysis, model and literature review. Personnel Psychology, 31, 665-699.

Beehr, T.A., and O'Hara, K. (1987) Methodological designs for the evaluation of occupational stress interventions. In: S. Kasl and C. Cooper (eds) Stress and Health: Issues in Research Methodology. Wiley & Sons, Chichester.

Bergan, T., Vaernes, R. J., Ingebrigsten, P., Tonder, O., Aakvaag, A., and Ursin, H. (1987) Relationships between work environmental problems and health among Norwegian divers in the North Sea. In: A. Marroni and G. Oriani (eds) Diving and Hyperbaric Medicine. Academic Press, New York.

Berridge, J. and Cooper, C.L. (1993) Stress and coping in US organizations: the role of the Employee Assistance Programme. Work & Stress, 7, 89-102.

Bhagat, R. S., and Chassie, M. B. (1981) Determinants of organizational commitment in working women: some implications for organizational integration. Journal of Occupational Behaviour, 2, 17-30.

Bhalla, S., Jones, B., and Flynn, D. M. (1991) Role stress among Canadian white-collar workers. Work & Stress, 5, 289-299.

Biersner, R.J., Gunderson, E.K., Ryman, D.H., and Rahe, R.H. (1971) Correlations of Physical Fitness, Perceived Health Status, and Dispensary Visits with Performance in Stressful Training. USN Medical Neuropsychioatric Research Unit. Technical report no: 71-30. US Navy, Washington DC.

Blank, A.S. (1981) The price of constant vigilance: the Vietman era veteran. Frontiers of Psychiatry, 11, Feb.

Blohmke, M., and Reimer, F. (1980) Krankheit und Beruf. Alfred Huthig Verlag, Heidelberg.

Bowers, K. S. (1973) Situationalism in psychology: an analysis and critique. Psychological Review, 80, 307-335.

Bradley, G. (1989) Computers and the Psychological Work Environment. Taylor and Francis, London.

Brady, J.V. (1958) Ulcers in 'executive' monkeys. Scientific American, 199, 95-100.

Brady, J.V. (1975) Toward a behavioural biology of emotion. In L. Levi (ed) Emotions: Their Parameters and Measurement. Raven, New York.

Brady, J.V. and Harris, A.H. (1977) The experimental production of altered physiological states. In W. Honig and J.E.R. Staddon (eds) Handbook of Operant Behaviour. Prentice-Hall, Engelwood Cliffs, California.

Brener, J. (1978) Visceral perception. In: J. Beatty (ed) Biofeedback and Behaviour: A NATO Symposium. Plenum Press, New York.

British Psychological Society (1992) Guidelines for the Prevention and Management of Violence at Work. British Psychological Society, Leicester.

Broadbent, D. E. (1971) Decision and Stress. Academic Press, New York.

Broadbent, D. E., and Gath, D. (1981) Ill health on the line: sorting myth from fact. Employment Gazette, 89, no. 3.

Brook, A. (1973) Mental stress at work. Practitioner, 210, 500-506.

Buck, V. (1972) Working Under Pressure. Staples Press, London.

Burke, R.J. (1986) Occupational and life stress and family: conceptual frameworks and research findings. International Review of Applied Psychology, 35, 347-369.

Canadian Mental Health Association (1984) Work and Well-being: The Changing Realities of Employment. Toronto, Ontario.

Cannon, W.B. (1929) Bodily Changes in Pain, Hunger, Fear and Rage: An Account of Recent Researches in the Function of Emotional Excitement. Appleton, New York.

Cannon, W.B., (1931) The Wisdom of the Body. Norton, New York.

Caplan, R. D., Cobb, S., French, J. R. P., van Harrison, R., and Pinneau, S. R. (1975) Job Demands and Worker Health. US Department of Health, Education and Welfare Publication no: NIOSH 75-160, US Government Printing Office, Washington DC.

Carayon, P. (in press) A longitudinal test of Karasek's Job Strain model among office workers. To appear in Work & Stress.

Chatterjee, D.S. (1987) Repetition strain injury - a recent review. Journal of the Society of Occupational Medicine, 37, 100-105.

Chatterjee, D.S. (1992) Workplace upper limb disorders : a prospective study with intervention. Occupational Medicine, 42, 129-136.

Cincirpini, P. M., Hook, J. D., Mendes de Leon, C. F., and Pritchard, W. S. (1984) A Review of cardiovascular, Electromyographic, Electrodermal and Respiratory Measures of Psychological Stress. National Institute for Occupational Safety and Health, contract no: 84-257, Cincinnati, Ohio.

Cobb, S. (1959) Contained hostility in rheumatoid arthritis. Arthritis and Rheumatism, 2, 419 - 3245.

Cobb, S., and Kasl, S. V. (1966) The epidemiology of rheumatoid arthritis. American Journal of Public Health, 56, 1657 - 1663.

Cobb, S., and Kasl, S. V. (1977) Termination: the Consequences of Job Loss. US Department of Health, Education and Welfare, Cincinatti.

Cohen, A. (1969) Effects of noise on psychological state. In: W. D. Ward and J. E. Fricke (eds) Noise as a Public Health Hazard. American Speech and Hearing Association, Washington DC.

Cohen, A. (1974) Industrial noise and medical, absence and accident record data on exposed workers. In: W. D. Ward (ed) Proceedings of the International Congress on Noise as a Public Health Problem. US Environmental Protection Agency, Washington DC.

Cohen, A. (1976) The influence of a company hearing conservative program on extra-auditory problems in workers. Journal of Safety Research, 8, 146-162.

Cohen, S. (1980) After effects of stress on human performance and social behaviour: a review of research and theory. Psychological Bulletin, 88, 82-108.

Cohen, S., and Willis, T. A. (1985) Stress, social support and the buffering hypothesis. Psychological Bulletin, 98, 310-357.

Colligan, M.J., Smith, M.J., and Hurrell, J.J. (1977) Occupational incidence rates of mental health disorders. Journal of Human Stress, 3, 34-39.

Control of Substances Hazardous to Health (Amendment) Regulations (1990) Statutory Instrument no: 2026. HMSO, London.

Control of Substances Hazardous to Health Regulations (1988). HMSO, London.

Cooper, C. L. (1978) Work stress. In: P. B. Warr (ed) Psychology at Work. Penguin, Harmondsworth.

Cooper, C. L. (1981) Executive Families Under Stress. Prentice Hall, Englewood Cliffs, New Jersey.

Cooper, C. L., and Davidson, M. (1982) High Pressure: Working Lives of Women Managers. Fontana, London.

Cooper, C. L., and Hingley, P. (1985) The Change Makers. Harper and Row, London.

Cooper, C.L., and Marshall, J. (1976) Occupational sources of stress: a review of the literature relating to coronary heart disease and mental ill health. Journal of Occupational Psychology, 49, 11-28.

Cooper, C. L., and Smith, M. J. (1986) Job Stress and Blue Collar Work. Wiley & Sons, Chichester.

Cooper, C.L., Allison, T., Reynolds, P., and Sadri, G. (1992a) An individual-based counselling approach for combating stress in British Post Office employees. In International Labour Office, Conditions of Work Digest (Vol. 11): Preventing Stress at Work. International Labour Office, Geneva.

Cooper, C.L., Sadri, G., Allison, T., and Reynolds, P. (1992b) Stress counselling in the Post Office. Counselling Psychology Quarterly, 3, 3-11.

Corey, D.M. and Wolf , G.D. (1992) An integrated approach to reducing stress injuries. In J.C. Quick, L.R. Murphy, and J.J. Hurrell (eds) Stress and Well-being at Work.

Cox, S., and Tait, R. (1991) Safety, Reliability and Risk Management. Butterworth Heinemann, London.

Cox, S., Cox, T., Thirlaway, M., and Mackay, C. J. (1985) Effects of simulated repetitive work of urinary catecholamine excretion. Ergonomics, 25, 1129-1141.

Cox, T. (1978) Stress. Macmillan, London.

Cox, T. (1980) Repetitive work. In: C. L. Cooper and R. Payne (eds) Current Concerns in Occupational stress. Wiley & Sons, Chichester.

Cox, T. (1984) Stress: a psychophysiological approach to cancer. In: C. L. Cooper (ed) Psychosocial Stress and Cancer. Wiley & Sons, Chichester.

Cox, T. (1985a) The nature and measurement of stress. Ergonomics, 28, 1155-1163.

Cox, T. (1985b) Repetitive work: occupational stress and health. In: C. L. Cooper and M. J. Smith (eds) Job Stress and Blue Collar Work. Wiley & Sons, Chichester.

Cox, T. (1987) Stress, coping and problem solving. Work & Stress, 1, 5-14.

Cox, T. (1988a) Psychobiological factors in stress and health. In S. Fisher and J. Reason (eds) Handbook of Life Stress, Cognition and Health. Wiley & Sons, Chichester.

Cox, T. (1988b) AIDS and stress. Work & Stress, 2, 109-112.

Cox, T. (1990) The recognition and measurement of stress: conceptual and methodological issues. In: E. N. Corlett and J. Wilson (eds) Evaluation of Human Work. Taylor & Francis, London.

Cox, T., and Cox, S. (1985) The role of the adrenals in the psychophysiology of stress. In: E. Karas (ed) Current Issues in Clinical Psychology. Plenum Press, London.

Cox, T. and Cox, S. (1992) Mental health at work: assessment and control. In R. Jenkins and N. Coney (eds) Prevention of Mental Ill Health at Work. HMSO, London.

Cox, T., and Cox, S. (1993) Psychosocial and Organizational Hazards: Monitoring and Control. Occasional Series in Occupational Health, No.5. World Health Organization (Europe), Copehagen, Denmark. (in press).

Cox, T., and Ferguson, E. (1991) Individual differences, stress and coping. In: C.L. Cooper and R. Payne (eds) Personality and Stress. Wiley & Sons, Chichester.

Cox, T., and Howarth, I. (1990) Organizational health, culture and helping. Work & Stress, 4, 107-110.

Cox, T., and Kuk, G (1991) Healthiness of schools as organizations: teacher stress and health. Paper to: International Congress, Stress, Anxiety & Emotional Disorders, University of Minho, Braga, Portugal.

Cox, T., and Leather, P. (1994) The prevention of violence at work: application of a cognitive behavioural theory. In: C. L. Cooper and I. Robertson (eds) International Review of Industrial and Organizational Psychology, Wiley & Sons, Chichester.

Cox, T., and Leiter, M. (1992) The health of healthcare organizations. Work & Stress, 6, 219-227.

Cox, T., and Mackay, C. J. (1981) A transactional approach to occupational stress. In: E. N. Corlett and J. Richardson (eds) Stress, Work Design and Productivity. Wiley & Sons, Chichester.

Cox, T., and Mackay, C. J. (1982) Psychosocial factors and psychophysiological mechanisms in the aetiology and development of cancers. Social Science and Medicine, 16, 381-396.

Cox, T., and Mackay, C.J. (1985) The measurement of self-reported stress and arousal. British Journal of Psychology, 76, 183-186.

Cox, T., Cox, S., and Thirlaway, M. (1983) The psychological and physiological response to stress. In: A. Gale and J. A. Edwards (eds) Physiological Correlates of Human Behaviour. Academic Press, London.

Cox, T., Ferguson, E., and Farnsworth, W. F. (1993) Nurses' knowledge of HIV and AIDS and their perceptions of the associated risk of infection at work. Paper to: VI European Congress on Work and Organizational Psychology, Alicante.

Cox, T., Gotts, G., Boot,N., and Kerr, J. (1988) Physical exercise, employee fitness and the management of health at work. Work & Stress, 2, 71-77.

Cox, T., Leather, P., and Cox, S. (1990) Stress, health and organizations. Occupational Health Review, 23, 13-18.

Cox, T., Watts, C., and Barnett, A. (1981) The Experience and Effects of Task-Inherent Demand. Final technical report to the US Army Research, Development and Standardization Group (UK).

Crown, S., Crown, J.M., and Fleming, A. (1975) Aspects of the psychology and epidemiology of rheumatoid disease. Psychological Medicine, 5, 291-299.

Davidson, M.J., and Cooper, C.L. (1981) A model of occupational stress. Journal of Occupational Medicine, 23, 564-570.

Davidson, M. J., and Earnshaw, J. (1991) Vulnerable Workers: Psychosocial and Legal Issues. Wiley & Sons, Chichester.

Davidson, M.J., and Cooper, C.L. (1983) Working women in the European Community - the future prospects. Long Range Planning, 16, 49-54.

DeFrank, R.S., and Cooper, C.L. (1987) Worksite management interventions: their effectiveness and conceptualization. Journal of Managerial Psychology, 2, 4-10.

Dembrowski, T.M., MacDougall, J. M., Williams, R. B., Haney, T. L., and Blumenthal, J. A. (1985) Components of Type A hostility and anger-in: relationship to angiographic findings. Psychomatic Medicine, 47, 219-233.

Dewe, P. (1987) New Zealand ministers of religion: identifying sources of stress and coping strategies. Work & Stress, 1, 351-363.

Dewe, P. (1991) Measuring work stressors: the role of frequency, duration and demand. Work & Stress, 5, 77-91.

Dewe, P., Cox, T., and Ferguson, E. (1993) Individual strategies for coping with stress at work: a review of progress and directions for future research. Work & Stress, 7, 5-15.

Diament, J., and Byers, S. O. (1975) A precise catecholamine assay for small samples. Journal of Laboratory and Clinical Medicine, 85, 679-693.

Dimsdale, J. E., and Moss, J. (1980a) Plasma catecholamines in stress and exercise. Journal of the American Medical Association, 243, 340-342.

Dimsdale, J. E., and Moss, J. (1980b) Short-term catecholamine response to psychological stress. Psychosomatic Medicine, 42, 493-497.

Dohrenwend, B. S., and Dohrenwend, B. P. (1974) Stressful Life Events: Their Nature and Effects. Wiley & Sons, New York.

Dohrenwend, B. S., Krasnoff, L., Askenasy, A. R., and Dohrenwend, B. P. (1988) The Psychiatric Epidemiology Research Interview Life Events Scale. In: L. Goldberg and S. Breznitz (eds) Handbook of Stress: Theoretical and Clinical Aspects. Free Press, New York.

Donaldson, J., and Gowler, D (1975) Prerogatives, participation and managerial stress. In: D. Gowler and K. Legge (eds) Managerial Stress. Gower Press, London.

Douglas, M. (1992) Risk and Blame. Routledge, London.

Dunn, J. P., and Cobb, S. (1962) Frequency of peptic ulcer among executives, craftsmen and foremen. Journal of Occupational Medicine, 4, 343 - 348.

Eaton, W.W., Anthony, J.C., Mandel, W., and Garrison, R. (1990) Occupation and prevalence of major depressive disorder. Journal of Occupational Medicine, 32, 1079-1086.

EC (1989) EC Framework Directive on the Workplace 89/391/EC. European Commission, Brussels.

Edwards, J.R. and Cooper, C.L. (1990) The person-environment fit approach to stress: recurring problems and some suggested solutions. Journal of Organizational Behaviour, 11, 293-307.

Einhorn, H.J., and Hogarth, R.M. (1981) Behavioural decision theory: processes of judgement and choice. Annual Review of Psychology, 32, 53-88.

Ekehammer, B. (1974) Interactionism in personality from a historical perspective. Psychological Bulletin, 81, 1026.

Ellertsen, B., Johnsen, T. B., and Ursin, H. (1978) Relationship between the hormonal responses to activation and coping. In: H. Ursin, E. Baade, and S. Levine (eds) Psychobiology of Stress: A Study of Coping Men. Academic Press, New York.

Elo, A-L. (1986) Assessment of Psychic Stress Factors at Work. Institute of Occupational Health, Helsinki.

Endresen, I. M., Vaernes, R. J., Ursin, H., and Tonder, O. (1987) Psychological stress factors and concentration of immunoglobulins and complement components in Norwegian nurses. Work & Stress, 1, 365-375.

Endresen, I.M., Ellertsen, B., Endresen, C., Hjelmen, A.M., Matre, R., and Ursin, H. (1991) Stress at work and psychological and immunological parameters in a group of Norwegian female bank employees. Work & Stress, 5, 217-227.

European Survey on the Work Environment (1992) European Foundation for the Improvement of Living and Working Conditions. Dublin, Ireland.

Eysenck, M. W. (1983) Anxiety and individual differences. In: G. R. J. Hockey (ed) Stress and Fatigue in Human Performance. Wiley & Sons, Chichester.

Feather, N.T. (1990) The Psychological Impact of Unemployment. Springer-Verlag, New York.

Feldman, S. (1991) Today's EAPs make the grade. Personnel, 68, 3-40.

Ferguson, D. (1973) A study of occupational stress and health. Ergonomics, 16, 649-663.

Ferguson, E., and Cox, T. (1993) Exploratory factor analysis: a user's guide International Journal of Assessment and Selection (in press).

FIET (1992) Resolutions adopted by the 22nd FIET World Congress (San Fransisco, August 1991). Geneva.

Figley, C.R. (1985) Trauma and Its Wake: The Study of Treatment of Post Traumatic Stress Disorder. Brunner/Mazel, New York.

Fisher, S. (1986) Stress and Strategy. Lawrence Erlbaum Associates, London.

Fletcher, B. C. (1988) The epidemiology of occupational stress. In: C. L. Cooper and R. Payne (eds) Causes, Coping and Consequences of Stress at Work. Wiley & Sons, Chichester.

Folger, R., and Belew, J. (1985) Non-reactive measurement: a focus for research on absenteeism and occupational stress. In: L. L. Cummings and B. M. Straw (eds) Organizational Behaviour. JAI Press Inc., Greenwich, Connecticut.

Folkhard, S., and Monk, T. H. (1985) Hours of Work - Temporal Factors in Work Scheduling. Wiley & Sons, Chichester.

Folkman, S. (1984) Personal control and stress and coping processes: a theoretical analysis. Journal of Personality and Social Psychology, 46, 839-852.

Folkman, S., and Lazarus, R. (1986) Stress process and depressive symptomology. Journal of Abnormal Psychology, 95 , 107-113.

Folkman, S., Lazarus, R., Gruen, R., and DeLongis, A. (1986b) Appraisal, coping, health status, and psychological symptoms. Journal of Personality and Social Psychology, 50, 571-579.

Folkman, S., Lazarus, R.S., Dunkel-Schetter, C,. DeLongis, A., and Gruen, R. (1986a) Dynamics of a stressful encounter: cognitive appraisal, coping, and encounter outcomes. Journal of Personality and Social Psychology. 50, 992-1003.

Forsythe, R.P., and Harris, R.E. (1970) Circulatory changes during stressful stimuli in rhesus monkeys. *Circulation Research (supp. 1)* 26-27, I.B-I.20.

Fox, B. H. (1981) Psychosocial factors and the immune system in human cancer. In: R. Ader (ed) Psychoneuroimmunology. Academic Press, New York.

Frankenhauser, M., and Gardell, B. (1975) Underload and overload in working life: a multidisciplinary approach. Reports from the Department of Psychology, no: 460, University of Stockholm, Stockholm.

Frankenhauser, M., and Gardell, B. (1976) Underload and overload in working life: outline of a multidisciplinary approach. Journal of Human Stress, 2, 15-23.

French, J. R. P., and Caplan, R. D. (1970) Psychosocial factors in coronary heart disease. Industrial Medicine, 39, 383-397.

French, J. R. P., and Caplan, R. D. (1972) Organizational stress and individual strain. In: A. Marrow (ed) The Failure of Success. AMACOM, New York.

French, J. R. P., Caplan, R. D., and van Harrison, R. (1982) The Mechanisms of Job Stress and Strain. Wiley & Sons, New York.

French, J. R. P., Rogers, W., and Cobb, S. (1974) A model of person-environment fir. In: G.W. Coehlo, D.A. Hamburg, and J.E. Adams, (eds) Coping and Adaptation. Basic Books, New York.

Friedman, M., and Rosenman, R.H. (1974) Type A: Your Behaviour and Your Heart. Knoft, New York.

Friedman, M., and Ulmer, D. (1984) Treating Type A Behaviour and Your Behaviour. Knoft, New York.

Gael, S. (1988) The Job Analysis Handbook for Business, Industry and Government. Wiley & Son, New York.

Ganster, D.C., and Fusilier, M.R. (1989) Control in the workplace. In: C.L. Cooper and I. Robertson (eds) International Review of Industrial and Organizational Psychology. Wiley & Sons, Chichester.

Ganster, D.C., Mayes, B.T., and Fuselier, M.R. (1986) Role of social support in the experience of stress at work. Journal of Applied Psychology, 71, 102-110.

Ganster, D.C., Mayes, B.T., Sime, W.E., and Tharp, G.D. (1982) Managing occupational stress: a field experiment. Journal of Applied Psychology, 67, 533-542.

Gardell, B. (1971) Alienation and mental health in the modern industrial environment. In: L. Levi (ed) Society, Stress and Disease Vol I. Oxford University Press, Oxford.

Gardell, B. (1973) Quality of Work and Non-work Activities and Rewards in Affluent Societies. Reports from Psychological Laboratories no: 403, University of Stockholm, Stockholm.

Gardiner, B.M. (1980) Psychological aspects of rheumatoid arthritis. Psychological Medicine, 10, 150-163.

Genest, M. (1983) Coping with rheumatoid arthritis. Canadian Journal of Behavioural Science, 15, 392-408.

Genest, M. (1989) The relevance of stress to rheumatoid arthritis. In R.W.J. Neufeld (ed) Advances in the Investigation of Psychological Stress.Wiley and Sons, New York.

Glass, D. C. (1977) Behaviour Patterns, Stress and Coronary Disease. Erlbaum, Hillsadle, New Jersey.

Glass, D. C., and Singer, J. E. (1972) Urban Stress: Experiments on Noise and Social Stressors. Academic Press, New York.

Green, L. W. (1974) Towards cost-benefit evaluations of health education. Health Education Monographs, 1 (Supplement), 34-36.

Gutek, B. A., Repetti, R. L., and Silver, D. L. (1988) Non-work roles and stress at work. In: C.L. Cooper and R. Payne (eds) Causes, coping and Consequences of Stress at Work. Wiley & Sons, Chichester.

Hacker, W. (1991) Objective work environment: analysis and evaluation of objective work characteristics. Paper presented to: A Healthier Work Environment: Basic Concepts & Methods of Measurement. Hogberga, Lidingo, Stockholm.

Hacker, W., Iwanova, A., and Richter, P (1983) Tatigkeits-bewertungssystem (TBS-L). Hogrefe, Gottingen.

Hall, E.M. (1991) Gender, work control and stress: a theoretical discussion and an empirical test. In J.V. Johnson and G. Johansson (eds) The Psychosocial Work Environment: Work Organization, Democratization and Health. Baywood Publishing, New York.

Handy, C. (1975) Difficulties of combining family and career. The Times, Sept 22, 16.

Harrington, J. M. (1978) Shift Work and Health: A critical review of the Literature. HMSO, London.

Hart, K.E. (1987) Managing stress in occupational settings: a selective review of current research and theory. In C.L. Cooper (ed) Stress Management Interventions at Work. MCB University Press Ltd.

Haslam, D. R. (1982) Sleep loss, recovery sleep and military performance. Ergonomics, 25, 163-178.

Haynes, S.G., Feinleib, M. , Levine, S., Scotch, N., and Kannel, W.B. (1978b) The relationship of psychosocial factors to coronary heart disease in the Framingham study, II. Prevalence of coronary heart disease. American Journal of Epidemiology, 107, 384-402.

Haynes, S.G., Levine, S., Scotch, N., Feinleib, M., and Kannel, W.B. (1978a) The relationship of psychosocial factors to coronary heart disease in the Framingham study, I. American Journal of Epidemiology, 107, 362-383.

Health and Safety at Work etc Act (1974). HMSO, London.

Health and Safety Commission (1990) Managing Occupational Stress: A Guide for Managers and Teachers in the Schools Sector. Health and Safety Executive, HMSO, London.

Health and Safety Commission (1992) Annual Report 1991/92. HMSO, London.

Health and Safety Executive (1988) Mental Health at Work.(leaflet no. INDG 59L) HSE, London.

Health and Safety Executive (1990a) Work Related Upper Limb Disorders : A Guide to Prevention. HMSO, London.

Health and Safety Executive (1990b) Mental Health at Work. Medical Division, Health & Safety Executive, London.

Health and Safety Executive (1991) Successful Health and Safety Management. HMSO, London.

Health and Safety Executive (1993) Mental Distress at Work: First Aid Measures. (leaflet no. INDG 129L) HSE, London.

Health and Safety Information Bulletin (1986) Handling Stress at Work. Industrial Relations Review and Report, Bulletin no.125, 6th May 1986.

Henry, J. P., and Stephens, P. M. (1977) Stress, Health and the Social Environment. A Sociobiologic Approach to Medicine. Springer, New York.

Hillas, S., and Cox, T. (1987) Post Traumatic Stress Disorder in the Police. Occasional Paper. Police Scientific Research and Development Branch, Home Office, London.

Hingley, P., and Cooper, C. L. (1986) Stress and the Nurse Manager. Wiley & Son, Chichester.

Holmes, T. H., and Rahe, R. H. (1967) The Social Readjustment Rating Scale. Journal of Psychosomatic Research, 11, 213-218.

Holroyd, K.A., and Lazarus, R.S. (1982) Stress, coping and somatic adaptation. In: L. Goldberger and S. Breznitz (eds) Handbook of Stress: Theoretical and Clinical Aspects. Free Press, New York.

Holt, R. R. (1982) Occupational stress. In: L. Goldberger and S. Breznitz (eds) Handbook of Stress: Theortical and Clinical Aspects. Free Press, New York.

House, J. S.(1974) Occupational stress and coronary heart disease: a review and theoretical integration. Journal of Health and Social Behaviour, 15, 12-27.

House, J. S., and Wells, J. A. (1978) Occupational stress, social support and health. In: A. McLean, G. Black, and M. Colligan (eds) Reducing Occupational Stress: Proceedings of a Conference. DWEH (NIOSH) Publication no: 78-140, 8-29.

House, J. S., McMichael, A.J., Wells, J.A., Kaplan, B.H., and Landerman, L.R. (1979) Occupational stress and health among factory workers. Journal of Health and Social Behaviour,20, 139-160.

Houts, P. S., and McDougall, VC. (1988) Effects of informing workers of their health risks from exposure to toxic materials. American Journal of Industrial Medicine, 13, 271-279.

Hurrell, J. J., and McLaney, M. A. (1989) Control, job demands and job satisfaction. In: S. L. Sauter, J. J. Hurrell, and C.L. Cooper (eds) Job Control and Worker Health. Wiley & Sons, Chichester.

Idzikowski, C., and Baddeley, A. D. (1983) Fear and dangerous environments. In: G. R. J. Hockey (ed) Stress and Fatigue in Human Performance. Wiley & Sons, Chichester.

ILO (1986) Psychosocial Factors at Work: Recognition and Control. Occupational Safety and Health Series no: 56, International Labour Office, Geneva.

ILO (1992) Preventing Stress at Work. Conditions of Work Digest, 11, International Labour Office, Geneva.

Intindola, B. (1991) EAPs still foreign to many small businesses. National Underwriter, 95, 21.

Irwin, J., and Anisman, H. (1984) Stress and pathology: immunological and central nervous system interactions. In: C. L. Cooper (ed) Psychosocial Stress and Cancer. Wiley & Sons, Chichester.

Ivancevich, J.M., and Matteson, M.T. (1980) Stress and Work. Scott Foresman, Glenview, Illinois.

Ivancevich, J.M., and Matteson, M.T. (1986) Organizational level stress management interventions: review and recommendations. Journal of Organizational Behaviour and Management, 8, 229-248.

Ivancevich, J.M., Matteson, M.T., Freedman, S.M., and Phillips, J.S. (1990) Worksite stress management interventions. American Psychologist, 45, 252-261.

Jackson, P. R., and Warr, P. B. (1984) Unemployment and psychological ill health: the moderating role of duration and age. Psychological Medicine, 14, 610-614.

Jackson, S. (1983) Participation in decision-making as a strategy for reducing job-related strain. Journal of Applied Psychology, 68, 3-19.

Jackson, S., and Schuler, R. S. (1985) A meta-analysis and conceptual critique of research on role ambiguity and role conflict in work settings. Organizational Behaviour and Human Decision Processes, 36, 16-78.

Jenkins, C. D., Rosenman, R. H., and Friedman, M. (1968) Replicability of rating the coronary prone behaviour pattern. Journal of Chronic Diseases, 20, 371-379.

Jenkins, C. D., Zyzanski, S.J., and Rosenman, R.H. (1976) Risk of new myocardial infarction in middle-aged men with manifest coronary heart disease. Circulation, 53, 342-347.

Jenkins, R. (1992) Prevalence of Mental Illness in the Workplace. In R. Jenkins and N. Coney (eds) Prevention of Mental Ill Health at Work. HMSO, London.

Jex, S.M. (1991) The psychological benefits of exercise in work settings: a review, critique, and dispositional model. Work & Stress, 5, 133-147.

Johansson, G. and Aronsson, G. (1984) Stress reactions in computerized administrative work. Journal of Occupational Behaviour, 5, 159-181.

Johnson, L.C., et al (1981) Biological Rhythms, Sleep and Shift Work. Advances in Sleep Research, Vol 7. Spectrum, New York.

Jones, D. M. (1983) Noise. In: G. R. J. Hockey (ed) Stress and Fatigue in Human Performance. Wiley & Sons, Chichester.

Jones, J.W., Barge, B.N., Steffy, B.D., Fay, L.M., Kunz, L.K., and Wuebker, L.J. (1988) Stress and medical malpractice: organizational risk assessment and intervention. Journal of Applied Psychology, 73, 727-735.

Kahn, R. L. (1973) Conflict, ambiguity and overload: three elements in job stress. Occupational Mental Health, 31, 2-9.

Kahn, R. L. (1974) Conflict, ambiguity and over work: three elements in job stress. In: A. McLean (ed) Occupational Stress. Charles C Thomas, Springfield, Illinois.

Kahn, R. L., and Byosiere, S. (1990) Stress in Organizations. In: M. Dunnette (ed) Handbook of Industrial and Organizational Psychology. Rand McNally, Chicago.

Kahn, R. L., and French, J. R. P. (1970) Status and conflict: two themes in the study of stress. In: J. E. McGrath (ed) Social and Psychological Factors in Stress. Holt, Rinehart and Winston, New York.

Kahn, R. L., Wolfe, D. M., Quinn, R. P., Snoek, J. D., and Rosenthal, R. A. (1964) Organizational Stress: Studies in Role Conflict and Ambiguity. Wiley & Sons, New York.

Kanter, R.M. (1977) Work and family in the United States: a critical review and agenda for research and policy. Russell SageFoundation, New York.

Karasek, R. A. (1979) Job demands, job decision latitude and mental strain: implications for job redesign. Administrative Science Quarterly, 24, 285-308.

Karasek, R. A. (1981) Job socialisation and job strain: the implications of two psychosocial mechanisms for job design. In: B. Gardell and G. Johansson (eds) Working Life: A Social Science Contribution to Work Reform. Wiley & Sons, Chichester.

Karasek, R.A., and Theorell, T. (1990) Healthy Work: Stress, Productivity and the Reconstruction of Working Life. Basic Books, New York.

Karasek, R.A., Baker, D., Marxer, F., Ahlbom, A., and Theorell, T. (1981) Job decision latitude, job demands and cardiovascular disease. American Journal of Public Health, 71, 694-705.

Karasek, R.A., Schwartz, J., and Theorell, T. (1982) Job characteristics, occupation, and coronary heart disease. (Final report on Grant No. R-01-OH00906). Cincinnati, OH: National Institute for Occupational Safety and Health.

Kasl, S. V. (1980) Epidemiological contributions to the study of work stress. In: C. L. Cooper and R. Payne (eds) Stress at Work. Wiley & Sons, Chichester.

Kasl, S. V. (1980) The impact of retirement. In: C.L. Cooper and R.L. Payne (eds) Current Concerns in Occupational Stress. Wiley & Sons, Chichester.

Kasl, S. V. (1984) Stress and health. Annual Review of Public Health, 5, 319-341.

Kasl, S.V. (1989) An epidemiological perspective on the role of control in health. In S.L. Sauter, J.J. Hurrell, and C.L. Cooper (eds) Job Control and Worker Health. Wiley & Sons, New York.

Kasl, S. V. (1992) Surveillance of psychological disorders in the workplace. In: G. P. Keita and S. L. Sauter (eds) Work and Well-Being: An Agenda for the 1990s. American Psychological Association, Washington DC.

Kasl, S. V., and Cobb, S. (1967) Effects of parental status incongruence and discrepancy in physical and mental health of adult offspring. Journal of Personality and Social Psychology, monograph: 7, 1-5.

Kasl, S. V., and Cobb, S. (1980) The experience of losing a job: some effects on cardiovascular functioning. Psychotherapy and Psychosomatics, 34, 88-109.

Kasl, S.V. and Cobb, S. (1982) Variability of stress effects among men experiencing job loss. In L. Goldberger and S. Breznitz (eds) Handbook of Stress: Theoretical and Clinical Aspects. Free Press, New York.

Kearns, J. (1986) Stress at work: the challenge of change. BUPA series The Management of Health: 1 Stress and the City, BUPA.

Kegeles, S.M., Coates, T., Christopher, A., and Lazarus, J. (1989) Perceptions of Aids: the continuing saga of Aids-related stigma. Aids, 3 (supp 1), S253-S258.

Keita, G. P., and Sauter, S. L. (1992) Work and Well-Being: An Agenda for the 1990s. American Psychological Society, Washington DC.

King, S.H., and Cobb, S. (1958) Psychosocial factors in the epidemiology of rheumatoid arthritis. Journal of Chronic Diseases, 7, 466.

King, S.H., and Cobb, S. (1959) Psychosocial studies in rheumatoid arthritis; parental factors compared in cases and controls. Arthritis and Rheumatism, 2, 322 - 331.

Kittel, F., Kornitzer, M., DeBacker, B., Dramaix, M., Sobolski, J., Degre, J., Denolin, H. (1983) Type A in relation to job stress, social and bioclinical variables: the Belgian physical fitness study. Journal of Human Stress, 9, 37-45.

Kobasa, S. (1979) Stressful life events, personality and health: an inquiry into hardiness. Journal of Personality and Social Psychology, 37, 1-13.

Kobasa, S., and Puccetti, M. (1983) Personality and social resources in stress resistance. Journal of Personality and Social Psychology, 45, 839-850.

Kobasa, S., Maddi, S., and Courington, S. (1981) Personality and constitution as mediators in the stress-illness relationship. Journal of Health and Social Behaviour, 22, 368-378.

Kobasa, S., Maddi, S., and Kahn, S, (1982) Hardiness and health: a prospective study. Journal of Personality and Social Psychology, 42, 168-177.

Kornhauser, A. (1965) Mental Health of the Industrial Worker. University of Chicago Press, Chicago, Illinois.

Kroes, W.H. (1976) Society's victim, the policeman: an analysis of job stress in policing. Thomas, Springfield.

Kryter, K. D. (1972) Non-auditory effects of environmental noise. American Journal of Public Health, 62, 389-398.

Lippe, K. (1990) Compensation for mental-mental claims under Canadian law. Behavioural Sciences and the Law, 8, 398-399.

Lipton, M.A. (1976) Behavioral effects of hypothalamic polypeptide hormones in animals and man. In E.J. Sachar (ed) Hormones, Behaviour and Psychopathology. Raven, New York.

Lisander, B. (1979) Somato-autonomic reactions and their higher control. In C. Brooks, K. Koizumi, and A. Sato (eds) Integrative Functions of the Autonomic Nervous System. Elsevier, New York.

Locke, A. A. (1976) The nature and causes of job satisfaction. In: M. D. Dunnette (ed) Handbook of Industrial and Organizational Psychology. Rand McNally, Chicago.

Logue, J.N. (1980) Mental health aspects of disaster. Paper presented to the fifth Annual National Hazards Research Workshop, Boulder.

Logue, J.N., Melick, M.E., and Struening, E. (1981) A study of health and mental health status following a major natural disaster. In R. Simmons (ed) Research in Community and Mental Health: An Annual Compilation of Research, Vol. 2. Greewich:, JAI.

Loher, B. T., Noe, R. A., Moeller, N. L., and Fitzgerald, M. P. (1985) A meta-analysis of the relation of job characteristics to job satisfaction. Journal of Applied Psychology, 70, 280-289.

Lundahl, A. (1971) Fritid Och Rekreation. All Manna Forlager. Laginkomstutredningen, Stockholm.

Lundberg, U., and Forsman, L. (1979) Adrenal medullary and adrenal cortical responses to understimulation and over stimulation: comparison between type A and type B persons. Biological Psychology, 9, 79-89.

MacDougall, J. M., Dembrowski, T. M., Dimsdale, J. E., and Hackett, T. P. (1985) Components of Type A, hostility and anger-in: further relationships to angiographic findings. Health Psychology, 4, 137-152.

Mackay, C.J. (1987) Violence to Staff in the Health Services. HMSO, London.

Mackay, C.J., Cox, T., Burrows, G., and Lazzerini, T. (1978) An inventory for the measurement of self-reported stress and arousal. British Jounral of Social and Clinical Psychology, 17, 283-284.

MacLennan, B. W. (1992) Stressor reduction: an organizational alternative to individual stress management. In J.C. Quick, L.R. Murphy, JJ. Hurrell (eds) Stress and Well-being at Work: Assessments and Interventions for Occupational Mental Health. American Psychological Association, Washington DC.

Management of Health & Safety at Work Regulations 1992. HMSO, London.

Mandler, G. (1982) Stress and thought processes. In: L. Goldberg and S. Breznitz (eds) Handbook of Stress: Theoretical and Clinical Aspects. Free Press, New York.

Margolis, B. L., and Kroes, W. H. (1974) Work and the health of man. In: J. O'Toole (ed) Work and the Quality of Life. MIT Press, Cambridge, Mass.

Kuorinka, I. (1979) Occupational strain from working movments. Paper to: International Ergonomics Association, Warsaw (August). Abstract in: Ergonomics, 22, 732.

Lacey, J. I. (1967) Somatic response patterning and stress: some revisions of activation theory. In: M. H. Appley and R. Trumbull (eds) Psychological Stress. Appleton-Century-Crofts, New York.

Landsbergis, P.A. (1988) Occupational stress among health care workers: a test of the job demands-control model. Journal of Organizational Behaviour, 9, 217-239.

Landy, F. J. (1989) The Psychology of Work Behaviour. Brooks/Cole, Monterey, California.

Landy, F. J. (1992) Work design and stress. In: G. P. Keita and S. L. Sauter (eds) Work and Well-Being: An Agenda for the 1990s. American Psychological Association, Washington DC.

Larwood, L., and Wood, M. M. (1979) Women in Management. Lexington Books, London.

Last, J. M. (1988) Dictionary of Epidemiology. Oxford University Press, New York.

Laville, A., and Teiger, C. (1976) Sante mentale et conditions de travail. Therapeutische Umschau, 32, 152-156.

Lazarus, R. S. (1966) Psychological Stress and the Coping Process. McGraw-Hill, New York.

Lazarus, R. S. (1976) Patterns of Adjustment. McGraw-Hill, New York.

Lazarus, R.S. and Folkman, S. (1984) Stress, Appraisal and Coping. Springer Publications, New York .

Leiter, M. (1991) The dream denied: professional burnout and the constraints of human service organizations. Canadian Psychology, 32, 547-558.

Leventhal, H., and Tomarken, A. (1987) Stress and illness: perspectives from health psychology. In: S. Kasl and C. Cooper (eds) Stress and Health: Issues in Research Methodology. Wiley & Sons, Chichester.

Levi, L. (1972) Stress and distress in response to psychosocial stimuli. Acta Medica Scandinavica, 191, supplement: 528.

Levi, L. (1981) Preventing Work Stress. Addision-Wesley, Reading, Mass.

Levi, L. (1984) Stress in Industry: Causes, Effects and Prevention. Occupational Safety and Health Series no. 51, International Labour Office, Geneva.

Levi, L. (1992) Psychosocial, occupational, environmental and health concepts, research results and applications. In: G.P. Keita and S.L. Sauter (eds) Work and Well Being: An Agenda for the 1990s. American Psychological Association, Washington DC.

Levi, L., Frankenhauser, M., and Gardell, B. (1986) The characteristics of the workplace and the nature of its social demands. In: S. Wolf and A. J. Finestone (eds) Occupational Stress, Health and Performance at Work. PSG Pub. Co. Inc., Littleton, MA.

Margolis, B. L., Kroes, W. H., and Quinn, R. P. (1974) Job stress; an unlisted occupational hazard. Journal of Occupational Medicince, 16, 652-661.

Marmot, M. G., and Madge, N. (1987) An epidemiological perspective on stress and health. In: S.V. Kasl and C.L. Cooper (eds) Stress and Health: Issues in Research Methodology, Wiley & Sons, Chichester.

Marshall, J. (1977) Job pressures and satisfactions at managerial levels. Unpublished PhD thesis, University of Manchester Institute of Science and Technology, Manchester.

Martin, R., and Wall, T. (1989) Attentional demand and cost responsibility as stressors in shop-floor jobs. Academy of Management Journal, 32, 69-86.

Mason, J. W. (1968) A review of psychoendocrine research on the pituitary-adrenal cortical system. Psychosomatic Medicine, 30, 576-607.

Mason, J. W. (1971) A re-evaluation of the concept of non-specificity in stress theory. Journal of Psychiatric research, 8, 323-333.

Matteson, M.T., and Ivancevich, J.M. (1987) Controlling Work Stress. Jossey-Bass, San Fransisco.

Matthews, K. A., Glass, D. C., Rosenman, R. H., and Bortner, R. W. (1977) Competitive drive, pattern A and coronary heart disease: a further analysis of some data from the Western Collaborative Group Study. Journal of Chronic Diseases, 30, 489-498.

Meichenbaum, D. (1977) Cognitive-Behaviour Modification. Plenum Press, New York.

Meichenbaum, D. (1983) Coping with Stress. Century Publishing, London.

Milgram, N.A. (1982) War-related stress in Israeli children and youth. In L. Goldberger and S.Breznitz (eds) Handbook of Stress: Theoretical and Clinical Aspects. Free Press, New York.

Millar, D.J. (1984) The NIOSH suggested list of the ten leading work-related diseases and injuries. Journal of Occupational Medicine, 26, 340-341.

Millar, D.J. (1990) Mental health and workplace: interchangeable partnership. American Psychologist, 45, 1165-1166.

Miller, D.G., Grossman, Z.D., Richardson, R.L., Wistow, B.W., and Thomas, F.D. (1978) Effect of signalled versus unsignalled stress on rat myocardium. Psychosomatic Medicine, 40, 432-434.

Miller, J. D. (1974) Effects of noise on people. Journal of the Acoustical Society of America, 56, 72-764.

Miller, S. (1979) Controllability and human stress: method, evidence and theory. Behavioural Research and Therapy, 17, 28-304.

Miller, S., Brody, D., and Summerton, J. (1988) Styles of coping with threat: implications for health. Journal of Personality and Social Psychology, 54, 142-148.

Ministry of Labour (1987) Survey on State of Employees' Health. Ministry of Labour, Tokyo, Japan.

Monjan, A.A. (1981) Stress and immunologic competence: studies in animals. In R. Ader (ed) Psychoneuroimmunology. Academic Press, New York..

Monk, T.H., and Tepas, D. (1985) Shift Work. In: C. L. Cooper and M. J. Smith (eds) Job Stress and Blue Collar Work. Wiley & Sons, Chichester.

Murphy, L.R. (1984) Occupational stress management: a review and appraisal. Journal of Occupational Psychology, 57, 1-15.

Murphy, L.R. (1988) Workplace interventions for stress reduction and prevention. In C.L. Cooper and R. Payne (Eds) Causes, Coping and Consequences of Stress at Work.

Murphy, L.R., and Hurrell, J.J. (1987) Stress management in the process of occupational stress reduction. Journal of Managerial Psychology, 2, 18-23.

Murphy, L.R., Hurrell, J.J. and Quick, J.C. (1992) Work and well-being: where do we go from here? InJ.C. Quick, L.R. Murphy, and J.J. Hurrell (eds) Stress and Well-being at Work: Assessments and Interventions for Occupational Mental Health. American Psychological Association, Washington DC.

Naitoh, P., Englund, C. E., and Ryman, D. H. (1983) Extending Human effectiveness During Sustained Operations Through Sleep Management. US Naval Health Research Center, San Diego, California.

Narayanan, V. K., and Nath, R. (1982) A field test of some attitudinal and behavioural consequences of flexitime. Journal of Applied Psychology, 67, 214-218.

Neale, M.S., Singer, J., Schwartz, G.E., and Schwartz, J. (1983) Conflicting perspectives on stress reduction in occupational settings: a systems approach to their resolution. Report to NIOSH on P.O. No. 82-1058, Cincinnati, Ohio.

Neary, J., Elliott, K.V., and Toohey, J. (1992) The causes of workplace stress and strategies for management. Paper presented at the International Symposium on Work-related Diseases: Prevention and Health Promotion, Linz, Austria.

Nerell, G. (1975) Medical complaints and findings in Swedish sawmill workers. In: B. Thunell and B. Ager (eds) Ergonomics in Sawmill and Woodworking Industries. National Board of Occupational Safety and Health, Stockholm.

Neufeld, R. W. J., and Paterson, R. J. (1989) Issues concerning control and its implementation. In: R. W. J. Neufeld (ed) Advances in the Investigation of Psychological Stress. Wiley & Sons, New York.

Newman, J. E., and Beehr, T. A. (1979) Personal and organizational strategies for handling job stress: a review of research and opinion. Personnel Psychology, 32, 1-43.

NIOSH (1988) Psychosocial Occupational Health. National Institute of Occupational Safety and Health, Washington, DC.

Nobile, R.J. (1991) Matters of confidentiality. Personnel, 68, 11-12.

Nordhus, I.H., and Fleime, A.M. (1991) Job stress in two different care-giving contexts: a study of professional and semi-professional health personnel in Norway. Work & Stress, 5, 229-240.

Nowack, K.M. (1991) Psychological predictors of health status. Work & Stress, 5, 117-131.

Nutt, P. C. (1981) Evaluation Concepts and Methods: Shaping Policy for the Health Administrator. SP Medical and Scientific Books, New York.

O'Brien, G. E. (1982) The relative contribution of perceived skill-utilization and other perceived job attributes to the prediction of job satisfaction: cross validation study. Human Relations, 35, 219-237.

O'Hanlon, J. F. (1981) Boredom: practical consequences and a theory. Acta Psychologia, 49, 53-82.

O'Leary, A. (1990) Stress, emotion, and human immune function. Psychological Bulletin, 108, 363-382.

Orpen, C. (1981) Effect of flexible working hours on employee satisfaction and performance. Journal of Applied Psychology, 66, 113-115.

Paffenbarger, R.S., Hale, W.E., Brand, R.J., and Hyde, R.T. (1977) Work-energy level, personal characteristics and fatal heart attack: a birth cohort effect. American Journal of Epidemiology, 105, 200-213.

Paffenbarger, R.S., Hyde, R.T., Wing, A.L., and Steinmetz, C.H. (1984) A natural history of athleticism and cardiovascular health. Journal of the American Medical Association, 252, 491-495.

Pahl, J. M., and Pahl, R. E. (1971) Managers and Their Wives. Allen Lane, London.

Patton, J. F., Vogel J. A., Damokosh, A. I., and Mello, R. P. (1989) Effects of continuous military operations on physical fitness capacity and physical performance. Work & Stress, 3, 69-77.

Payne, R. (1988) Individual differences in the study of occupational stress. In: C.L. Cooper and R. Payne (eds) Causes, Coping and Consequences of Stress at Work. Wiley & Sons, Chichester.

Payne, R., and Fletcher, B. (1983) Job demands, supports and constraints as predictors of psychological strain among school teachers. Journal of Vocational Behaviour, 22, 136-147.

Payne, R., and Hartley, J. (1987) A test of a model for exlaining the affective experience of unemployed men. Journal of Occupational Psychology, 60, 31-47.

Pearlin, L., and Schooler, C. (1978) The structure of coping. Journal of Health and Social Behavior, 19, 2-21.

Pearse, R. (1977) What Managers Think About Their Managerial Careers. AMACOM, New York.

Perkins, D. V. (1988) The assessment of stress using life events scales. In: L. Goldberg and S. Breznitz (eds) Handbook of Stress: Theoretical and Clinical Aspects. Free Press, New York.

Perrewe, P., and Ganster, D. C. (1989) The impact of job demands and behaviural control on experienced job stress. Journal of Organizational Behaviour, 10, 136-147.

Peterson, P. (1981) Comparison of relaxation training, cognitive restructuring/behavioural training and multimodal stress management training seminars in an occupational setting. Dissertation submitted to Fuller Theological Seminary, Los Angeles, California.

Pierce, J.L. and Newstrom, J.W. (1983) The design of flexible work schedules and employee responses: relationships and processes. Journal of Occupational Behaviour, 4, 247-262.

Porter, L. W. (1990) Commitment patterns in industrial organizations. Paper to: Society for Industrial and Organizational psychology, Miami Beach, Florida (April).

Powell, L. H. (1987) Issues in the measurement of the Type A behaviour pattern. In: S. V. Kasl, and C. L. Cooper (eds) Stress and Health: Issues in Research Methodology. Wiley & Sons, Chichester.

Quick, J.C., and Quick, J.D. (1984) Organizational Stress and Preventive Management. McGraw-Hill, New York.

Quick, J.C., Joplin, J.R., Gray, D.A., and Cooley, E.C. (in press) The occupational life cycle and the family. In L.L'Abate (ed.), Handbook of Developmental Family Psychology and Psychopathology. Wiley & Sons, New York.

Quick, J.C., Murphy, L.R., and Hurrell, J.J. (1992) Stress and Well-being at Work: Assessments and Interventions for Occupational Mental Health. American Psychological Association, Washington DC.

Quick, J. C., Murphy, L. R., Hurrell, J. J., and Orman, D. (1992) The value of work, the risk of distress, and the power of prevention. In: J.C. Quick, L.R. Murphy, and J.J. Hurrell (eds) Stress & Well Being at Work: Assessments and Interventions for Occupational Mental Health. American Psychological Association, Washington DC.

Rahe, R. H. (1969) Multi-cultural correlations of life change scaling: America, Japan, Denmark, and Sweden. Journal of Psychosomatic Research, 13, 191-195.

Repetti, R. L. (1987) Linkages between work and family roles. In: S. Oskamp (ed) Applied Social Psychology Annual Vol 7. Family Processes and Problems. Sage, Beverly Hills.

Repetti, R. l., and Crosby, F. (1984) Gender and depression: exploring the adult role explanation. Journal of Social and Clinical Psychology, 2, 57-70.

Repetti, R. L., Matthews, R. A., and Waldron, I. (1989) Employment and women's health: effects of paid employment on women's mental and physical health. American Psychologist, 44, 1394-1401.

Rice, H.K. (1963) The responding-rest ratio in the production of gastric ulcers in the rat. Psychological Reports, 13, 11-14.

Riley, V. (1979) Stress - cancer contradictions: a continuing puzzlement. Cancer Detection and Prevention, 2, 159-162.

Riley, V. (1981) Psychoneuroendocrine influences on immunocompetence and neoplasia. Science, 212, 1100-1109.

Riley, V., Fitzmaurice, M. A., and Spackman, D. H. (1981) Psychoneuroimmunological factors in neoplasia: studies in animals. In: R. Ader (ed) Psychoneuroimmunology. Academic Press, New York.

Rimon, R.A. and Laakso, R. (1985) Life stress and rheumatoid arthritis: a 15-year follow-up study. Psychotherapy and Psychosomatics, 43, 38-43.

Robertson, I. T., and Cooper, C. L. (1983) Human Behaviour in Organizations. MacDonald and Evans Ltd., London.

Ronen, S. (1981) Flexible Working Hours; An Innovation in the Quality of Work Life. McGraw Hill, New York.

Rosa, R.R. and Colligan, M.J. (1986) The NIOSH Fatigue Test Battery: Laboratory Validation of a Portable System for Field Study of Extended Workdays and Work Scheduling. NIOSH internal report. National Institute for Occupational Health, Cincinnati.

Rosa, R. R., Colligan, M. J., and Lewis, P. (1989) Extended workdays: effects of 8-hour and 12-hour rotating shifts schedules on performance, subjective aleartness, sleep patterns and psychosocial variables. Work & Stress, 3, 2-32.

Rose, R. M., Poe, R. O., and Mason, J. W. (1967) Observations on the relationship between psychological state, 17-OHCS excretion and epinephrine, norepinephrine, insulin, BEI, estrogen and androgen levels during basic training. Psychosomatic Medicine, 29, 544.

Rosenman, R. H., Friedman, M., Straus, R., Wurm, M., Kositchek, R., Hahn, W., and Werthessen, N. T. (1964a) A predictive study of coronary heart disease: appendix. Journal of the Amerian Medical Association, 189, 1-4.

Rosenman, R. H., Friedman, M., Straus, R., Wurm, M., Kositchek, R., Hahn, W., and Werthessen, N. T. (1964b) A predictive study of coronary heart disease. Journal of the Amerian Medical Association, 189, 113-124.

Russek, H. I., and Zohman, B. L. (1958) Relative significance of heredity, diet and occupational stress in CHD of young adults. American Journal of Medical Sciences, 235, 266-275.

Rutenfranz, J. (1982) Occupational health measures for night and shift workers. Journal of Human Ergology, 11 (supplement), 67-86.

Rutenfranz, J., Colquhoun, W. P., Knauth, P., and Ghata, J. N. (1977) Biomedical and psychosocial aspects of shift work: a review. Scandinavian Journal of Work and Environmental Health, 3, 165-182.

Rutenfranz, J., Haider, M., and Koller, M. (1985) Occupational health measures for night workers and shift workers. In: S. Folkard and T. H. Monk (eds) Hours of Work: Temporal Factors in Work Scheduling. Wiley & Sons, Chichester.

Ryman, D.H., and Ursin, H. (1979) Factor analyses of the physiological responses of company commanders to stress. Quoted in : Ursin, H. (1979) Personality, activation and somatic health: a new psychosomatic theory. In: S. Levine and H. Ursin (eds) Coping and Health. Plenum Press, New York.

Ryman, D.H., Naitoh, P., and Englund, C. E. (1989) Perceived exertion under conditions of sustained work and sleep loss. Work & Stress, 3, 5-68.

Salvendy, G., and Smith, M. (1981) Machine Pacing and Occupational Stress. Wiley & Sons, Chichester.

Sarason, I.G., de Monchaux, C., and Hunt, T. (1975) Methodological issues in the assessment of life stress. In: L. Levi (ed) Emotions: Their Parameters and Measurement. Raven, New York.

Sauter, S.L. (1992) Introduction to the NIOSH proposed National Strategy. In: G.P. Keita and S.L. Sauter (eds) Work and Well Being: An Agenda for the 1990s. American Psychological Association, Washington DC.

Sauter, S.L., Hurrell, J.J., and Cooper, C.L. (1989) Job Control and Worker Health. Wiley and Sons, Chichester.

Sauter, S.L., Murphy, L.R., and Hurrell, J.J. (1990) Prevention of work-related psychological disorders: A national strategy proposed by the National Insitute for Occupational Safety and Health (NIOSH). American Psychologist, 45, 146-158.

Sauter, S.L., Murphy, L.R., and Hurrell, J.J. (1992) Prevention of work related psychological disorders: a national strategy proposed by the National Institute for Occupational Safety and Health. In: G. P. Keita and S. L. Sauter (eds) Work and Well-Being: An Agenda for the 1990s. American Psychological Association, Washington DC.

Schneiderman, N. (1978) Animal models relating behavioural stress and cardiovascular pathology. In T. Dembroski (ed) Proceedings of the Forum on Coronary-Prone Behaviour. DHEW publication no.(NIH) 78-1451. US Government Printing Office, Washington DC.

Schonpflug, F. and Battmann, A (1988) The costs and benefits of coping. In: S. Fisher and J. Reason (eds) Handbook of Life Stress, Cognition and Health. Wiley & Son, Chichester

Schott, F. (1992) Panel comments: work design. In: G. P. Keita and S. L. Sauter (eds) Work and Well-Being: An Agenda for the 1990s. American Psychological Association, Washington DC.

Schriber, J.B. and Gutek, B.A. (1987) Some time dimensions of work: measurement of an underlying aspect of organizational culture. Journal of Applied Psychology, 7, 624-650.

Schwartz, G. (1980) Stress management in occupational settings. Public Health Reports, 95, 99-108.

Scott, R., and Howard, A. (1970) Models of stress. In: S. Levine and N. Scotch (eds) Social Stress. Aldine, Chicago.

Scriven, M. (1967) The methodology of evaluation. In: R. E. Stake (ed) Perspectives of Curriculum Evaluation. AERA Monograph Series on Curriculum Evaluation no. 1, Rand McNally, Chicago.

Sells, S. B. (1970) On the nature of stress. In: J. McGrath (ed) Social and Psychological factors in Stress. Holt, Rinehart and Winston, New York.

Selye, H. (1936) A syndrome produced by diverse nocuous agents. Nature, 138, 32.

Selye, H. (1950) Stress, Acta Incorporated, Montreal.

Selye, H. (1956) Stress of Life. McGraw-Hill, New York.

Selye, H. (1976) Stress in Health and Disease. Butterworths, Boston.

Sharit, J., and Salvendy, G. (1982) Occupational stress: review and appraisal. Human Factors, 24, 129-162.

Shekelle, R. B., Gale, M., Ostfeld, A. M., and Paul, O. (1983) Hostility, risk of coronary heart disease, and mortality. Psychosomatic Medicine, 45, 109-114.

Shekelle, R. B., Ostfeld, A. M., and Paul, O. (1969) Social status and incidence of CHD. Journal of Chronic Disorders, 22, 381-394.

Shilling, S., and Brackbill, R.M. (1987) Occupational health and safety risks and potential health consequences perceived by US workers. Public Health Reports, 102, 36-46.

Shirom, A., Eden, D., Silberwasser, S., and Kellerman, J. J. (1973) Job stresses and risk factors in CHD among occupational categories in kibbutzim. Social Science and Medicine, 7, 875-892.

Singer, J.A., Neale, M.S., Schwartz, G.E., and Schwartz, J. (1986) Conflicting perspectives on stress reduction in occupational settings: a systems approach to their resolution. In M.F. Cataldo and T.J. Coates (eds) Health and Industry: A Behavioural Medicine Perspective. Wiley & Sons, New York.

Sklar, L. S., and Anisman, H. (1981) Stress and cancer. Psychological Bulletin, 89, 36-406.

Sleeper, R. D. (1975) Labour mobility over the life cycle. British Journal of Industrial Relations, 13.

Smith, A. (1991) A review of the non-auditory effects of noise on health. Work & Stress, 5, 49-62.

Smith, M.J. (1985) Machine-paced work and stress. In C.L. Cooper and M.J. Smith (eds) Job Stress and Blue Collar Work. Wiley and Sons, Chichester.

Smith, M.J., Hurrell, J.J., and Murphy, R.K. (1981) Stress and health effects in paced and unpaced work. In G. Salvendy and M.J. Smith (eds) Pacing and Occupational Stress. Taylor and Francis, London.

Smith, R. P. (1981) Boredom: a review. Human Factors, 23, 329-340.

Spector, P. E. (1986) Perceived control by employees: a meta analysis of studies concerning autonomy and participation in decision making. Human Relations, 39, 1005-1016.

Spector, P. E. (1987) Interactive effects of perceived control and job stressors on affective reactions and health outcomes for clerical workers. Work & Stress, 1, 155-162.

Spielberger, C.D. (1976) The nature and measurement of anxiety. In C.D. Spielberger and R. Diaz-Guerrero (eds) Cross-Cultural Anxiety. Hemisphere, Washington DC.

Spurgeon, A., and Harrington, J. M. (1989) Work performance and health of junior hospital doctors - a review of the literature. Work & Stress, 3, 117-128.

Stainbrook, G. L., and Green, L. W. (1983) Role of psychosocial stress in cardiovascular disease. Houston Heart Bulletin, 3, 1-8.

Stampi, C. (1989) Polyphasic sleep strategies imporve prolonged sustained performance: a field study on 99 sailors. Work & Stress, 3, 41-55.

Stein, M., Keller, S., and Schleifer, S. (1981) The hypothalamus and the immune response. In H. Weiner, M. Hofer, and A. Stunkard (eds) Brain, Behaviour and Bodily Disease. Raven, New York.

Stewart, R. (1976) Contrasts in Management. McGraw-Hill, New York.

Stone, E.A. (1975) Stress and catecholamines. In A. Friedhoff (ed) Catecholamiones and Behaviour, Vol 2. Plenum, New York.

Strauss, G. (1974) Workers: attitudes and adjustments. In the American Assesmbly, Columbia University, The Worker and the Job: Coping with Change. Prentice-Hall, Englewood Cliffs, NJ.

Susser, M. (1967) Causes of peptic ulcer: a selective epidemiological review. Journal of Chronic Diseases, 20, 435-456.

Sutherland, V. J., and Cooper, C. L. (1990) Understanding stress: psychological perspective for health professionals. Psychology and Health, series: 5. Chapman and Hall, London.

Symonds, C.P. (1947) Use and abuse of the term flying stress. In Air Ministry, Psychological Disorders in Flying Personnel of the Royal Air Force, Investigated during the War, 1939-1945. HMSO, London.

Szabo, S, Maull, E.A., and Pirie, J. (1983) Occupational Stress: understanding, recognition and prevention. Experientia, 39, 1057-1180.

Tavistock Institute of Human Relations (1986) Violence to Staff: A Basis for Assessment and Prevention. HMSO, London.

Thompson, S.C. (1981) Will it hurt less if I can control it? A complex answer to a simple question. Psychological Bulletin, 90, 89-101.

Turkkan, J.S., Brady, J.V., and Harris A.H. (1982) Animal studies of stressful interactions: a behavioural-physiological overview. In L. Goldberger and S. Breznitz (eds) Handbook of Stress: Theoretical and Clinical Aspects. Free Press, New York.

Turnage, J. J., and Spielberger, C.D. (1991) Job stress in managers, professionals and clerical workers. Work & Stress, 5, 165-176.

Ulrich, R.E., and Azrin, N.H. (1962) Reflexive fighting in response to aversive stimulation. Journal of the Experimental Analysis of Behaviour, 5, 511-520.

Uris, A. (1972) How managers ease job pressures. International Management, June, 45-46.

Ursin, H. (1979) Personality, activation and somatic health: a new psychosomatic theory. In: S. Levine and H. Ursin (eds) Coping and Health. Plenum Press, New York.

Ursin, H., Mykletun, R., Tonder, O., Vaernes, R. J., Relling, G., Isaksen, E., and Murisaon, R. (1984) Psychological stress factors and concentrations of

immunoglobulins and complement components in humans. Scandinavian Journal of Psychology, 23, 193-199.

USDHHS (1980) New Developments in Occupational Stress: Proceedings of a Conference. US Department of Health and Human Services, no: NIOSH 81-102, US Government Printing Office, Washington DC.

Vaernes, R. J., Knardahl, S., Romsing, J., Aakvaag, A., Tonder, O., Walter, B., and Ursin, H. (1988) Relationships between environmental problems, defense strategies and health among shiftworkers in the process industry. Work & Stress, 1, 7-15.

Vaernes, R. J., Myhre, G., Aas, H., Homnes, T., Hansen, I., and Tonder, O. (1991) Relationships between stress, psychological factors, health and immune levels among military aviators. Work & Stress, 5, 5-16.

Vaernes, R. J., Warncke, M., Eidsvik, S., Aakvaag, A., Tonder, O., and Ursin, H. (1987) Relationships between perceived health and psychological factors among submarine personnel: endocrine and immunological effects. In: A. Marroni and G. Oriani (eds) Diving and Hyperbaric Medicine. Academic Press, New York.

Vollhardt, B.R., Ackerman, S.H., Grayzel, A.I., and Barland, P. (1982) Psychologicaly distinguishable groups of rheumatoid arthritis patients: a controlled single blind study. Psychosomatic Medicine, 44, 353-361.

von Restorff, W., Kleinhanss, G., Schaad, G., and Gorges, W. (1989) Combined work stresses: effect of reduced air renewal on psychological performance during 72hr sustained operations. Work & Stress, 3, 15-20.

Voydanoff, P., and Kelly, R. F. (1984) Determinants of work-related family problems among employed parents. Journal of Marriage and the Family, 46, 881-892.

Wall, T.D. and Clegg, C.W. (1981) A longitudinal study of group work redesign. Journal of Occupational Behaviour, 2 , 31-49.

Wardell, W. I., Hyman, M., and Bahnson, C B. (1964) Stress and coronary heart disease in three field studies. Journal of Chronic Diseases, 17, 73-84.

Warr, P. B. (1982) Psychological aspects of employment and unemployment. Psychological Medicine, 12, 7-11.

Warr, P. B. (1983) Work, jobs and unemployment. Bulletin of the British Psychological Society, 36, 305-311.

Warr, P. B. (1987) Work, Unemployment and Mental Health. Cambridge University Press, Cambridge.

Warr, P. B. (1990) Decision latitude, job demands and employee well-being. Work & Stress, 4, 285-294.

Warr, P. B. (1992) Job features and excessive stress. In: R. Jenkins and N. Coney (eds) Prevention of Mental Ill Health at Work. HMSO, London.

Warshaw, L.J. (1979) Managing Stress. Addison-Wesley, Reading, Mass.

Waterhouse, J.M., Folkhard, S., and Minors , D.S. (1992) Shiftwork, Health and Safety: An Overview of the Scientific Literature 1978-1990. HMSO, London.

Webb, E. J., Campbell, D. T., Schwartz, R. D. and Sechrest, L. (1966) Unobtrusive Measures: Nonreactive Research in the Social Sciences. Rand McNally, Chicago.

Weiner, H. (1977) Psychobiology and Human Disease. Elsevier, New York.

Weiss, J.M. (1972) Psychological factors in stress and disease. Scientific American, 226, 104-113.

Weitzman, E.D., Boyar, R.M., Kapen, S., and Hellman, L. (1975) The relationship of sleep and sleep stages to neuroendocrine secretion and biological rhythms in man. Recent Progress Hormone Research, 31, 399-446.

Welford, A. T. (1973) Stress and performance. Ergonomics, 16, 567-580.

Wilensky, H. (1960) Work, careers and social integration. International Social Science Journal, 4, 54 -560.

Williams, R. B., Barefoot, J. C., and Shekelle, R. B. (1985) The health consequences of hostility. In: M. A. Chesney and R. H. Rosenman (eds) Anger and Hostility in Cardiovascular and behavioural Disorders. Hemisphere Publishing Corp., Washington DC.

Williams, R. B., Haney, T. L., Lee, K. L., Kong, Y., Blumenthal, J. A., and Whalen, R. E.(1980) Type A behaviour, hostility and coronary atherosclerosis. Psychosomatic Medicine, 42, 539-549.

Wyler, A., Masuda, M., and Holmes, T. (1968) Seriousness of illness scale. Journal of Psychosomatic Research, 11, 363-375.

Zegans, L.S. (1982) Stress and the Development of Somatic Disorders. In L.Goldberger and S. Breznitz (eds) Handbook of Stress: Theoretical and Clinical Aspects. Free Press, New York.


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