SCREENING AND MANAGEMENT OF THE WORKPLACE FOR CVD RISK

INDIVIDUAL STRESS MANAGEMENT: EFFECTIVE OR NOT?

by Kenneth M. Nowack, PhD

Individual stress-management interventions are defined as techniques designed to help employees modify their appraisal of stressful situations or deal more effectively with symptoms of stress. Diversity of stress techniques, use of varying health outcome measures, and methodological limitations make it difficult to reach firm conclusions about the efficacy of stress-management interventions. Current research suggests that individual stress-management interventions generally are effective in reducing negative individual health outcomes, but do not consistently affect job/organization-relevant outcomes such as absenteeism, turnover, productivity, and job satisfaction.

Concern with the effects of occupational stress on productivity, absenteeism, and health-related problems have increased dramatically during the past decade.[88] Although causal relations between job stressors and outcomes have not been conclusively demonstrated, associations between specific types of job stressors (e.g., job strain), individual (e.g., physiologic) and organizational (e.g., job satisfaction) outcomes have been observed consistently.[71,84] These outcomes, regardless of the antecedents, inevitably generate high organizational medical care expenditures, litigation, and operational costs. Organizations have been making efforts to implement individual stress-management interventions to reduce the cost associated with these negative consequences.

According to Ivancevich, Matteson, Freedman, and Phillips, worksite stress-management interventions refer to any cooperative action initiated by an organization for reducing the presence of work-related stressors, or for helping individuals to reduce and/or cope with the negative consequences of these stressors.[43] The goals of these interventions are to reduce specific occupational stressors,[53] modify individual's cognitive appraisal of stressful events,[64] or help individuals cope more effectively. Stress-management interventions traditionally implemented in the worksite can be categorized by the type of exposure the intervention is designed to reduce or eliminate, including: environmental (e.g., chemical and biologic stressors), physical and ergonomic (e.g., noise, rotating shiftwork, equipment); and psychosocial. Psychosocial interventions are aimed at various points in the stress process and can be classified as **organizational change** (*primary interventions*), **stress reduction** (*secondary interventions*), or **stress treatment**, such as employee assistance programs (*tertiary interventions*).

Organizational change interventions focus on identifying worksite stressors, either through comprehensive assessments and modifications[46] or participatory processes during which employees identify stressors and develop solutions.[57] Participatory processes typically include enhanced employee involvement in decision-making, job redesign, participatory action research, autonomous work teams, re-engineering, team building, and 360-degree feedback.

The first type of stress reduction intervention focuses on developing **individual strategies** for alleviating stress-related symptoms. It is the most common type in the workplace. Some examples include progressive muscle relaxation, visualization, biofeedback, meditation, and exercise. The second type of stress reduction intervention is assumed to occur through increased confidence and **interpersonal coping skills**. Examples include assertiveness training, conflict management, communication skills, and leadership development. The third type of stress reduction intervention is assumed to occur through increased **intrapersonal awareness** and insight of cognitive and affective reactions to job stressors. Examples include cognitive restructuring, stress inoculation training, and cognitive-behavioral skills training.

Evidence of the success of occupational stress management interventions generally is confusing and imprecise in light of the considerable heterogeneity of published studies. Interpretation of the occupational stress management literature is difficult because of numerous methodological and conceptual issues, including the use of diverse measures of stressors, moderator variables, strains, and health outcomes; short-term evaluation periods; and a preponderance of self-report measures often confounded with negative affectivity.[42,71,76] Despite these issues, the practicality and effectiveness of worksite stress-management interventions generally support individual, but not organizational, impact.[9,19,46,71,109] Overall, it appears that individual stress management interventions may have a positive effect, but if employees return to an unchanged work environment and its intrinsic stressors, those beneficial effects are likely to be eroded. Published studies suggest that the differential effectiveness of worksite stress-management interventions may depend entirely on the unique individual and organizational outcomes targeted.[9,84,109] A comprehensive review of the occupational stress-management literature allows a summary of the effectiveness of individual-oriented techniques on diverse health and organizational outcomes:

1. Subject matter experts in the occupational stress management field rated **relaxation** as the most practical and least expensive intervention, and the easiest to implement. With respect to effectiveness, exercise and muscle relaxation were considered to be the most effective interventions to alter somatic symptoms and psychological outcomes, whereas stress inoculation and assertiveness training were rated least effective.[9]

2. Stress-management interventions that include a **combination of training techniques** (e.g., muscle relaxation and cognitive-behavioral skills training) seemed to produce the most consistent and significant results across diverse health-outcome measures. The combination of relaxation and cognitive strategies appears to be the most effective type of individually oriented worksite stress-management intervention.[71,72]

3. As the main intervention technique, **biofeedback** appeared to be used least frequently of all interventions, and its effects on most health-outcome and job/organizational measures appeared unremarkable.[71]

4. Recent research examining the impact of **lifestyle and health programs** (e.g., exercise) shows consistently positive effects on psychological outcomes (e.g., depression), but the benefits may not be sustained. Ivancevich, et al. suggest that,

after a short time, 70% of individuals fail to maintain long-term commitment to exercise habits and are likely to revert to their previous lifestyle.[43]

5. In assessing the efficacy of stress-management interventions on *specific* outcomes, relaxation appears to consistently produce significant effects on some physiologic outcomes (e.g., blood pressure) and little change on other outcomes. **Cognitive-behavioral skills** training was the single intervention technique most frequently cited in stress management studies and produced the most consistent effects on psychologic outcomes, particularly anxiety. For somatic complaints, a combination of stress-management techniques appears most effective, and for job/organizational outcomes, job redesign, participatory action research, autonomous work teams, and organizational change interventions appear to be the most effective.[71,72,77,84]

6. None of the **individual stress-management interventions** were consistently effective in producing effects on job/organization-relevant outcomes such as absenteeism, turnover, accidents, health care costs, productivity, or job satisfaction. Murphy found that of individual stress-management strategies, cognitive techniques produced changes in job/organizational measures in 75% of the studies he reviewed.[71] However, in most of these studies cognitive techniques were associated primarily with subjective (e.g., job satisfaction) and not objective endpoints (e.g., absenteeism, productivity).

7. Recent findings suggest that **participatory organizational change** efforts (e.g., job redesign, participatory action research, and autonomous work teams) may be particularly effective in reducing or eliminating specific occupational stressors (e.g., job strain), and as a result, affecting both diverse individual and organizational outcome measures (e.g., productivity, blood pressure).[46,109]

Researchers have assessed the effectiveness of various stress-management interventions practiced in the workplace. Current research suggests that the effects of any one type of individual or organizational outcome typically depend on the specific stress-management technique used. Researchers and practitioners should continue to design and evaluate more comprehensive stress-management programs that attempt to change stressful aspects of the work environment as well as help individual employees learn to manage stress through improved coping. To maximize the effectiveness of occupational stress-management interventions, practitioners should attempt to integrate current findings on individual and organizational change, including readiness to change models,[87] relapse prevention,[66] transfer of training,[4] job redesign,[37] and participatory action research.[46]

HYPERTENSION: COULD LOWERING JOB STRAIN BE A THERAPEUTIC MODALITY? *by Peter Schnall, MD*

There is a well-established link between hypertension (elevated BP) and increased risk for stroke and heart disease. Indeed, recognition of rapidly rising rates of stroke and heart attack following World War II led to intensive efforts by private organizations like the American Heart Association and agencies of the U.S. government to modify known risk factors for CVD. This led, in turn, to the conduct of a number of clinical trials[2,16] that demonstrated the effectiveness of treating hypertension with medications to lower BP with consequent reduction in stroke and CVD morbidity and mortality. It is now well-established medical practice to place individuals on medication for hypertension if clinic-ascertained BPs exceed 140/90 mmHg.[25]

Unfortunately, the primary cause(s) of hypertension and CVD—which recent evidence suggests is, in part, a product of the organization and nature of work—remains neglected as potential arenas for intervention and primary prevention. In the U.S., the focus is on medical treatment of individuals with elevated BP. Given the widespread availability of effective pharmacologic and nonpharmacologic treatment for hypertension, the reader may appropriately ask, "Why should we bother with interventions aimed at preventing/reducing work-related stress and/or changing the workplace?" The following pages address this question.

Evidence that Elevations in BP Increase Risk of Stroke and Heart Disease

Evidence from epidemiological studies shows that an increase of 5 mmHg in BP has a considerable impact on stroke and heart attack rates in the general population. A meta-analysis of nine prospective studies[16] conducted among women and men concluded that a persistent elevation of 5 mmHg of diastolic BP increases the risk of strokes by 34% and the risk of coronary heart disease by 21%.[63] Furthermore, the association between daytime ambulatory BP and these endpoints is stronger than that of casual BP.[85,86]

Evidence that Treatment of Hypertension Leads to Reduction in Risk

During the past three decades, considerable evidence for the benefit of treating hypertension has been documented through a series of clinical trials beginning with the Veterans Administration Cooperative Study Group on Antihypertensive Agents in 1967.[111] Two forms of treatment for hypertension are widely available and in common use. For individuals with mild levels of BP elevation (BP ≤ 140/90 mmHg), nonpharmacologic interventions such as salt restriction, weight loss, and relaxation techniques are preferred. In the event of a nonresponse or further increase in BP despite these treatments, medications intended to lower BP are prescribed. Treatment of hypertension with antihypertensive medication generally results in BP reductions proportionate to the amount and number of medications.[1]

Limitation of Medical Treatment of Hypertension

Three serious limitations are associated with hypertension medications: issues of efficacy, side effects, and high cost. First, with respect to efficacy, there is the observation that lowering BP in clinical studies (e.g., a 10 mmHg decrease in diastolic BP from 100 mmHg to 90 mmHg) does not lower future morbidity and mortality to the same level as exists in an untreated population with BPs of 90 mmHg.[2] In addition, antihypertensive drugs are even less effective in preventing CVD than in preventing stroke.[2] Second, the greater the drug intervention, the greater the side effects experienced by the patient. These side effects not only can have a substantial, negative impact on an individual's quality of life, but can cause morbidity and mortality as well.[1,94] Third, chronic treatment is associated with substantial cost.

These limitations argue for nonpharmacologic interventions. However, while such nonpharmacologic interventions as weight loss, relaxation therapy, and salt restriction frequently are effective, they often are less so than medications and usually do not return BP to normal in individuals with sustained elevations of BP.[25] The problems with intervening exclusively on these "proximate" causes of disease and the need for a social-ecologic-public health approach are discussed on pages 245–252.

Evidence that Job Strain Is Linked to Hypertension

Several threads of evidence now link the workplace to hypertension and ultimately to CVD. Specifically, during the past two decades many studies have linked job strain to increases in ambulatory BP (amBP) and to CVD (see Chapter 2). The largest study of job strain and hypertension that uses AmBP monitoring in a longitudinal design has been the ongoing Cornell Worksite AmBP Study, which is designed to investigate the hypothesis that exposure to job strain is causally related to increases in mean AmBP.[98]

The sample consists of 285 healthy male employees, aged 30–60 at initial recruitment (Time 1), at eight New York City worksites; 195 were restudied 3 years after their initial participation (Time 2), and 194 were restudied 6 years later (Time 3). Mean systolic (S) and diastolic (D) AmBP at work, home, and during sleep were computed from 24-hour recordings and diary entries specifying location. The relationship of job strain to AmBP was examined cross-sectionally at each round of data collection. In addition, to take advantage of our information on job strain status at each assessment and to evaluate the impact of changes in exposure, a job strain change variable was constructed with four categories: those defined as having no job strain at either Time 1 or Time 2 (N = 138), those reporting job strain at both times (N = 15), and two groups that changed job strain status. We repeated this analysis comparing Times 1 and 3 as well as Times 2 and 3.[95] Multiple regression analysis was used to examine the cross-sectional associations of AmBP with job strain, as well as to predict 3-year and 6-year change in AmBP (from Time 1 to Time 2, Time 2 to Time 3, and Time 1 to Time 3) with job strain change, controlling for age, body mass, race/ethnicity, smoking status, alcohol consumption, education, sodium, and physical exertion level of the job.

Among the findings from the Cornell Worksite AmBP study is the observation in all three cross-sectional analyses (Times 1, 2, 3) of consistent significant effects of job strain on AmBP.[95] Subjects with job strain had work SAmBP/DAmBP that was 5–7/3–5 mmHg higher than subjects without job strain. Moreover, those men facing chronic job strain—working in high-strain jobs at two points in time—had work SAmBP/DAmBP on average 10–12/6–8 mmHg higher than those with no job strain at both times. The two crossover groups had intermediate levels of BP. Effect sizes for chronic 3-year exposure to job strain were larger than the estimated effect of aging 25 years or gaining 50 pounds in weight. In longitudinal analyses, subjects who changed from exposure to job strain to no exposure 3 years later had a decrease in SAmBP/DAmBP of about 5/3 mmHg.[95]

These findings lead to the following conclusions: (1) The relationship between job strain and AmBP has been replicated on three separate occasions, enhancing the validity of the initial observation first reported in 1992.[95,97] (2) Repeated exposure to job strain is associated with the highest levels of AmBPs. (3) Changes in job strain status predict change in AmBP over 3- and 6-year periods. (4) Job strain emerges in this research project as a consistent and substantial risk factor for hypertension in men.

Most importantly, these findings for men have been replicated in recent studies conducted among women. Four out of six studies of job strain that used AmBP found an effect.[12,52,106,110] There is evidence in the study by Laflamme and colleagues that the effect of exposure to job strain on AmBP is persistent beyond working hours, as university-educated women exposed to high job strain had an average of 6 mmHg ($p = .012$) higher SAmBP than nonexposed women over a 24-hour working day.[52] In addition, as in the Cornell Worksite AmBP study, repeated exposure to job

strain showed a substantially greater effect on AmBPs than exposure at only one point in time.[52]

Evidence that Changing Job Characteristics Leads to Lower BP

The question arises whether or not *preventing* exposure to job strain (including taking action to remove job strain for those already exposed) might not lead to lower BPs for working men and women, and to the prevention of stroke and CVD. The Cornell study sheds some light on this issue of the impact of changing job characteristic on AmBP. The authors reported that:

> *Those with job strain at Time 1 but not at Time 2 had a significant decrease in AmBP at work and home after controlling for other risk factors. Based on a comparison of regression coefficients, the effect of no longer being exposed to job strain at Time 2 on change in work and home SAmBP is comparable in magnitude, but opposite in direction, to the effect of aging 15 years or gaining more than 40 pounds. The decrease of 5/3 mmHg in work and home AmBP is larger than the observed treatment effect on BPs (2–4 mmHg systolic, 2–3 mmHg diastolic) of a weight-reduction intervention in four clinical trials. Moreover, the fall in work AmBP in this group is largest (–11.3 mmHg SAmBP and –5.8 mmHg DAmBP) among those subjects who entered the study as cases (i.e., subjects with elevated casual BPs at recruitment, N = 10). This finding suggests that the removal of job strain, especially for those with elevated BP, can result in a substantial reduction in AmBP. The amount of decrease in AmBP when job strain is removed is proportional to the initial height of AmBP—the greater the entry AmBP, the greater the fall.*[97]

The following case is illustrative of the potential impact of changes in job characteristics on AmBP. One of the employees in the Cornell study went from reporting having job strain at Time 1 to not having job strain at Time 2, accompanied by a dramatic fall in his AmBP. His interview on the NBC Nightly News on November 23, 1998 provides anecdotal support that positive changes in his worklife led to lowered job strain.

> Reporter: *This participant from the Cornell Study was one of those middle-level managers for a liquor manufacturer. He had very high blood pressure, until he got a promotion.*
>
> Participant: *I had accomplished a couple of key things that gave me a track record, which made me feel good, and I feel much more in control of what I'm doing.*

In addition to the evidence from the Cornell Worksite BP study, two recent intervention studies have examined the impact of worksite changes on casual measures of BP. Kawakami, et al. implemented a stress reduction program among blue-collar workers that included organizational changes.[48] This was intended to alleviate symptoms of depression due, in part, to overwork. Machine work was streamlined, production steps were reduced, and on-the-job training to enhance skills was introduced, thereby reducing job strain. While the study design was not optimized to detect workplace BP changes, nonetheless there was observed a decrease in casual systolic and diastolic BP of 4.4 mmHg and 2.5 mmHg, respectively, that approached statistical significance. A study of urban bus drivers by Rydstedt and colleagues found that an intervention intended to improve traffic conditions, thereby decreased route time and perceived workload among drivers, led to significantly fewer job hassles and lower systolic BP in the intervention group.[93] These

studies provide evidence of the feasibility of worksite interventions intended to reduce worksite stressors and lower BP.

The Best Intervention for Elevated BP

A 5 mmHg decrease in BP brought about by nonpharmacologic means (such as weight loss) may result in lower risk of heart disease than a comparable fall in BP due to antihypertensive drug treatment. The effect of no longer being exposed to job strain in the Cornell AmBP Worksite Study was comparable in magnitude to losing more than 40 pounds. However, the effort needed for large numbers of working people to successfully achieve this goal is daunting indeed! These findings support the potential benefit of a public health approach. Workplace interventions to reduce or prevent job stress (e.g., increased job control to reduce job strain) should receive priority as an important preventive and therapeutic modality for individual workers and, probably most importantly, for groups of workers. Nonpharmacological interventions (such as weight reduction) to lower BP are recommended for individuals with mild elevations of BP, while treatment with medications is reserved for those who have developed sustained hypertension.

There are a number of possible worksite interventions to reduce psychosocial stressors, such as job strain, associated with increased BP. It is feasible to intervene at the worksite on each or all of the key dimensions that constitute iso-strain (demands, control, and support).

First, workload demands can be limited by, for example, attenuation of time pressure and more realistic deadlines and caseloads. As conflict is an important component of the Karasek demand scale, clarifying roles and diminishing conflicting instructions may result in lowered perceived demands by an employee. Note that when people report working hard, they often are referring to excessive work hours; thus, interventions to limit the length of the work week, and work day as well as increase work breaks may reduce reports of psychological demand.

Second, decision latitude can be increased—for example, through training to increase skills, or by providing workers with enhanced authority over their work.

Third, social support can be increased in a number of ways, including improved supervisory techniques and group activities. Most importantly, efforts to promote collective work activities should be maximized. A consequence of enhanced collectivity is usually an increased sense of empowerment, which impacts favorably on decision latitude.

In addition, while other identified work stressors have not been examined here, a number of work related psychosocial variables, such as effort-reward imbalance, are amenable to change (see Chapter 2).

Discussion and Conclusions

Readers of this article may reasonably point to a great need for additional evidence that reducing job strain leads to lowered BP, and assert that an intervention trial should be conducted. This author concurs that a high priority should be given to further validating the role of job strain and other psychosocial stressors in causing hypertension and CVD and in determining that changes in these risk factors result in improved health and cardiovascular status (see Chapter 13 for a further discussion of interventions).

However, while intervention studies are highly desirable in establishing causal relationships, from a public health perspective they are not believed absolutely essential before acting to reduce an exposure believed harmful to the public (e.g.,

cigarettes and lung cancer).[92] This is especially true if the benefits from an intervention greatly outweigh any possible harm. Assessments of harm must include the potential negative impact on both the individual and the workplace, with the latter including an assessment of the *social costs* of workplace change as well as the economic impact on the company. In addition, much of the economic costs of work-induced CVD have been transferred from business to society (an externality of costs), as illnesses become particularly burdensome after employees retire from work. These costs need to be included in any cost-benefit analysis.

The lack of definitive evidence regarding the benefits of reducing job strain on hypertension should not deter individuals, especially clinicians, in a position to effect changes at the workplace from doing so, for the following reasons:

- Reducing work stress (e.g., job strain) may lower BP and reduce risk for heart attack.
- Lowering work stress has a number of potentially salutary effects on employees (e.g., improved mental status).
- Work reorganization may prove cost effective as a means of controlling CVD. The costs of interventions that enhance decision latitude, reduce demands, and increase social support should prove less expensive and more effective in the long run as a means of reducing cardiovascular risk than current medical and drug treatments or other interventions (e.g., weight loss for BP control).
- Employers gain twofold from work reorganization, first through a healthier work force and second because reducing work stress frequently leads to greater job productivity and job satisfaction for employees.
- Most importantly, it is unethical to withhold an effective intervention.

The recent exciting discovery that work stress (e.g., job strain) is an important risk factor for hypertension and CVD and, most importantly, that a reduction of job strain is associated with a substantial reduction in BP opens the door to possible interventions at the workplace aimed at reducing work stress and thereby lowering BP or preventing its increase. The critical question becomes—Do we have enough evidence to justify initiating these interventions? We need not wait for definitive evidence of the causal role of job strain. Both the employee and the employer stand to gain from interventions. The reduction of work stress promises wide-ranging benefits to individuals in the form of better CVD health, improved mental status, greater job satisfaction, and more energy for the rest of their lives. For companies the initial economic costs will be offset in the long run by reduced medical costs and a healthier, more productive workforce. A win-win situation, if there ever was one.

THE CLINICIAN'S ROLE *by Samuel Melamed, PhD, and Paul Froom, MD*

Evidence from well-designed, methodologically rigorous studies points to the effectiveness of worksite-based intervention targeted to modify risk behaviors, reducing physiological CV risk factors.[39,61,71,83,114] However, evidence that such interventions subsequently lower CV morbidity and mortality is limited, based on relatively old studies, and contradictory.[6,51,91]

Worksites have become increasingly attractive points for such interventions for a number or reasons: (1) many adults who would not otherwise seek out risk reduction service through traditional healthcare outlets can be reached repeatedly and at relatively low cost; (2) the convenience of preventive services offered at the

worksite, even on work time, may increase participation rate; (3) environmental factors (e.g., cafeteria food choices and no-smoking policies) and social support of coworkers are likely to increase the effectiveness of worksite health promotion and disease prevention programs; and (4) employers assume that such programs offset their cost in reduced medical expenditures.[83]

The conduction of worksite CV risk management interventions is supported by senior management and decision makers for a variety of reasons, including enhanced moral and company image, productivity improvement, and yield for health and medical care cost containment. Clinicians (e.g., company physicians and nurses, medical consultants, occupational health physicians and nurses) often are consulted and may be advocates for the disease prevention effectiveness of such programs. Furthermore, ample evidence suggests that program effects are more likely to be maintained if the worksite continues to support and reinforce employee risk reductions. Thus, continuous input from clinicians is warranted to motivate senior management to institute CV risk management interventions and health promotion programs as an integral part of the fabric and culture of the organization. In addition, clinicians may take an active role in conducting various parts of the worksite intervention, and in the ongoing evaluation of their effectiveness.

Types of Worksite Interventions

Worksite interventions that are designed to reduce CV risk can be roughly classified as primary, secondary, or tertiary in nature, each having different aims. The aim of primary interventions is to reduce the risk factors or to change the nature of the job stressors; the aim of secondary interventions is to alter the ways individuals respond to risks of job stressors; and the aim of tertiary interventions is to heal those who have been traumatized.[41] These interventions may be categorized as health promotion programs; stress management; or alterations of the sources of stress, through job design or organizational change.

HEALTH PROMOTION PROGRAMS

These interventions target both healthy workers (as a way of primary prevention) and employees at risk (secondary prevention). The initial step of such programs frequently is obtaining self reports of risky behaviors through various Health Risk Appraisal (HRA) questionnaires.[3] HRAs often are combined with biometric measures of blood pressure (BP), serum cholesterol (and other lipids), obesity, or aerobic fitness. After participation in the screening, employees typically are given personalized feedback by mail: by forwarding the results to the employee's healthcare provider with consent of the employee; by computerized feedback from the HRAs; and/or by individualized risk reduction counseling.[83]

Experienced practitioners realized over the years that feedback given to employees on the basis of HRAs and medical screening results did not motivate employees to reduce their health risks.[3] Thus, health promotion and disease prevention programs introduced interventions based on theories and models of behavior change and behavior modification techniques to assist employees to make lifestyle changes, gain control of CV risk factors, and maintain those benefits over time.

The majority of health promotion programs target single risk factor reduction or health-promoting behaviors, such as weight control, smoking cessation, nutrition and cholesterol reduction, and fitness exercise. Furthermore, many "workplace" health promotion programs really have nothing to do with the workplace even when located there. They are a form of secondary medical intervention aimed at individuals

with risk factors for some disease (e.g., hypertension). In recent years, however, an increasing number of larger companies have developed and implemented multi-component programs that address multiple CV risk factors. Such programs can meet different needs of different employees. Programs that address multiple risk factors have a greater opportunity of attracting the participation of "high-risk" employees, due to numerous points of access. Furthermore, after employees have successfully managed one risk factor, they may be more motivated and more confident to try to change other behaviors.[39,83]

Multi-component CV risk management interventions vary in scope and intensity. Many include assessment of major risk factors for CVD, with personalized feedback provided to each employee. High-risk employees are referred to their physicians. Opportunities to learn and practice new skills are provided through self-help material and workshops and seminars on nutrition, weight control, and other health-promoting behaviors. Some of the programs incorporate modifications in organizational policy or the physical work environment to facilitate employee behavioral change. Modifications include policies restricting or banning smoking on the work premises, eliminating cigarette vending machines, providing onsite exercise facilities, offering cafeteria food that is lower in fat and calories, and providing financial incentives for risk behavior reduction.

The focus of multi-component programs can be on the entire employee population or on the subset of employees who exhibit elevated risk factors. Several programs use intensive individualized activities that focus on specific factors. It is increasingly clear that programs successful in reducing CV risk include extensive and sustained personal and behavioral counseling by physicians, nurses, and dietitians for high-risk employees. Such personal followup is maintained through the duration of the intervention trials.[39,83] This finding implies that company physicians and nurses could play crucial roles in CV risk management by instituting periodical HRAs along with long-term medical followup and counseling of high-risk employees. Interventions that are designed for high-risk employees can stand alone. However, many experts maintain that designing health promotion activities for other workers and creating a supportive environment can facilitate and contribute to the endurance of intervention effects among high-risk employees.

Stress-Management Interventions

Stress management strategies may be part of comprehensive health promotion programs, but often are conducted by themselves. They are defined as techniques designed to help employees modify their appraisal of stressful situations (secondary prevention) and/or to deal more effectively with symptoms of stress (tertiary intervention). Typically, stress management interventions are prescriptive and person-oriented, such as progressive muscle relaxation, biofeedback, meditation, and cognitive behavioral skill training.[71] Such programs show positive trends in reducing cholesterol levels and lowering BP in normotensives as well as in hypertensive workers. Related outcomes of these programs include desired changes in catecholamine levels (adrenaline and nonadrenaline), plasma rennin, cardiac function, and pulse rate.[71]

Organizational Prevention Strategies

There is a long-standing call to broaden the scope of work-based CV risk prevention programs to include organizational prevention strategies,[20,47,56] and also to include the often-neglected target groups of blue-collar and rank-and-file employees.[20]

Organizational prevention strategies are conceived to be a primary prevention[41,88] and represent preferred approaches to contain the adverse effect of job stress because they focus on reducing or eliminating the sources of the problem (generally referred to as job stressors) in the work environment.[41] The envisaged benefits of organizational prevention strategies are based on the compelling evidence for the association between job stress (including job strain) and risky behaviors such as smoking and lack of physical exercise,[34,40,45,69] elevated ambulatory BP levels,[68,96,97] serum lipid levels,[100,101] and CV disease morbidity and mortality.[96]

A variety of organizational strategies have been developed over the years and are now available for creating healthy organizations and altering the sources of stress at work.[18,47,73,74,88] These strategies include, for example, job redesign, job enrichment, participative management, implementing self regulating teams, Total Quality Management (TQM), and participatory action research. It should be noted, however, that in referring to organizational change, techniques that are potentially salutogenic are not distinguished from those that increase job strain, e.g., lean production. TQM has elements of both, as demonstrated clearly in a recent article on lean production by Landsbergis, Cahill, and Schnall.[54]

Tertiary intervention programs usually are in the form of employee assistance programs (EAPs).[10,13] In practice, tertiary intervention programs are more common in the workplace than primary intervention programs, with secondary intervention programs intermediate in frequency.[73] EAPs are job-based strategies designed to help troubled employees and their families identify problems and resolve them through confidential, short-term, in-house or external counseling (referrals are made for more specialized services and for followup services). EAPs also may offer supervisory training, education and prevention programs, and health promotion activities.

Because of their access to organizations, EAPs have significant potential for reducing stress-related problems. However, for this potential to be realized, EAPs need to incorporate a primary (as well as secondary) intervention component and begin to provide feedback to organizations about stressful work environment factors. Feedback from an EAP in the form of summary statistics (which protect worker confidentiality) permits organizations to pinpoint high-stress departments or areas to establish a starting point for more in-depth intervention efforts.[41]

The outcomes selected to assess the effectiveness of the EAPs are derived from the EAP objectives and usually include the percentage of employees who take up the service, changes in job satisfaction, mental and physical well-being, individual turnover, absenteeism, and job performance. Rigorous and methodologically sound studies to evaluate EAP effectiveness are lacking.

Organizational prevention methods (including EAPs) were designed primarily to attain organizational objectives as well as to improve workers mental and physical well being. To date, only a few studies investigate the impact of these prevention methods on reducing CV risk factors or lowering CV morbidity and mortality. Orth-Gomer, et al. demonstrated that an organizational intervention was associated with an improved lipid profile.[81] Barrios, et al. showed that an "inner quality management" program resulted in increases in contentment, job satisfaction, and communication, and decreases in physical symptoms of stress and of BP levels in hypertensive individuals.[5] Finally, Landsbergis, et al. showed that increase in job decision latitude was associated with smoking cessation.[55]

Evaluation studies are needed to examine the effectiveness of organizational prevention strategies, alone or in combination with traditional health promotion

TABLE 1. Outcomes of Worksite Interventions

Direct Outcomes	Indirect Outcomes
Blood pressure (clinic & ambulatory)	*Costs Reduction*
Serum cholesterol	Health care costs reduced
Body mass index & weight control	Disability costs reduced
Body fat	Workers' compensation costs reduced
Aerobic fitness	Insurance costs reduced
Smoking cessation	*Individual Outcomes*
Heart rate variability	Satisfaction with the intervention
ST changes	Employee morale
Carotid atherosclerosis	Reduction of physical exhaustion and burnout
Metabolic/neuroendocrine parameters	Injury rate
Self-reported symptoms	*Organizational Outcomes*
Overall Health Outcomes	Performance/productivity
Cardiovascular morbidity	Organizational effectiveness
Cardiovascular mortality	Absenteeism, turnover
Total mortality	Improved safety (fewer accidents)

programs, in reducing CV disease risk. There is some evidence that introduction of organizational prevention strategies, such as EAPs, facilitates the adoption of health promotion programs by the workers.[11] Various professionals associated with the occupational health care setting—physicians, nurses, social workers, psychologists, technicians, and physiotherapists—can play a pivotal role in evaluating the outcomes of organizational prevention strategies.

Outcomes of Worksite Intervention Programs

Worksite CV risk reduction programs that increase employees awareness, encourage health-promoting activities, and teach new skills are likely to yield a variety of outcomes that may go beyond reduction of CV risk factors and/or risk for CVD (Table 1). Reviews of the literature suggest that a program must be sustained for a minimum of 1 year to bring about risk reductions among employees. Risk reduction may be maintained for 5 years or more after the program is ended.[39,83] The expected long-term health outcomes of CV risk reduction—reduced morbidity and mortality—has been demonstrated to date only in one study.[51] More long-term followup studies are needed to determine whether such endpoints are achieved.

Senior management/decision makers who might invest in worksite health promotion programs for a clear business purpose expect the favorable changes in employees' health to result in cost reduction outcomes. Other individual and organizational outcomes also are possible. Those most frequently measured are satisfaction with the program and fullfilment of individuals' needs. These outcomes are important since they relate to whether workers will persist in the current program and join future programs. Additional benefits to employees are increased morale and reduction of physical exhaustion, burnout, and injuries. Financial benefits to the company include increased productivity and organizational effectiveness, reduced absenteeism and turnover, and improved safety.

Evaluation of Worksite Intervention Programs

Evaluation of worksite intervention programs is needed to provide scientific evidence that they are successful in achieving their objectives (Table 2). To conduct a high-quality evaluation, the method should be determined to advance—at the stage of designing the intervention program—so that the needed data is collected from the

TABLE 2. Evaluation Criteria for Worksite Interventions

I. Outcome evaluation Short- and long-term effectiveness in changing/modifying risk factors for CVD and/or facilitating health promoting behaviors Impact on overall health outcomes Attaining indirect outcomes	III. Attrition from the sample (e.g., nonresponse to post intervention assessment) IV. Cost outcomes Cost effectiveness Cost savings Cost-benefit analysis
II. Participation rates % completing an initial risk assessment and screening % completing a minimal proportion of the program	

outset. Goetzel provided an excellent description of different types of intervention designs.[32]

The most immediate role that the clinician may play is in the evaluation of the direct medical outcomes. Clinicians should be aware, however, of other facets for evaluating intervention programs (see Table 2), and consider this information when arriving at conclusions concerning program effectiveness. This information is needed if one wishes to explore additional benefits of the intervention programs, to ensure validity of inference made concerning their effectiveness, and to examine various aspects of cost outcomes.

OUTCOME EVALUATION

Basic program effectiveness assessment examines whether or not direct outcomes were attained. Using a proper experimental design, one can test if there was a favorable post-intervention change in biometric measures, risky behaviors, and/or health-promoting behaviors compared to pre-intervention baseline levels; and whether these changes exceeded those that occurred in the comparison groups. The recommended length of followup to detect intervention effect is at least 1 year, although length of followup does not seem to be associated with the strength of study results.[39] Preferably, followup assessment should be performed during the same season as the baseline assessment (12 or 24 months following the baseline study) to avoid the problem of a seasonal effect on the results.

A secular trend for improved health behavior in the general population also needs to be taken into account.[6] An excellent example of the need for a comparison group in the face of secular trends can be found in the study by Johanning, Landsbergis, Geissler, and Karazmann.[44] In this study of the effectiveness of a worksite CV health promotion program among mass transit operators, equal benefits were seen in both intervention and control groups.

Multiple followup assessments are warranted to demonstrate the extent to which early intervention effects are maintained over time. Longer followup periods of 5–12 years are needed to detect a possible impact on overall health outcomes, such as CV morbidity and mortality.[51,91] Experts other than clinicians, such as economic analysts, social science researchers, and statisticians, can be called upon to evaluate whether individual and organizational outcomes (see Table 1) were attained.

Another part of the evaluation process is the assessment and control of factors that threaten the validity of the conclusions. The most notable factors are participation rates and attrition from the sample. Conrad, Conrad, and Walcott-McQuigg discussed sources of threat to the participation rates and internal validity of worksite intervention research.[17]

Participation Rates

Evaluators of worksite intervention programs frequently focus only on changes among active participants, and overlook the problem of self-selection of employees into such programs. In assessing the overall benefit to the workplace, consider the number of nonparticipants, especially of those who may be at an elevated or even high risk. It is important to uncover the participation rates of low-risk and high-risk employees. Two definitions of participation rates are presented in Table 2. The second is considered a more rigorous criterion for participation. For further elaboration on the issues of participation rate see Glasgow, McCaul, and Fisher.[29]

Attrition from the Sample

Attrition from the sample constitutes a serious threat to the internal validity of most intervention studies. There is, for example, a possibility of differential attrition due to high-risk employees dropping out of the study, in which case the effectiveness of the program may be inflated. In some studies, the nonresponse to followup assessments was greater in the intervention conditions, especially in the more intensive interventions, than in the comparison condition.[39,83]

Cost Outcomes

There are three types of assessment of cost outcomes. *Cost effectiveness* refers to the unit cost of providing a service or for achieving a specific health outcome. *Cost savings* refers to a possible reduction in actual medical care costs. *Cost-benefit analysis* compares the savings from a program, compared with the cost of providing that program.[104] Of the three cost outcomes, the one most often examined is cost effectiveness, but even this is restricted to a small proportion of the studies. Usually reported is program effectiveness in reducing cardiac risk (e.g., through hypertension control, lowering serum cholesterol levels and smoking cessation), decreased illness related to absences, cost saving to individuals and to the organization, reduced medical claims, and improved performance and productivity. Estimation of costs needed to evaluate cost effectiveness is complex, and requires consideration and recording of a multitude of parameters. Two studies have provided good examples for calculating cost-effectiveness indices.[24,115]

Cost-savings and cost-benefit analyses are less common, and their expediency has been questioned. As O'Donnel pointed out, businesses may not consider rigorous cost-benefit analyses to be a justifiable investment; such analyses may constitute a significant portion of the total program budget and may not be necessary.[78] Furthermore, besides the logical appeal, it is not totally clear that economic benefits constitute an important motivating factor for businesses to adopt health promotion programs.[112] Economists have suggested that health promotion programs are being oversold as a means of containing business costs.[112] Direct financial benefits of both reduction in medical care costs and absenteeism accrue to the employer only for those individuals with medical benefits through a self-insured plan. There are no direct changes in costs for those enrolled in community-rated health maintenance organizations (HMOs) or fully insured plans.[38] Note, too, that health care costs tend to be distributed unevenly, and a small percentage of employees incur the largest percentage of medical costs.[49] Moreover, costs may manifest most strongly in later years of life after active employees have retired.[83]

In a disease with long latency, such as heart disease, it is difficult to demonstrate reduction on morbidity and mortality resulting from prevention programs. The

expected benefit may take 30–40 years to realize in the 20-year-old worker and at least 10 years in the middle-aged worker. However, CVD prevention programs may lead to worker perceptions that their company is benevolent and looking out for their interests. This might lead to substantial and immediate financial benefits to the employer by increased productivity, decreased accident costs, and lowered absenteeism. In fact, Patton argues that the impact of health promotion on productivity is the major economic benefit to the firm.[82] Other potential benefits include decreased worker turnover and enhanced ability to recruit workers.[38]

Changes in workforce size and composition as a result of turnover and changes in medical benefit plans affect costs.[83] In the dynamic, modern workplace, short-term employment is not uncommon; for example, with 15% annual turnover, 50% of the population will leave in 3 years.[38] Long-term morbidity might be an issue. Furthermore, if sick workers are not replaced or if productivity is maintained with a replacement paid by insurance, then the employer may not be concerned with the absenteeism rate or even the accident rate. In other words, improving worker's health may not translate into a cost benefit for the employer. On the other hand, firms with low employee turnover, high costs to replace or substitute an employee, and an older employee population enjoying a rich medical plan are most likely to realize economic gains from worksite health promotion.[82]

A Wider Perspective

Health promotion programs should be conceived by clinicians and others to cover first and foremost worker health, but also organizational wellness. Such programs may maximize the benefits to workers and employers alike, both in the short and long term. The physician minimizes costs from a "public health" perspective (both economic and human) by treating the sick, preventing the well from becoming sick, and creating an environment in which wellness can flourish. As Cartwright, Cooper, and Murphy state: "Organizational health can be measured in a variety of ways other than by an analysis of the profit and loss account. Profitability is a clear indicator of the success and financial health of an organization at a given point of time. However, it is not necessarily a good predictor of future performance, unless account is taken of the ability of the organization and its workforce to continue to sustain and possibly increase that level of performance over time. An automobile may be running perfectly one day, despite a neglectful owner, but it is invariably only a matter of time before a costly breakdown occurs. Similarly, the performance and financial health of an organization is dependent upon the physical and psychological health of its members."[14]

A PUBLIC HEALTH APPROACH IN CLINICAL PRACTICE *by June Fisher, MD and Karen Belkić, MD, PhD*

Increasingly, clinicians are incorporating aspects of cardiac disease prevention into their practices—whether in primary care or cardiology. These efforts predominantly focus on personal behavior for cardiac risk reduction. It is practically unthinkable for a primary care physician or cardiologist not to take a smoking history, weigh the patient, measure the BP, and order a lipid profile. Though most of us are not trained in counseling patients regarding these risk factors, increasingly we are addressing preventive measures with our patients who are at risk. These measures may include pharmacologic agents, for patients with hypertension or lipid abnormalities,

and behavioral changes such as dietary modifications, exercise, and smoking cessation. This broadening of clinical practice to include prevention of CVD is, no doubt, a consequence of the enormous public health campaign—which focuses on individual behavioral change. Ironically, while these efforts have been directed toward the workplace as a major venue to engage large numbers of people, little programmatic effort has been given to the workplace itself as a critical factor in the prevention of CVD. As pointed out by Stokols and colleagues: "These programs have emphasized risk factor reduction strategies (e.g., smoking cessation, stress management, health risk appraisal) but have not integrated disease prevention and safety programs with organizational policies to enhance the physical and social quality of the workplace."[103]

How can the clinician integrate this broader perspective into actual practice? A first and most critical step in a public health approach is to consider how the workplace could affect patients' cardiovascular (as well as overall) well-being. Taking an occupational history as it relates to the cardiovascular system is essential for all cardiovascular patients (see Chapter 8). If the history suggests that the workplace is cardionoxious, the clinical event in question should be evaluated as a potential cardiovascular sentinel event. This knowledge is indispensible for managing individual patients in a cardionoxious workplace. The next challenge is for clinicians to proactively contribute, from their unique vantage point, toward efforts to create healthy work conditions, as a key component of effective prevention.

Risk Factor Reduction and the Cardionoxious Workplace: Where Is the "Leverage Point"?

The worksite increasingly has become a key site of health promotion efforts, with implicit and often explicit focus on CV risk.[26,28,30,33,58] However, researchers have emphasized the need to incorporate a "social ecological" strategy, in which supportive environmental conditions are created to bolster individual efforts to improve their own health.[102] Similarly, Link and Phelan emphasize the importance of the social context in which individual risk factors occur.[62] These authors note that "proximate causes" of disease such as poor diet, high cholesterol, and lack of exercise, have been the major arena of epidemiologic study, while the "more distal" underlying social factors have received relatively little attention. Kok and colleagues emphasize that to be successful, the focus of risk factor modification efforts should be on the determinants of an unhealthy behavior for a given target group.[50]

Cartwright, Cooper, and Murphy apply these concepts directly to the workplace, noting that focusing on the outcome or "back-end" of the stress process offers damage limitation, but does not address the sources of stress in the organizational structure, nor the nature of the workplace.[14] Donaldson criticizes the current paradigm in worksite health promotion as failing "to consider the system of work in which employee behavior is embedded."[21] A small but emerging body of observational and controlled interventional data supports this idea, suggesting that increasing decision latitude and eliminating rapidly rotating shift work and other cardio-deleterious work stressors may be associated with favorable modification of cardiac risk factors such as smoking and hyperlipidemia.[55,80,81]

These principles also are illustrated in our own experience, as clinicians seeking to lower standard cardiac risk factors among patients with various degrees of CVD severity who work in cardionoxious jobs—most notably, professional drivers. The importance of the active role of the physician in smoking cessation efforts is well-recognized.[31,79] However, we found that despite devotion of substantial time

and the use of state-of-the-art methods, our efforts among professional drivers were only minimally effective—particularly with regard to this critical cardiac risk factor—unless there was a concomitant amelioration in stressful working conditions.[7,108] Thus, we concluded: "There is a lack of attention to interventions at the workplace which could attenuate cardiac risk . . . Effective primary prevention in professional drivers requires a three-pronged approach aimed at modifiable occupational, as well as behavioral and standard risk factors."[8]

These findings were particularly important in relation to patients with advanced CVD, as well as those with highest overall cardiac risk. All of the (albeit small) groups of professional drivers who had suffered an acute cardiac event and were still smoking, and/or those who were heavy smokers (> 30 cigarettes/day), continued to smoke with the same intensity or more at 6-month followup after the physician-directed smoking cessation session. Awareness, and probably even motivation, were not the problem: nearly all of these very high-risk drivers placed smoking cessation as their first health-related priority in self-generated statements.[7] Similarly, in a cohort of San Francisco urban transit operators, even though smoking cessation was a high priority, and all operators received counseling in this regard at the time of the mandated biennial medical examinations, smoking was found to increase with length of time on the job.[89]

Wells and colleagues note that the "social-ecological approach . . . highlights the importance of high-impact leverage points" to the effectiveness of health promotion efforts.[113] Among professional drivers, our empirical data strongly implicates modifiable factors in the work environment as a "leverage point" with respect to several cardiac risk factors (CRF). Intensity and duration of exposure to this stressful occupation were associated with obesity, as well as smoking intensity. Among the cohort of San Francisco urban transit operators, body mass index (BMI) increased significantly with length of employment, after adjustment for age, race, and gender. With over 20 years on the job, the mean adjusted BMI was 27.9.[90] Multivariate analysis revealed that the total burden of occupational stressors, as assessed using the Occupational Stress Index,[8] was an independent predictor of smoking intensity, and that number of hours of professional driving per day independently predicted BMI among the professional drivers studied in Stockholm.[23] Besides finding that workplace stressors represented important determinants of baseline CRF status, some preliminary data also suggested that change in work conditions may be associated with lowering of CRF among professional drivers. It was concluded that the professional drivers who were the heaviest smokers faced the greatest load from potentially modifiable job stressors (e.g., time pressure, barriers, special hazards, long work hours), and that amelioration of at least some of these appeared to be necessary in efforts toward smoking reduction and cessation.

Further, Emdad and colleagues asserted that "long driving hours mean more sedentary time (and) may . . . trigger overeating. Drivers tend to eat a heavy meal once arriving home after a long workday. Thereafter, due to exhaustion, they often remain sedentary and then fall asleep . . . Breaking this pattern by changing the work schedule, together with dietary instruction, has resulted in notable weight reduction in individual cases."[23] Thus, in addition to intensive efforts aimed at cardiac risk factors, "modification of the work environment, with participation of the drivers themselves in formulating the modifications, would be a needed component of such a preventive intervention."[23]

Worksite health promotion effectiveness also can be improved by specific, concrete actions by the employer. For example, shared company and employee time was

found to be significantly associated with long-term quit rate of worksite smoking cessation programs.[28] Physical activity could be better promoted by providing opportunities (e.g., time for exercise, proximity to the worksite). Specific recommendations have included exercise programs related to the nature of the job demands and carried out during work time, exercise activities for general fitness during breaks, and worksite exercise facilities. Empirical data indicates that social support may be a critical factor in increasing recreational physical activity among professional drivers.[23]

The Occupational Cardiology Paradigm: Acquired CV Disorders as Occupational Sentinel Health Events

There are a myriad of pathways by which work stressors can impact upon the cardiovascular system. The clinician must be on the alert for the occurrence of unexpected patterns or clusters of CVD in the workplace. Historically, in other medical disciplines, the astute clinician often has been the one who identified occupationally associated diseases, with resultant major changes in the work environment. A classic example is that of Dr. Irving Selikoff and colleagues in the relation between asbestos exposure and mesothelioma, as well as pulmonary interstitial fibrosis (asbestosis).

In contrast, cardiologists typically have not been the ones to herald the occurrence of clusters of workplace-related CVD, probably because CVD is so common. The multifactorial nature of CVD, the difficulty of evaluating psychosocial factors, and the relatively scant attention paid to the relevant occupational factors in the cardiologic literature are other major reasons why occupational cardiology remains, at best, only an incipient clinical discipline.

The concept of an *occupational sentinel health event* must be incorporated into the realm of cardiology. Markowitz cogently summarizes the fundamental role of the clinician for the implementation of the concept:

> *The occupational sentinel health event concept conveys three important and related notions. First, it is useful as a heuristic device to allow health care providers and public health authorities to sort through health events of individuals and populations to determine* a priori *which health events and patterns of health events are most likely to be caused by occupational factors, given current knowledge. Second, the sentinel health events concept transforms the health problems of individuals into the potential health problems of populations. To recognize the diagnosis of an occupational disease in an individual as a sentinel health event facilitates the identification of others at the workplace who are also ill or who may become ill if exposure continues. Third, the occurrence of a sentinel health event may signify the failure of a system to control known occupational hazards and thereby to prevent cases of unnecessary occupational disease.*[65]

Mullan and Murthy provided a list of 64 diseases or conditions which could be considered as occupational sentinel health events.[70] It was based on a survey of the published literature in which documentation was required concerning the etiologic agent and the occupations, industries, and/or processes which involve the noxious agent. Surprisingly, cardiovascular diagnoses are not on the list! Given the large body of data concerning the workplace and CVD, there is an urgent need to rectify the situation by systematic consideration of the multifaceted contribution of the workplace to CVD.

Invaluable clues concerning occupational sentinel health events often can be obtained from individual workers. Questions in the occupational cardiology history

could include: Have you heard about a large number of your coworkers having high blood pressure, high lipid levels, or serious heart disease? Have you heard about very young coworkers developing these conditions? Queries should be made about exposure of coworkers to cardionoxious workplace factors. The scope might be broadened to include inquiries about large numbers of workers complaining of fatigue, being on sick-leave, or manifesting other nonspecific clues of exposure to cardionoxious work. It also might be illuminating to ask about relevant disorders of other organ systems; for example, musculoskeletal disorders may be repetitive motion injuries—manifestations of short-cycle, high-strain work. If these indicators suggest that a cardiovascular sentinel health event is present, a systematic followup should be triggered.

Occupational Cardiology in the Primary Care Setting: Strategies and Barriers

A suggested approach for an occupational cardiology work-up is presented in Chapter 8, with a series of strongly recommended steps as well as minimal requirements. Each of these suggestions was justified on the basis of current scientific knowledge. However, a substantial gap exists between this new diagnostic/therapeutic paradigm and established cardiologic practice. The pressing question then becomes how, in practice, to implement this paradigm, particularly within the primary care setting (Fig. 1).

Once a cardionoxious workplace is suspected, there are a number of resource persons with whom to work. An excellent resource may be a cardiologist or other clinician who sees many people from the same worksite as a result of contractual relations with the employer or the health insurer, and who has an interest in primary intervention. Besides the primary cardiology clinician, resource professionals can include: occupational health clinicians, work-stress environment specialists, industrial hygienists, and epidemiologists.

This team should work with key participants in the workplace, i.e., labor and management, in the process of hazard recognition and control. The concepts and

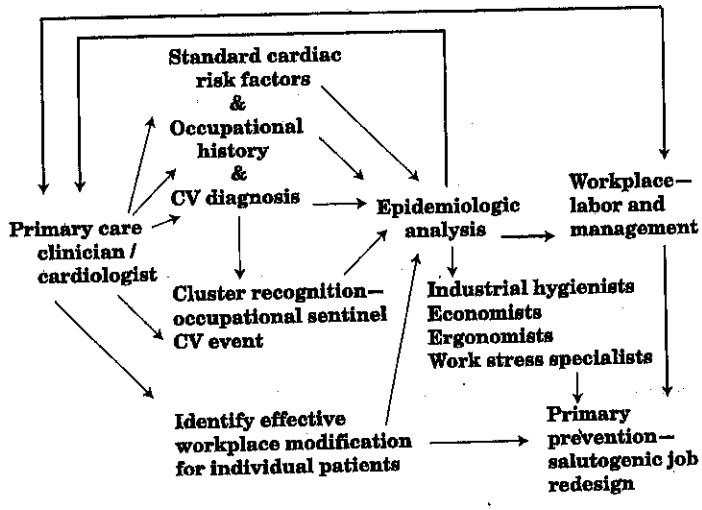

FIGURE 1. Occupational cardiology in a primary care setting: a public health approach.

core methodology of Participatory Action Research (PAR) provide an excellent framework for this process.[22,99] Fundamentally, "the strategy involves a cyclical process of reflection and action in which the stakeholders (a) identify aspects of the system that they wish to change, (b) analyze 'causes' of system dysfunction, develop and implement action plans, and create a plan to evaluate the effects of their actions."[99] This PAR approach would be integrated with job-related monitoring of workers' health,[47] for which the clinician's role would be of paramount importance.

Some of the major barriers to implementation include: lack of training and skills in occupational health; time limitations of clinical practice; lack of access to the workplace/noncooperative management; fear on the part of management of the occupational relatedness of the CVD and the possibility of workers' compensation proceedings; employee fear of losing their jobs; and clinician reluctance to get involved in possible litigation/depositions. Many of these barriers overlap with those obstructing the implementation of preventive services, in general. Maron and colleagues emphasize the lack of perceived legitimacy of preventive medicine and the concomitant lack of incentives, including reimbursement, as key impediments to the delivery of CVD preventive services.[67]

Educational efforts, starting with structured clinical training in preventive medicine for all medical students and universal availability of combined MD/MPH programs, are critical in the long-term solution.[15] More immediately, moving from an adversarial to a cooperative interaction is essential. The authority of the clinician, whose interest is first and foremost the well-being of his or her patients, can represent a stabilizing force, promoting cooperation among the various participants in the work process (e.g., labor, management, occupational hygienists, engineers, economists).

Besides health maintenance organizations contracting primary care to a specific industry, there are a number of other settings in which an occupational cardiologic paradigm could be realized. These include: regional-geographic clinical care, referrals from coworkers because of the clinician's demonstrated interest in the workplace and CVD, contracts for mandated examinations, workers' compensation examinations, occupational health services, and screening programs (especially hypertension screening). It would be ideal to have primary care facilities for cardionoxious work staffed by clinicians whose interest and expertise is in primary CV medicine, occupational health, and work organization.

The Cardiovascular Safety of the Work Environment: Ethical Considerations

The clinician often is called upon to judge the cardiovascular work fitness of patients. This fitness-for-work assessment could be inappropriately used. The clinician should, by all means, prevent the misuse of these evaluations by the company to select "physiological super-humans" who are resistant to a cardionoxious work environment. Rather, the aim must be to foster a work environment which, *at the very least*, is not harmful to the CV system of the vast majority of persons. Achieving this goal often entails work modification to minimize factors that produce psychosocial and other forms of stress.

A crucial ethical obligation is to avoid iatrogenic disqualification. In particular, the clinician must ensure that the results of physiologic testing, e.g., ambulatory monitoring or laboratory testing of cardionoxious agents, are not misused for the purpose of identifying a "biological elite" and excluding others from the workplace, as a substitute for creating healthier working conditions. These principles are the logical extension of the health professional's basic duty "to protect confidential

health information when dissemination of that information, intentional or inadvertent, can adversely affect an employee's job situation and lead to reassignment, lack of advancement, or even preferential termination.[103]

There are special circumstances (e.g., jobs whose performance may affect public safety) in which the clinician must render an estimation of risk for the occurrence of cardiac or other events which could lead to impaired consciousness (see Chapter 9). Note that many of these jobs carry with them a high cardionoxious potential, as threat-avoidant vigilant work often coupled with numerous other deleterious conditions. One of the most urgent needs is for clinicians, together with occupational ergonomists and other specialists, to have greater influence to recommend and implement cardio-protective guidelines about work conditions for these jobs. The basis for these guidelines would be integrative worksite and laboratory physiologic investigations. The clinician is continually faced with the dilemma of making a judgement about the individual's cardiovascular work fitness, knowing full well that the job *itself* is cardionoxious. A proactive approach offers the possibility of ameliorating this ethical dilemma.

The Clinician as Catalyst for Change and Advocate for Preservation of Healthy Work

The clinician's experience with the efficacy of workplace modifications for individual patients also can be invaluable in a larger context. Clearly effective changes could be extended into the public health realm, informing primary preventive workplace interventions. For example, eliminating split-shifts was associated with lowered blood pressure and behavioral changes such as smoking cessation and weight loss in a patient with borderline hypertension and other signs of the CV metabolic syndrome (see Chapter 8). If this workplace modification repeatedly yielded similar positive results in high-risk patients, a trial of eliminating split-shifts could be recommended. Here, the clinician's experience would be playing a key role in charting the exploration of potentially cardio-salutogenic workplace changes.

Another important proactive role for the clinician is to advocate for the preservation of healthy work in the face of potentially deleterious changes such as downsizing, outsourcing, and new systems of work organization, including lean production, total quality management, or modular manufacturing. Lean production has been associated with increased job demands but only minor changes in skill levels and job decision-making authority, and thus holds the potential for increasing the risk of hypertension and CHD.[54] Outsourcing has been found to be associated with cardio-deleterious catabolic changes in a small, controlled study of bus drivers.[75]

Illustrations: The Authors' Experience

The approach outlined here is grounded, in part, in our own experience as clinicians. The second author (KB) began her interest in occupational cardiology while caring for myocardial infarction (MI) patients in a coronary care unit (CCU): observing that these cardiac events were strikingly frequent among persons with stressful, cardionoxious jobs; facing the frustration of seeing those patients return to the same jobs; and often observing their repeated admission to the CCU within a short interval. These clinical impressions are corroborated by the study of Theorell, et al. demonstrating that return to high-strain work is a powerful predictor of cardiac mortality among young MI patients.[107]

The first author's (JF) research interest in stress and CVD was generated from her activities as an attending physician in internal medicine at San Francisco General

Hospital, where she and her associates performed the biennial medical examinations required by the U.S. Department of Transportation for maintenance of a commercial driver's license. Review of the first month's data suggested that there might be an elevated rate of hypertension among these transit operators. The data was then monitored for a year. Both labor and management felt that the work of a San Francisco transit operator was highly stressful, and this belief was corroborated by the clinicians' on-site observations on the buses and trolleys. Based upon these initial observations and input from labor and management, in collaboration with the University of California Berkeley's Social and Behavioral Epidemiology Program, the Northern California Center for Occupational and Environmental Health, and the Department of Medicine at the University of California, San Francisco, a major study was undertaken to investigate these observations. This study has now developed into a long-term program, not only to identify the impact of work on the operators' health status, but also to make recommendations for improving their work environment. The initial study corroborated the early observations that the transit operators had higher rates of hypertension compared to referent groups of employed persons.

Subsequently, this finding was observed to be highly consistent across various geographic and cultural settings. In-depth "triangular" investigation of the work conditions of these transit operators was undertaken, including objective observation methods to measure the barriers, obstacles, restrictive time bindings, and other stressors of urban transport operators.[35,36] A number of recommendations were made to help guarantee adequate rest time and relieve the heavily burdensome time pressure faced by the transport operators. Using the research findings and recommendations which were regularly reported back to both the company and the union, cable car operators drew up their own plan for changing the work environment. This not only increased rest times between runs, but improved productivity. More recently, these recommendations are being instituted by a joint labor-management committee on one of the most heavily travelled trolley lines. This is a pilot study for what is referred to as the Ambassador program, and will be expanded system wide.[105] A major obstacle has been a larger, political issue directly related to the underfunding of public transportation.

Technical interventions with a similar aim of improving the traffic environment in Stockholm, Sweden provide some encouraging preliminary results: trends toward lowered worksite blood pressure and heart rate levels at followup.[93]

Another result of these efforts is that U.S. Department of Transportation examinations now include an obligatory consideration of hypertension. Unfortunately, however, these do not incorporate evaluation of how hypertension specifically relates to the work environment of professional drivers. This is particularly important with regard to compliance. Hypertensive operators requiring medical treatment generally perceive that their primary care providers lack awareness of the work factors unique to their profession, and this perception hampers adherence to treatment regimens.[27] For example, many of the drivers say that the constraints of the job, e.g., not having rest breaks or easily available rest-room facilities, make them hesitant to take prescribed diuretics. They also report that many of the drugs make them feel less vigilant. This underscores the need to integratively consider the work environment from the inception of any such efforts, and the limitations of a narrowly focused, purely clinical approach.

Overall, despite the many obstacles and difficulties faced along this road, when clinicians expand their horizons to encompass a public health view of the workplace, there is a real chance of improving CV well-being of their patients, and this can be profoundly gratifying.

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Drs. Fisher and Belkić

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