

AN INNER QUALITY APPROACH TO REDUCING STRESS AND IMPROVING PHYSICAL AND EMOTIONAL WELLBEING AT WORK

BOB BARRIOS-CHOPLIN¹, PhD, ROLLIN McCraty^{2*}, MA AND BRUCE CRYER², MA
¹US Naval Postgraduate School Dept of Systems Management, Monterey, California, USA
²Institute of HeartMath, Boulder Creek, California, USA

SUMMARY

This exploratory field study examined the impact of an Inner Quality Management program (IQM) on a group of Motorola employees. IQM is a training program designed to help people increase productivity through improved health, communication, goal clarity, positive mood and job satisfaction, and through the reduction of tension, burnout, physical symptoms of stress and negative mood. Both psychological and physiological measures were assessed in the 6-month study. The study involved three groups: managers, engineers and factory workers. Results showed that contentment, job satisfaction and communication significantly increased after the training, while tension, anxiety, nervousness and physical symptoms of stress significantly decreased. Blood pressure in hypertensive individuals decreased, and there was a reduction in sympathetic nervous activity. Implications for workplace wellbeing are discussed. © 1997 by John Wiley & Sons, Ltd.

Stress Med., 13: 193–201, 1997.

No. of Figures: 0. No. of Tables: 4. No. of Refs: 45.

KEY WORDS — stress; hypertension; heart rate variability; autonomic nervous system; stress management; communication skills; job satisfaction

INTRODUCTION

We know that some level of stress is required to make appropriate responses to environmental stimuli, and even higher levels are sometimes useful for short bursts of increased performance. This article acknowledges those required levels, while focusing on those inappropriate stress responses which can aggregate over time to create dysfunctional mental and physiological consequences. Our thesis is that individuals initiate, and therefore have the potential to control, a major portion of their inappropriate stress responses, including affect, attitudes and physical responses. Many personality variables have been shown to moderate stress responses, including interpretive styles. Little work has been done to determine if these interpretive styles can be changed in a relatively short and inexpensive manner, to the benefit of the individual

and thus to the organization. One approach to changing interpretive styles is training in 'self-management'. This exploratory field study examined the effect of one self-management program, Inner Quality Management, on three groups of Motorola employees.

THE COSTS OF OCCUPATIONAL STRESS

In a 1992 United Nations Report, 'job stress' was cited as 'the 20th-century disease'.¹ In a recent survey, 75 per cent of Americans described their jobs as stressful, with most reporting that the stress they experienced has increased over the past 10 years.² In a 1991 survey of 600 workers, one-third thought about quitting their jobs because of job stress and 14 per cent actually did.³ It is estimated that 60 per cent of all absenteeism from work is caused by stress,⁴ resulting in roughly 1 million persons absent each workday.¹ A recent poll conducted by Lou Harris and Associates found that 89 per cent of all adults, or 158 million Americans, experience what they describe as high

Correspondence to: Rollin McCraty, Institute of HeartMath, 14700 West Park Ave, Boulder Creek, CA 95006, USA. Tel: (408) 338-8727. Fax: (408) 338-1182. E-mail: rollin@heartmath.org

levels of stress. More than half felt 'great stress' at least once or twice a week, while more than one in four reported high levels of stress 'nearly every day.'

Stress leads to thoughts and emotions that influence the autonomic nervous system, the hormonal and the immune systems.⁵ Mental and emotional reactions and inner turmoil produce changes in sympathetic nervous system activity⁶ and stimulate the hypothalamic–pituitary–adrenal axis (hormonal system),⁶ which initiates a cascade of reactions that affect virtually every system in the body, including brain process and perception. Individuals under stress can experience psychological symptoms, such as feelings of anxiety, dissatisfaction, irritability, listlessness and forgetfulness; they can also undergo behavioral changes such as short-tempered behavior, a decrease in productivity and excessive smoking or drinking; or can endure physical reactions, including rapid heartbeat, loss of appetite, fast breathing, tensed muscles and perspiration.⁷ For the organization, the effects of stress are many, and may include high absenteeism — both from work and within work — poor work performance and reduced efficiency and effectiveness, low staff morale and high staff turnover.⁸

American businesses pay the price of workers who suffer from job-related stress. Recent estimates are that job stress costs employers more than \$200 billion a year in absenteeism, tardiness, burn-out, lower productivity, high turnover, workers' compensation and medical insurance costs.¹ This has been estimated by one researcher to represent a cost of \$1700 per employee per year for a medium-sized manufacturing company, and can amount to more than the company's profits.¹⁰ In addition, estimates from the National Institute of Occupational Safety and Health suggest that 60–80 per cent of accidents on the job are stress-related.⁹ In one older study, according to the National Safety Council, workplace accidents cost the United States \$33 billion and resulted in 11,300 deaths and 1.9 million disabling injuries in a single year,¹ and these figures are likely to have increased in recent years.

Dr Paul J. Rosch, President of the American Institute of Stress, reports that 75–90 per cent of all visits to health-care providers result from stress-related disorders.² In 1990, over 40 per cent of people aged 18 and older related experiencing adverse health effects from stress within the past year.¹⁰ The American Heart Association reports

that more than half of all Americans will succumb to heart disease¹¹ and that more than 50 million workdays a year, adding up to \$8 billion, are lost annually to heart-related diseases.¹² Among the nation's top executives, an estimated \$10–20 billion is lost each year through absence, hospitalization and early death, much of it a direct result of stress.¹³

LIMITATIONS OF CURRENT STRESS MANAGEMENT APPROACHES

Again, we want to emphasize that not all stress responses are harmful. Some are useful and necessary and allow us to meet challenges as well as threats. In this article, as in much of the literature and practice, the focus is on potentially harmful, inappropriate stress responses.

Many stress management approaches, such as exercise and fitness programs, time management techniques and nutritional education programs, have been implemented over the past 10–15 years to help people cope with increased stress in the workplace. Although there have been some benefits realized from these programs, they have not resulted in the desired outcomes, and the level of stress experienced by workers has continued to rise. While most of the adult population reports experiencing personal or emotional problems in the course of a year, about 50 per cent of these people say that they are unable to solve their problems and about one-third state that they are unable to do anything to make their problems more bearable.¹⁰ The main limitation of most stress management approaches now in use is that while helpful, they do not provide a means to reduce or prevent stress in the moment that it occurs.

Dr Graham Burrows, President of the International Society for Investigation of Stress, has proposed that people's experience of stress results primarily from problems in perception and problems in communication.¹⁴ It is how an individual perceives and reacts to an event that determines whether or not the stress response is activated. The inability to communicate effectively with others underlies much of the stressful emotional turmoil that people experience. If employees are not taught methods which allow them to self-manage their perceptions and learn effective and efficient communication skills, the stress response continues and compounds, and can eventually lead to disease or burnout.^{15,16}

A NEW FOCUS ON STRESS PREVENTION VERSUS STRESS MANAGEMENT

Many authors have asserted that a person's 'world view' influences the amount and intensity of felt stress and emotion. Coming from various disciplines, these theories have different terms and foci, but a unifying principle is that individuals perceive stressors differently, based on certain dispositions, traits, perceptual tendencies and interpretive styles. One such disposition has been termed hardiness, composed of the qualities of commitment to self, an attitude of vigorousness towards the environment, a sense of meaningfulness and an internal locus of control. Kobasa found that highly stressed executives who were also high in hardiness experienced less illness than counterparts who were low in hardiness.¹⁷ Using a later formulation of hardiness as commitment, control and challenge, a significant correlation between increased hardiness and reduced illness was found.¹⁸ Another world view which has received some attention as a moderator of stress and affect is perceived control, or locus of control. In one study of working parents, perceived task control was positively related to elation and calmness and negatively related to stress.¹⁹ Further, in a study of female clerical workers, it was found that increased perceived control buffered the effects of stress on their health.²⁰

A third world view has been termed sense of coherence (SOC). Antonovsky asserts that one's construction of reality affects coping and health.²¹ He states that stressors can be perceived as negative, positive, neutral or irrelevant. Persons with strong SOC would appraise potential stressors as more positive or less threatening, and would have more effective coping behaviors in the face of negative stressors, while tending to ignore irrelevant and neutral stressors. Further, Lazarus mentions several other world views which might create a resilience to stressors, such as constructive thinking, hope, learned resourcefulness, optimism and self-efficacy.²²

A fourth world view predicted to moderate stress is interpretive style.^{23,24} Since this construct has recently been linked to organizational stress, it will be the term used in this article. Thomas and Tymon in their *Stress Resiliency Profile* identify three interpretive styles which they predict will influence job-related stress.²³ They are: deficiency focusing ('the habit of focusing upon the negatives at the expense of the positives'); low skill recognition

('a tendency for us not to recognize the role of our own abilities in producing our successes'); and necessitating ('when we think that it is necessary or imperative that we do something'). In two studies of 142 part-time MBA students and 408 project engineers, they found that deficiency focusing, low skill recognition and necessitating all predicted greater negative stress symptoms.²⁴

Implicit in these theories is a model of the stress process. In this model, potential stressors exist in the environment (including past and future events). These potential stressors interact with one's world view to produce an appraisal of the stressor. The appraisal results in a judgement of threat (or harm), challenge (or gain), neutrality or irrelevance. The valence and import assigned to the stressor by the appraisal triggers physiological and affective responses, which in turn influence behavior and health, moderated by coping actions.

If one accepts this model, the path to improved workplace wellbeing and productivity is through possessing, or acquiring, an interpretive style that minimizes negative emotion and inappropriate stress and maximizes positive emotion and communication.

THE STRESS PREVENTION INTERVENTION

The Inner Quality Management program as developed by the Institute of HeartMath consists of four training modules delivered over 1 day's time: (1) Freeze-Frame²⁵ (changing interpretive styles to affect mood and stress); (2) Intuitive Communication (enhancing communication and goal clarity); (3) Power Tools for Inner Quality (creating a caring culture and job satisfaction); and (4) Quantum Management (operationalizing the above tools day to day).

Freeze-Frame is a tool designed to revise people's interpretive style so they may effectively deal with stressors in the moment an inappropriate stress response is recognized, or, with practice, prevent the inappropriate stress response altogether. Briefly stated, the technique instructs people to consciously disengage from negative mental and emotional reactions as they occur by shifting their attention to the area of the heart and self-generating a sincere positive feeling state, such as appreciation or caring. The primary physiological advantage is that the body does not go into the normal destructive response of a tense moment,

thus stopping the wear and tear on the body and psyche. As a result of using Freeze-Frame, the person can think more clearly and achieve a constructive evaluation of how to handle the situation in an energy-efficient way. The Freeze-Frame technique has been shown consistently to produce improvements in autonomic nervous system balance in both normal individuals and subjects with a number of pathological states.^{5,26}

A previous study using the Freeze-Frame technique in a psychological intervention program resulted in significant reductions in life stress, state and trait anxiety levels and self-assessed physical symptoms in a group of 24 HIV-positive individuals.²⁷ Two other studies with healthy individuals using the Freeze-Frame technique to enhance positive emotional states showed increased salivary IgA levels⁵ and increased sympathovagal balance.²⁸ Increased sympathovagal balance is known to protect the heart against detrimental physiological effects associated with overactive sympathetic outflow from the brain.²⁹

The Intuitive Communication module is intended to provide practical tools which enhance communication between co-workers and improve goal clarity. As mentioned, one of two main sources of stress involves communication issues. Lack of good communication between co-workers and between managers and the workforce is often the source of much of the emotional inner turmoil that preoccupies one's thought processes. This often leads to feelings of hostility, mistrust and separation between team members and has a negative impact on productivity, team work and creativity.

Often it is difficult to hear others because we are preoccupied with our own internal thought processes. The Intuitive Listening tool teaches the importance of stopping one's inner dialogue while listening to the essence of a communication from someone else.

HYPOTHESES

Hypothesis 1. Contentment, happiness, care for others, communication, goal clarity and job satisfaction will increase from time 1 (before the training) to time 2 (after the training).

Hypothesis 2. Tension, anger, burnout, nervousness, anxiety and physical symptoms of stress will decrease from time 1 to time 2.

Hypothesis 3. Blood pressure in hypertensive individuals will decrease from time 1 to time 2.

Hypothesis 4. Stress reduction will result in lowered resting autonomic activity, as evidenced by changes in heart rate variability from time 1 to time 2, indicating a calmer baseline emotional state.

METHODS

Participants

The participants were 48 employees selected by the company, consisting of nine executives (group 1), nine software engineers (group 2) and 30 factory workers (group 3). The mean age was 42, with an age range of 21–68.

Data collection

All groups completed a 58-item questionnaire (see below for details) just prior to the training sessions. Groups 1 and 2 completed the same questionnaire 6 months after the training. Group 3 completed the same questionnaire 3 months after the training, due to the company's desire to complete the project.

Groups 1 and 2 had blood pressure and ECG readings recorded at the same two times they completed the questionnaire. (The researchers were not able to record these physiological measures for group 3, as the factory workers were not made available by management at the needed time.) All participants were instructed to practise the IQM techniques daily for the period of the study.

MEASURES

Psychological measures

Pertinent literature was considered when selecting psychological measures. Well-established instruments measuring one construct (such as stress) had to be rejected due to their length and the need to measure a total of 12 constructs which were predicted to be affected by the training. There were also practical limits on the amount of employee time available to complete the questionnaires. Therefore, three- to six-item scales were used to measure most constructs of interest.

The survey instrument had 58 items scaled to represent 12 constructs. The instrument was titled 'Personal Opinion Survey' (POS). Measures of affect followed the two-factor mood structure described by Watson and Tellegen.³⁰ Scales were formed after reliability analysis as

follows: happiness (elated, happy, joyous, $\alpha = 0.84$); contentment (peaceful, calm, relaxed, $\alpha = 0.77$); burnout (burned out, fatigued, exhausted, $\alpha = 0.88$); and the individual items of nervous, tense, anxious and anger.

Job satisfaction was measured with six items, e.g. 'I like working here' and 'I think about leaving my job within a year', $\alpha = 0.83$. Goal clarity was measured with four items, e.g. 'Our group members are working toward the same goal', $\alpha = 0.72$.

The construct of stress was measured with six physical symptom items, e.g. 'I experience rapid heartbeats due to stress', 'I experience heartburn due to stress'. The construct of communication was measured with 12 items, e.g. 'My supervisor and I communicate well with each other', 'Our meetings at work are well organized', $\alpha = 0.87$. The construct of care was measured by six items, e.g. 'I treat my co-workers with kindness', 'My relationship with co-workers is harmonious', $\alpha = 0.85$.

The stem for the above items was, 'Below are words and statements that describe the way people sometimes feel. For each item below, please circle the number that reflects how frequently you feel that way'. There were seven possible answers, ranging from never (1) to always (7).

Heart rate variability measures

The time interval between heartbeats is always changing. Heart rate variability (HRV), derived from the electrocardiogram (ECG), is a measurement of these beat-to-beat changes in heart rate. The interaction of sympathetic and parasympathetic nervous system signals from the brain to the heart and the feedback signals from the baroreceptor system to the brain result in these beat-to-beat changes. Heart rhythms are influenced by emotions, thoughts and physical exercise. These changing rhythms affect not only the heart but also the brain's ability to process information, including decision-making, problem-solving and creativity. Heart rhythms have been shown to affect the brain's cortical activity through the baroreceptor pathway,³¹ and previous research has introduced the terms 'cortical inhibition' and 'cortical facilitation' to describe the effects of different heart rhythm patterns on cortical functions.³² States of negative emotion, such as anger or frustration, produce disordered heart rhythms,³³ which may inhibit certain aspects of cortical function.

The mathematical transformation (fast Fourier transforms) of the HRV data into power spectral

density (PSD) is used to discriminate and quantify sympathetic and parasympathetic activity and total autonomic nervous system (ANS) activity. The HRV power spectrum is divided into two frequency ranges, LF (0.04–0.15 Hz), which is an index of sympathetic activity and resonance in the baroreflex loop, and HF (0.15–0.4 Hz), which is primarily parasympathetic activity.^{34,35}

It has been shown in a number of studies that during mental or emotional stress, there is an increase in sympathetic activity and a decrease in parasympathetic activity.^{36–39} This results in increased strain on the heart and on the immune and hormonal systems. A recent study from the Institute of HeartMath's laboratory using PSD analysis of HRV has shown that simply recalling feelings of anger significantly increases sympathetic outflow to the heart, in contrast to feelings of appreciation, which decrease sympathetic and increase parasympathetic outflow.²⁸ Increased sympathetic activity is associated with a lower ventricular fibrillation threshold and an increased risk of fibrillation,³⁸ in contrast to increased parasympathetic activity, which protects the heart.²⁹ These findings may explain why mental and emotional stress can predict the risk of sudden cardiac death following acute myocardial infarction⁴⁰ as well as the development of hypertension.^{41,42} For an expanded understanding of these measures, see reference 43.

Blood pressure measures

A recent study has confirmed that 28 per cent of the American adult population has high blood pressure, or hypertension.⁴⁴ As previously mentioned, hypertension is the leading risk factor for the development of heart disease and stroke. Stress and increased blood pressure (BP) have often been correlated. Much stress is of psychological origin and due to emotional arousal. The mechanisms by which anger, helplessness or a loss of control and security exert their various autonomic and neuroendocrine effects can result in increased blood pressure.⁴⁵

In this study there were four blood pressure readings taken by a certified medical technologist on each of the two measurement days (recorded at the same time the participants completed the Personal Opinion Survey). The first measurement was taken when the participant arrived at the recording location. The second was taken after sitting still for 5 minutes and thinking only

Table 1 — Means and standard deviations for the pre/post IQM training for the managers and engineers group (groups 1 and 2)

	Pre	SD	Post	SD	<i>t</i>	<i>df</i>	<i>p</i> <
Contentment	3.86	(0.98)	4.52	(1.00)	-2.80	17	0.05
Happiness	3.65	(0.72)	3.74	(0.81)	-0.44	17	NS
Care	5.60	(0.45)	5.72	(0.58)	-1.01	17	NS
Nervousness	2.94	(0.73)	2.39	(0.70)	3.83	17	0.001
Tension	3.35	(1.06)	3.00	(1.06)	1.10	16	NS
Anxiety	3.33	(1.19)	3.11	(1.28)	1.29	17	NS
Burnout	3.12	(0.85)	2.72	(1.11)	1.58	17	NS
Angry	2.44	(0.71)	2.17	(0.71)	1.76	17	NS
Physical stress	2.33	(0.93)	1.96	(0.60)	2.52	17	0.05
Communication	4.79	(0.58)	4.97	(0.67)	-1.72	17	NS
Goal clarity	5.11	(0.72)	5.31	(0.62)	-1.09	17	NS
Job satisfaction	5.87	(0.69)	5.31	(0.90)	1.86	17	NS

neutral (non-stressful) thoughts. The third was obtained after the subject sat for 5 minutes thinking about stressful situations in their work environment. The fourth was taken following a 5 minute period in which participants practised the stress reduction technique they used to relax or reduce their stress. In the pre-IQM training (baseline) recordings, some participants used deep breathing techniques, meditation or prayer. At the 6-month measurement points, the stress reduction technique utilized was the Freeze-Frame technique, which they had learned as part of the IQM training.

RESULTS

In this study a *p*-value of <0.05 was considered significant. Due to different time lapses between interventions and the end of the study, groups 1 and 2 were analyzed together (after 6 months), while group 3 was analyzed separately (after 3 months).

Psychological measures

The baseline scores obtained from the Personal Opinion Surveys between the two groups were analyzed for differences using single-factor ANOVA. The groups were significantly different in only three of the 12 constructs measured. The factory workers scored significantly higher in happiness ($F = 0.035$) than the managers and engineers. The managers and engineers

scored significantly higher in communication ($F = 0.0014$) and job satisfaction ($F = 0.0062$) than the factory workers.

The data obtained from the Personal Opinion Surveys were analyzed for pre/post training differences using paired sample *t*-tests.

Table 1 contains the pre/post IQM training results from the survey instrument for the managers and engineers group (groups 1 and 2).

Hypothesis 1 was partially supported. There was a significant increase in contentment.

Hypothesis 2 was partially supported. There were significant decreases in nervousness and the physical symptoms of stress.

Table 2 contains the pre/post IQM training results from the survey instrument for the factory workers (group 3).

Hypothesis 1 was partially supported. There were significant increases in communication and job satisfaction.

Hypothesis 2 was partially supported. There were significant decreases in tension and anxiety.

While not always achieving significance, the changes in all means from time 1 to time 2 were always in the predicted direction.

Blood pressure results

Hypothesis 3 was supported. Analysis of the baseline blood pressure data revealed that, of the 18 participants comprising groups 1 and 2, two were classified as stage 2 hypertensive and three as stage 1 hypertensive. This number of participants with hypertension ($N = 5$) equaled 28 per cent of the sample, which corresponds to the

Table 2 — Means and standard deviations for the pre/post IQM training for the factory workers group (group 3)

	Pre	SD	Post	SD	<i>t</i>	<i>df</i>	<i>p</i> <
Contentment	4.31	(1.27)	4.43	(1.09)	-0.52	29	NS
Happiness	4.38	(1.22)	4.66	(1.29)	-1.31	29	NS
Care	5.05	(1.18)	5.42	(1.04)	-1.80	29	NS
Nervousness	3.03	(1.25)	2.70	(0.92)	1.38	29	NS
Tension	3.27	(1.23)	2.57	(0.68)	2.57	29	0.05
Anxiety	3.48	(1.41)	2.97	(1.05)	2.10	28	0.05
Burnout	3.41	(1.19)	3.06	(1.13)	1.59	29	NS
Angry	2.50	(0.63)	2.33	(0.61)	1.54	29	NS
Physical stress	2.69	(1.37)	2.43	(1.10)	1.23	29	NS
Communication	3.98	(0.76)	4.34	(0.98)	-2.49	29	0.05
Goal clarity	4.65	(1.05)	4.99	(1.01)	-1.54	29	NS
Job satisfaction	4.97	(1.31)	5.61	(1.03)	-2.46	29	0.05

national average of 28 per cent of the population. None of these participants was being treated by a doctor or taking any medications to control hypertension.

Table 3 shows the blood pressure readings from these individuals at the beginning and end of the study. Of the five participants classified as hypertensive at the beginning of the study, four had reduced their systolic BP (mean 18.5 mm-g) and diastolic BP (mean 9 mm-g). At the end of the 6-month period, all of the participants were classified as either normal or high normal. Table 3 also shows the further reductions in BP that these participants were able to achieve when they used the Freeze-Frame technique after taking a resting BP reading.

Heart rate variability results

The raw data baseline values to post-IQM training values were analyzed for significance by using the Wilcoxon signed rank test (*t*) employing the sum of the ranks for positive and negative differences for each group.

Hypothesis 4 was supported. The power spectral density (PSD) analysis of the HRV data results is presented in Table 4.

Table 3 — Blood pressure measurements

Subject	Pre	Post	After Freeze-Frame	Pre/post delta
1	160	137.5	120	-22.5
	98	88	80	-10
2	143	114	115	-29
	76	76	70	0
3	162	138	136	-24
	80	69	65	-11
4	130	130	122	0
	96	87	84	-9
5	139	122	119	-17
	94	79	78	-15
<i>Mean results</i>				
Systolic	146.8	128.3	122.4	-18.5
Diastolic	88.8	79.8	75.4	-9

There was not a significant change in HF (parasympathetic) power. However, there was a significant decrease in total power and heart rate standard deviation, indicating a reduction in resting autonomic activity.

Table 4 — HRV measurements: means and standard deviations

	Pre	(SD)	Post	(SD)	<i>z</i>	<i>p</i> <
HR (bpm)	74.57	(9.31)	71.95	(12.39)	1.35	NS
SD (msec)	72.29	(33.31)	60.85	(19.53)	2.42	0.05
LF	0.039	(0.04)	0.01	(0.01)	1.79	NS
HF	0.018	(0.02)	0.015	(0.01)	1.60	NS
Total power	0.097	(0.10)	0.060	(0.03)	2.17	0.05

DISCUSSION

Taken together, the results of this study are encouraging for identifying inexpensive, on-call stress prevention tools which could enhance workplace health and productivity. The results show that the IQM program was successful in increasing certain groups' contentment, job satisfaction and communication. Also, certain groups reported lower levels of tension, anxiety, nervousness and physical stress. The fact that all the formerly hypertensive participants in this study were able to ameliorate this condition by learning and practising tools to manage their stress is dramatic and encouraging. In addition, the reduction in subjects' resting autonomic activity further supports the psychological measures, suggesting a shift in their baseline emotional state to one of decreased tension and anxiety. The fact that improvements in the physical symptoms of stress combined with reductions in blood pressure and decreased resting autonomic activity occurred as a result of a self-management intervention illustrates the profound impact that stress can have on our physiology and work performance. By teaching the participants how to manage their perceptions to control their emotional turmoil, the source of stress was concurrently managed.

While there are many advantages to field studies, there are several drawbacks which indicate care should be taken in interpreting results. First, we did not have a control or comparison group, as the company was interested in training, not lack of training. Many events in addition to the IQM training could have affected participants in the 3–6 months from the first training to the end of the study. Our only control over this threat was post-study interviews with supervisors of the three groups. They all stated they were not aware of any internal or external events that would have significantly influenced the groups' responses.

The results of this study are encouraging for those who believe that human beings have a greater potential for self-management than is commonly recognized. If interpretive styles can be revised by training, as these results suggest, a large portion of the billions of dollars spent on stress management and stress-related illness could be channeled into more productive activities. Additionally encouraging is the notion that current levels of self-management regarding stress and affect can be improved with training and practice. The end result may be that individuals may 'let in' productive and

necessary stress responses, while screening out inappropriate responses, maximizing their potential effectiveness and health.

REFERENCES

1. National Safety Council. *Stress Management*. Jones and Bartlett, Boston, 1995.
2. Rosch, P. Job stress: America's leading adult health problem. *USA Mag.* 1991; May.
3. Worker stress. *Wall Street J.* 1991; May 7.
4. Cooper, C. and Payne, R. *Causes, Coping and Consequences of Stress at Work*. Wiley, New York, 1988.
5. Rein, G., McCraty, R. M. and Atkinson, M. Effects of positive and negative emotions on salivary IgA. *J. Adv. Med.* 1995; **8**(2): 87–105.
6. Black, P. H. Psychoneuroimmunology: Brain and immunity. *Sci. Med.* 1995; **2**(6): 16–25.
7. Broers, P., Evers, A. and Cooper, C. Differences in occupational stress in three European countries. *Int. J. Stress Manage.* 1995; **2**(4): 171–180.
8. Rees, D. and Cooper, C. Occupational stress in health service workers in the U.K. *Stress Med.* 1992; **8**: 79–90.
9. Cain, C. Job stress cases mounting: Experts. *Bus. Insurance* 1987; March 2: 28.
10. US Department of Health and Human Services. *Healthy People 2000: National Health Promotion and Disease Prevention Objectives*, 1991.
11. American Heart Association. *Common Sense About Feeling Tense*. Heart at Work Program, 1995.
12. Hafen, B., Frandsen, K., Karren, K. and Hooker, K. *The Health Effects of Attitudes, Emotions and Relationships*. EMS Associates, Provo, 1992.
13. Kiev, A. Managing stress to achieve success. *Exec. Health* 1987; **24**(1): 14.
14. Burrows, G. Stress in the professional. In: *Seventh International Congress on Stress*. American Institute of Stress, Montreux, 1995.
15. Grossarth-Maticek, R., Eysenck, H. J. and Vetter, H. Personality type, smoking habit and their interaction as predictors of cancer and coronary heart disease. *Personal. Ind. Diff.* 1988; **9**(2): 479–495.
16. Cooper, C. and Marshall, J. Occupational sources of stress: A review of the literature relating to coronary heart disease and mental health. *J. Occupat. Psychol.* 1976; **49**: 11.
17. Kobasa, S. Stressful life events; personality and health: An inquiry into hardiness. *J. Pers. Soc. Psychol.* 1979; **37**(1): 1–14.
18. Kobasa, S., Maddi, S. and Kahn, S. Hardiness and health: A prospective study. *J. Pers. Soc. Psychol.* 1982; **42**(1): 168–172.
19. Williams, K. and Alliger, G. Role stressors, mood spillovers and perceptions of work–family conflict in employed parents. *Acad. Manag. J.* 1994; **37**(4): 837–842.

20. Lawler, K. and Schmied, L. A prospective study of women's health: The effects of stress hardiness, locus of control, type A behavior and physiological reactivity. *Women and Health* 1992; **19**(1): 27.
21. Antonovsky, A. *Unraveling the Mystery of Health*. Jossey Bass, San Francisco, 1987.
22. Lazarus, R. From psychological stress to emotions: A history of changing outlooks. *Ann. Rev. Psych.* 1993; **44**: 12-26.
23. Thomas, K. and Tymon, W. *Stress Resiliency Profile*. Xicom, Tuxedo, New York, 1992.
24. Thomas, K. and Tymon, W. Interpretive styles that contribute to job related stress: Two studies of managerial and professional employees. *Stress, Anx. Coping* 1995; **8**: 235-250.
25. Childre, D. L. *Freeze Frame®*, *Fast Action Stress Relief*. Planetary Publications, Boulder Creek, 1994.
26. McCraty, R., Atkinson, M. and Tiller, W. A. New electrophysiological correlates associated with intentional heart focus. *Subtle Energies* 1995; **4**(3): 251-268.
27. Rozman, D., Whitaker, R., Beckman, T. and Jones, D. A pilot intervention program which reduces psychological symptomatology in individuals with human immunodeficiency virus. *Complement. Ther. Med.* 1996; **4**: 226-232.
28. McCraty, R., Atkinson, M., Tiller, W. A., Rein, G. and Watkins, A. The effects of emotions on short term heart rate variability using power spectrum analysis. *Am. J. Cardiol.* 1995; **76**: 1089-1093.
29. Lown, B. and Verrier, R. Neural activity and ventricular fibrillation. *N. Engl. J. Med.* 1976; **294**(21): 1165-1172.
30. Watson, D. and Tellegen, A. Toward a consensual structure of mood. *Psychol. Bull.* 1985; **98**(2): 219.
31. Rau, H., Pauli, P., Brody, S. and Elbert, T. Baroreceptor stimulation alters cortical activity. *Psychophysiol.* 1993; **30**: 322-325.
32. Lacey, J. I. and Lacey, B. C. Two-way communication between the heart and the brain: Significance of time within the cardiac cycle. *Am. Psychologist* 1978; February: 99-113.
33. Tiller, W., McCraty, R. and Atkinson, M. Toward cardiac coherence; a new non-invasive measure of autonomic system order. *Alt. Ther.* 1996; **2**(1): 52-65.
34. Baselli, G., Cerutti, S., Badilini, F. *et al.* Model for the assessment of heart period variability interactions of respiration influences. *Med. Biol. Eng. Comput.* 1994; **32**: 143-152.
35. Ori, Z., Monir, G., Weiss, J., Sayhouni, X. and Singer, D. H. Heart rate variability frequency domain analysis. *Amb. Electrocardio.* 1992; **10**(3): 499-537.
36. Ironson, G., Boltwood, C. T., Bartzokis, T. *et al.* Effects of anger on left ventricular ejection fraction in coronary artery disease. *Am. J. Cardiol.* 1992; **70**(3): 281-285.
37. Kamada, T., Miyake, S., Kumashiro, M., Monou, H. and Inoue, K. Power spectral analysis of heart rate variability in type As and type Bs during mental workload. *Psychosom. Med.* 1992; **54**: 462-470.
38. Lown, B., DeSilva, M. and Lenson, R. Role of psychologic stress and autonomic nervous system changes in provocation of ventricular premature complexes. *Am. J. Cardiol.* 1978; **41**(6): 979-985.
39. Steptoe, A. and Sawada, Y. Assessment of baroreceptor reflex function during mental stress and relaxation. *Psychophysiol.* 1989; **26**(2): 140-147.
40. Shelelle, R. B., Vernon, S. W. and Ostfeld, A. M. Personality and coronary heart disease. *Psychosom. med.* 1991; **53**: 176-184.
41. Markovitz, J. H., Matthews, K. A., Kannel, W. B. and Cobb, J. L. Psychological predictors of hypertension in the Framingham study: Is there tension in hypertension? *JAMA* 1993; **270**(20): 2439-2494.
42. Conway, J., Boon, N., Jones, J. V. and Sleight, P. Involvement of the baroreceptor reflex in changes in blood pressure with sleep and mental arousal. *Hyperten.* 1983; **5**: 746-748.
43. McCraty, R. and Watkins, A. *Autonomic Assessment Report Interpretation Guide*. Institute of HeartMath, Boulder Creek, CA, 1996.
44. Burt, V. L., Whelton, P., Roccella, E. J. *et al.* Prevalence of hypertension in the US adult population. Results from the Third National Health and Nutrition Examination Survey, 1988-1991. *Hyperten.* 1995; **25**(3): 305-313.
45. Brody, M. J., Natelson, B. H., Anderson, E. A. *et al.* Behavioral mechanisms in hypertension. *Cir.* 1987; **76**(Suppl. I): I95-I100.