Impact of the Power to Change Performance Program on Stress and Health Risks in Correctional Officers

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SUMMARY

This study investigated the impact of HeartMath's Power to Change Performance stress and health risk reduction program on physiological and psychological stress and health risk factors in a sample of correctional peace officers. Eighty-eight officers from three facilities were randomized to an experimental group and a wait-list control group. The experimental group participated in the stress and health risk reduction program, which was delivered over two consecutive days. The program included instruction on health risk factors as well as training in positive emotion-focused stress reduction techniques intended to reduce negative emotional arousal, improve physiological balance, increase positive affect, and enhance performance. Learning and practice of the techniques was enhanced by heart rate variability feedback, which helped participants learn to self-generate physiological coherence, a beneficial mode associated with increased efficiency and synchronization in the functioning of physiological systems.

Measures of physiological and psychological stress and health risk were assessed before the program and again 3 months afterward. The measures included in the health risk assessment were the Personal Wellness Profile self-report survey, which assesses a broad range of health-related information, behaviors, and attitudes; and four biometric markers: height, weight, blood pressure, and total cholesterol levels. Additional measures reflective of physiological stress and overall health included cortisol and DHEA, secretory immunoglobulin A (an immune system marker), HDL and LDL cholesterol, triglycerides, fasting glucose levels, a 10-minute resting electrocardiogram, and measures of heart rate variability (an indicator of autonomic function). Three self-report psychological surveys were also included to assess emotional stress and work-related variables.

An analysis of baseline data revealed that officers in this study were under greater stress and at greater health risk in comparison to a reference sample of working adults. A within-group analysis of pre-post changes showed that 3 months after the intervention program, employees in the experimental group demonstrated significant reductions in stress and health risk factors, as well as significant improvements in work-related parameters. Physiological changes in the experimental group included significant reductions in total cholesterol, LDL cholesterol levels, the total cholesterol/HDL ratio, fasting glucose levels, mean heart rate, and systolic and diastolic blood pressure. Psychological changes included significant reductions in overall psychological distress, anger, fatigue, hostility, interpersonal sensitivity, speed and impatience, and global Type A behavior, and increases in gratitude and positive outlook. There were also improvements in key organizationally relevant measures in the experimental group after the program, including significant increases in productivity, motivation, goal clarity, and perceived manager support. Finally, the reduction in health risk factors achieved in this study are projected to lead to reductions in both health care and absentee costs, yielding a total projected annual cost savings of $699 per employee.

A limitation of this study was its small sample size, which did not allow for adequate statistical power to detect between-group differences associated with the intervention program. This, combined with the presence of cross-contamination effects between the experimental and control groups, precluded a meaningful between-group comparison. A

post-study survey indicated that in addition to direct communication of program content between the groups, the intervention program had a favorable impact on the overall organizational climate, factors that likely contributed to the directional improvements in various stress- and health-related parameters that were observed in the control group. A further limitation of this investigation was its relatively short follow-up period, particularly with regard to the measurement of long-term physiological improvements. It is likely that studies with longer follow-up periods would demonstrate additional reductions in health risk factors and increased health care cost savings. It is also recommended that future studies include actual measurements of health care utilization and costs.

In conclusion, the results of this study indicate that the Power to Change Performance program was effective in significantly reducing stress and health risk factors in a population of correctional peace officers, while enhancing employee productivity and psychological well-being. These changes were realized with minimal intervention and in a relatively brief period of time, and should result in significant cost savings to the organization if the program is expanded to larger employee populations. Thus, by reducing the physiological, psychological, performance-related, and financial impact of high stress and health risks in the crucial and demanding profession of corrections work, this program promises significant benefits both to the employees as individuals and to the organization as a whole.

INTRODUCTION AND BACKGROUND

Employers give a range of reasons for implementing health promotion programs. There is a general interest in increasing productivity, reducing absenteeism, increasing morale, enhancing the quality of life, lowering health risks, and promoting overall employee well-being. Common criteria to set priorities in disease prevention and health promotion programs are:[1]

- Cost-benefit and cost-effectiveness considerations
- Prior demonstration of benefits
- Time frame for realization of benefits
- Relevance of the program to risks in the organization
- Employee interest in the program

Stress management and health promotion programs are especially relevant in correctional settings as correctional peace officers are exposed to stress outside the range of usual human experience. The operational duties of correctional officers may at any time place officers in life-threatening situations, in which the decisions they make can truly mean the difference between life or death for both themselves and others. In addition to the intensity of acute stressors experienced in the moment, the feelings that officers carry with them after such emotionally charged incidents represent a more enduring source of stress. Constant exposure to interpersonal violence, negative or confrontational interactions, a sense of personal endangerment, and subservience to an ambivalent, watchful public produce negative emotional repercussions that can affect officers on a chronic basis.[2-5]

In addition to the operational stressors inherent in police and corrections work, numerous studies have shown that factors related to organizational structure and climate can be a significant source of stress.[6-8] Shift schedules that disrupt normal sleep patterns and social life, authoritarian management styles, poor interpersonal relationships with supervisors, interdepartmental politics, lack of adequate planning and resources, lack of promotion and transfer opportunities, lack of autonomy in performing duties, and lack of recognition for work accomplishments are among these organizational stressors.[3, 7, 9]

From a psychophysiological perspective, it is important to appreciate that the incidents, situations, or events that individuals typically equate with "causing" their stress are actually only triggers of the stress response. In reality, stress is the negative perceptions, feelings, and emotions that are triggered by a perceived challenge or threat, whether real or imagined. These negative perceptual and emotional processes in turn drive a wide range of physiological responses and adaptations, commonly described as aspects of the "stress response." Thus, the actual source of the "stress" that people experience consists primarily of internal emotional turmoil, such as feelings of frustration, anger, worry, anxiety, fear, insecurity, depression, or resentment. Clearly, exposure to stressors such as heavy workloads, time pressure, communication difficulties, or unexpected inconveniences can trigger such stressful feelings; importantly, however, once established as "familiar," these stress-producing emotional patterns—and their negative physiological consequences—can be perpetuated even in the absence of a specific external stressor.

Without effective management, the various acute and chronic stressors of law enforcement impose a significant burden on physical and psychological health, leading to adverse physiological, emotional, and behavioral outcomes.[2, 3, 10] One study indicated that police officers are over twice as likely as people in other occupations to develop cardiovascular disease.[11] In fact an analysis of the National Occupational Mortality Surveillance System found that the highest mortality ratio for ischemic heart disease mortality was among sheriffs, correctional officers, police officers, and firefighters.[12]

Cardiovascular disease continues to be the leading cause of death in the United States, and ischemic heart disease is the most common type of heart disease. Established risk factors for ischemic heart disease include diabetes mellitus, disorders of lipid metabolism, high blood pressure, cigarette smoking, obesity, and physical inactivity. The role of the work environment or work climate in the development of heart disease and other health challenges is of great interest. Much of the focus is on the role of job stress,[13] shift work, psychological stress,[14] and perceived job security,[15] as these factors have all been shown to contribute to heart disease.

The epidemiological literature is replete with studies demonstrating the relationship between modifiable health risks and morbidity and mortality.[16, 17] However, there is less direct evidence on the association between modifiable health risks and individual health care expenditures. A comprehensive review of peer-reviewed and published studies examining the financial impact of health promotion programs concluded that there are good correlational data to suggest that high levels of stress, excessive body weight, and multiple risk factors are associated with increased health care costs and illness-related absenteeism. This review also concluded that health promotion programs are associated with reduced health care costs.[18]

A major step forward was taken when Goetzel and colleagues used the Health Enhancement Research Organization (HERO) database to examine the association between ten modifiable health risks and health care expenditures.[19] The focus of this study and the central unit of analysis was the individual employee. The study sought to document increased health care expenditures associated with certain health risks at the individual level. It was found that employees at high risk for poor health outcomes had significantly higher expenditures than did employees at lower risk in seven of ten risk categories: those who reported themselves as depressed (70% higher expenditures), at high stress (46%), with high blood glucose levels (35%), at extremely high or low body weight (21%), with high blood pressure (12%), and with a sedentary lifestyle (10%). Employees with multiple risk profiles for specific disease outcomes had higher expenditures than did those without these profiles for the following diseases: heart disease (228% higher expenditures), psychosocial problems (147%), and stroke (85%). The authors concluded that common modifiable health risks are associated with increases in the likelihood of incurring health expenditures and in the magnitude of those expenditures.

Although the Goetzel study addressed the financial repercussions of risk factors for an individual employee, it did not examine the cost impact on an entire group of employees. This void was filled by a study conducted by Anderson,[20] who assessed the relationship between modifiable health risks and total health care expenditures for six large private-sector (Chevron; Health Trust, Inc.; Hoffmann-La Roche; Marriott) and public-sector employers (state of Tennessee and state of Michigan) while controlling for confounding factors that may also influence expenditures. Eleven risk factors (exercise, alcohol use, eating, current and former tobacco use, depression, stress, blood pressure, cholesterol, weight, and blood glucose) were dichotomized into high-risk and lower-risk levels. Risk factors were associated with 25% of total expenditures. Stress was the most costly factor, accounting for 8% of all health care expenditures, with tobacco use, obesity, and lack of exercise also being linked to substantial expenditures. Manning et al. also reported that stress and lack of social support accounted for 7% to 9% of all health care expenditures.[21] It is difficult to believe that the parity of these two evaluations is solely due to chance, especially given that three other studies that included stress also reported a significant association.[20, 22, 23]

It is difficult to measure overall productivity in a population of correctional officers; however, one aspect of productivity that is well established to be related to stress and some health risks is absenteeism. In theory, a healthier work force could be expected to be sick less often. To the degree that work site health promotion programs increase employee health status, the incidence of absenteeism should be reduced. Absenteeism results in both direct and indirect costs to employers. Lower absenteeism rates improve worker productivity and reduce the costs of hiring substitute workers.[1] Of the established risk factors, stress has been most often related to absenteeism. There is a well-established, independent association between work-related and life-related stress and absenteeism.[24-28]

There is evidence that stress also contributes to absenteeism through its association with a variety of major health problems, including coronary heart disease, cancer, diabetes, bacterial and viral infections, and depression,[29-31] many of which result in frequent or prolonged absences from work. Survey data show that employees report stress to be the cause of approximately 14% of all cases of absenteeism in the United States.[32]

It has been argued that special consideration should be given to reducing occupational stress among law enforcement officers due to the unique stresses that they encounter.[33] Officers operating under severe and chronic stress may well be at greater risk of error and over-reaction that can compromise their performance and safety. While officers receive ample training in the theoretical knowledge and technical skills required to perform their jobs and take effective action in an emergency situation, most receive little if any training in the stress reduction skills needed to help them quickly regain psychological and physiological equilibrium during or after the intense challenges of their work. It is clear that practical stress reduction techniques are needed to help correctional officers better manage the stresses of their jobs, reduce health risks, and improve well-being.

Purpose of Study

The purpose of this research was to determine the effectiveness of the HeartMath Power to Change Performance stress and health risk reduction program in reducing stress and health risk factors in correctional peace officers. The two hypotheses were: (1) psychological stress can be reduced by providing correctional officers with specific techniques to both effectively manage stress as it occurs and to prevent it before it occurs and (2) reductions in psychological stress will correlate with reductions in measures of heath risk. The specific objectives were:

(1) To determine the levels of physiological and psychological stress and health risk factors in a representative volunteer group of correctional peace officers as compared to the general working population.
(2) To determine the impact of an established stress reduction program on reducing stress in correctional officers.
(3) To determine the ability of the stress reduction program to reduce physiological health risk factors in correctional officers.
(4) To determine the ability of the stress reduction program to reduce psychological health risk factors in correctional officers.

Description of Study

The study used a randomized wait-list control design. Correctional officers from three institutions at the Northern California Youth Correctional Center in Stockton participated in the study: the Karl Holton Youth Correctional Drug and Alcohol Abuse Treatment Facility, N.A. Chaderjian Youth Correctional Facility, and O.H. Close Youth Correctional Facility. Volunteers for participation in the study were recruited through posting of flyers at the sites.

Institutional Review Board approval for the study was obtained from the Claremont Graduate University Institutional Review Board, which meets all requirements of federal guidelines, 21 CRF 56. Participants were fully informed about the study and signed informed consent forms.

Approximately one hundred correctional officers were to be recruited into the program. A total of 94 participants were actually recruited and completed the baseline assessments. Shortly thereafter, 3 dropped out of the study due to time conflicts. Two more became trainers for the program and one became a program coordinator.

Once the baseline data were analyzed, the remaining 88 volunteers were stratified into three relative risk groups: high, medium, and low risk using the Adult Treatment Panel III 10-year risk assessment guidelines. They were then randomly assigned to the experimental or wait-list control group, with 44 participants in each. Age and gender were also added to the randomization criteria to insure that both groups had a homogeneous distribution. Following the baseline data collection, any participants (experimental or control group) who were considered by the study physician to need immediate medical attention or to be at a substantially higher health risk were contacted by phone at home by the physician.

The experimental group then participated in the 2-day Power to Change Performance program (described below). Approximately 8 weeks after the program, all experimental group participants were contacted by phone at home in order to answer any questions they had or discuss any challenges they might be having with the techniques they had learned or lifestyle changes they might wish to make. Those participants who at baseline were considered at higher risk were contacted by the study physician, while the others were called by a program facilitator. The facilitators took notes regarding the questions and comments made by the participants.

Approximately 90 days after the experimental group participants had attended the training program, both groups again completed the same stress and health risk assessments. At the time of post data collection, 7 participants from the control group were unable to attend for the following reasons: military service (1), job transfer (1), schedule conflicts (3), and medical leave (2). Data from 6 subjects were excluded from the study for the following reasons: pregnancy (1 experimental group participant, 1 control), spouses in experimental group (2 control), prior HeartMath training (1 control), and abnormal baseline physiological results requiring medical intervention (1 control). Thus, the final summary is based on data from a total of 75 participants (43 experimental and 32 control). Following the completion of the study, the wait-list control group then received the same training program.

MEASURES

Health Risk Assessment

The measures used in the health risk assessment included both a self-report survey and biometric data. The Personal Wellness Profile (PWP) (Wellsource, Portland, OR) was used to obtain the self-reported health risk data. This survey includes 75 questions pertaining to the following general areas: health information; physical activity; eating practices; alcohol, drugs, and smoking; stress and coping; social health; safety; medical care; and health view. The validity and reliability of these questions have been studied in numerous applications, a review of which was recently published.[34] Additionally, the prediction of future health care cost savings resulting from reductions in the health risks measured by the PWP has been demonstrated based on actual heath care expenditures.[22] The four primary biometric measures used in the health risk assessment were height, weight, blood pressure, and cholesterol. These measures were collected at the worksite by a licensed nurse. Table 1 shows the parameters used to define high risk and the percentage of employees in the study who were designated at risk for each variable at baseline, compared to corresponding percentages in a reference sample of working adults from a large workplace study.[22] The criteria used to define high risk are based largely on the recommendations of national consensus scientific panels.

Table 1. High-Risk Criteria and Percentage of Employees at Risk

Risk Factor	High-Risk Criteria	% of Employees	
		Current Study (N = 75)	Reference Group (N = 1,838)
1. Lifestyle Habits:			
Smoking	Current Smoker	5%	34%
Physical Activity	Rarely/Never	35%	10%
Medication/Drug Use	Almost Every Day, Sometimes	5%	10%
Absences Due to Illness	Five Days or More	53%	12%
Drinking Alcohol	Ex-Drinker or Heavy Drinker (more than 21 drinks per week)	0%	9%
Seatbelt Usage	Using Seatbelt 25% of Time or Less	2%	39%
2. Psychological Perceptions:			
Life Satisfaction	Not Very Satisfied or Somewhat Satisfied	8%	15%
Job Satisfaction	Strongly Disagree or Disagree	25%	28%
Physical Health	Fair or Poor	17%	18%
Serious Medical Problems	Yes	2%	21%
3. Health Risks:			
Systolic Blood Pressure	Greater than 140 mmHg	7%	15%
Diastolic Blood Pressure	Greater than 90 mmHg	20%	11%
Cholesterol	240 mg/dl or Greater	35%	22%
Relative Body Weight	More than 20% Overweight	35%	28%
Chronic Bronchitis/Emphysema	Yes	0%	8%
Risk Age Index	Greater than 4.0 Years (difference between appraised and achievable ages)	83%	38%

Lipid panel

The lipid panel included measurements of total cholesterol, high-density lipoprotein (HDL) cholesterol, low-density lipoprotein (LDL) cholesterol, triglycerides, and blood glucose levels. Blood samples were obtained using fingerstick collection and assessed by reflectance photometry (Cholestech-LDX System, Hayward, CA). Blood glucose levels were measured after at least a 9-hour fast. A total cholesterol level of 240 mg/dl or higher was considered a risk factor.[35]

Blood pressure

Blood pressure measurements (auscultary method) were made with an instrument that measures the pressure generated by the cuff and the arterial pulsation (DynaPulse, Pulse Metric, San Diego, CA). A total of three blood pressure readings were taken, with a 5-minute rest period prior to the first measure and between measures. The average of the three measures was used as the final blood pressure value. Systolic blood pressure greater than 140 mm Hg was considered a risk factor, as was a diastolic blood pressure greater than 90 mm Hg.

Autonomic Function: Heart Rate Variability

Although not used as part of the risk analysis, a 10-minute resting electrocardiogram (ECG) was recorded for heart rate variability analysis to provide an assessment of autonomic nervous system function. Heart rate variability (HRV), which is derived from the ECG, is a measure of the naturally occurring beat-to-beat changes in heart rate. The analysis of HRV provides important information relative to the function and balance of the autonomic nervous system, and decreased HRV is a powerful predictor of future heart disease, increased risk of sudden death, as well as all-cause mortality.[36-38] In this regard, HRV is increasingly being used as a noninvasive screening tool to identify at-risk individuals.

Cortisol, DHEA, and S-IgA: Adrenal Stress Index
Measurements were also taken of the stress-related hormones cortisol and dehydroepiandrosterone (DHEA), as well secretory immunoglobulin A (S-IgA), a marker of immunity. A number of investigators have proposed the DHEA/cortisol ratio to be an important biological marker of stress and aging.[39, 40] When individuals are under prolonged stress a divergence in the DHEA/cortisol ratio results.[41] The effects of DHEA/cortisol imbalance can be severe, and may include elevated blood sugar levels, increased bone loss, compromised immune function, decreased skin repair and regeneration, impaired memory and learning, increased fat accumulation, and brain cell destruction.[39-42] S-IgA is the predominant antibody class found in mucosal secretions, which serves as the body's first line of defense against pathogens, and is easily measured noninvasively.

To assess levels of cortisol, DHEA, and S-IgA, saliva samples were collected at four time points over a 24-hour period (Adrenal Stress Index, Diagnos-Techs, Inc., Kent WA). Samples were sent to an external reference laboratory for analysis.

Psychological Measures

In addition to the psychological scales of the PWP, three other psychological instruments were used in this study. These were included primarily to provide measures of common psychological symptom and behavior patterns associated with emotional stress. Additionally, measures of positive emotions and attitudes, as well as measures relevant to organizational climate and workplace effectiveness were included in this part of the assessment.

Jenkins Activity Survey
The Jenkins Activity Survey (JAS) (The Highlands, Chapel Hill, NC) is a multiple-choice questionnaire that is designed as a measure of Type A and coronary-prone behavior. Type A behavior patterns are characterized by extremes of competitiveness, striving for achievement and personal recognition, aggressiveness, haste, impatience, and explosiveness and loudness in speech. The JAS yields a composite Type A scale score and three factor-analytically-derived subscales: Speed and Impatience, Job Involvement, and Hard-Driving and Competitive. Concurrent validity has been established by comparing JAS scores to Type A ratings based upon a structured interview. Evidence for the predictive validity of the JAS comes primarily from the prospective findings of the Western Collaborative Group Study. Analysis of JAS Type A scores of 2,750 healthy men showed the Type A scale to distinguish the 120 future clinical cases of coronary heart disease from those men who subsequently remained healthy. Numerous studies have also found patients with coronary heart disease to score higher on the JAS Type A scale than patients without heart disease.

Brief Symptom Inventory
The Brief Symptom Inventory (BSI) (National Computer Systems, Minneapolis, MN) is designed to reflect psychological symptom patterns. This 53-item self-report inventory contains 9 symptom scales (Somatization, Obsessive-Compulsive, Interpersonal Sensitivity, Depression, Anxiety, Hostility, Phobic Anxiety, Paranoid Ideation, and Psychoticism) and 3 global indices (Global Severity Index, Positive Symptom Distress Index, and Positive Symptom Total).

Personal and Organizational Quality Assessment
The Personal and Organizational Quality Assessment (POQA) (Institute of HeartMath, Boulder Creek, CA) is a self-report inventory designed to reflect the key psychological and workplace elements that contribute to organizational climate. The instrument provides a comprehensive assessment in the two main topic areas. Personal scales reflect employees' moods, attitudes, and stress-related symptoms. The stress symptom items possess clinical relevance as valid measures of stress, which can exert a significant negative impact on employee health and work performance. Organizational scales are comprised of questions concerning such areas as strategic understanding, goal clarity and work attitude, job involvement, and factors related to employee behavior, attitudes toward work, and ability to perform well. Standardized scores enable comparisons of the status or performance of an individual or group with that of a relevant reference group.

DESCRIPTION OF PROGRAM

The Power to Change Performance program is based on the positive emotion-focused techniques developed by the Institute of HeartMath (Boulder Creek, CA). These research-based techniques are designed to reduce stress and negative affect, increase positive affect, enhance health, and improve performance.[43] Previous studies have demonstrated that the HeartMath techniques favorably impact physiological balance by reducing sympathetic arousal, increasing parasympathetic activity,[44, 45] reducing stress hormone levels,[46] and enhancing immune system activity.[47, 48] These techniques have also been shown to impact organizationally relevant outcomes, such as improving productivity, goal clarity, communication, and job satisfaction, and reducing employee turnover.[43, 49-52] In addition, practice of the HeartMath techniques has been demonstrated to improve health status and quality of life in diverse clinical populations. For example, significant blood pressure reductions have been demonstrated in individuals with hypertension,[52] improved functional capacity and reduced depression in congestive heart failure patients,[53] improved psychological health and quality of life individuals with diabetes,[54] and improvements in symptoms in patients with cardiac arrhythmias.[55]

The efficacy of the HeartMath program in a law enforcement setting has previously been demonstrated in a study that examined the impact of a program on police officers from seven different agencies in Santa Clara County, California. Officers trained in the techniques experienced decreased stress, negative emotions, and fatigue, increased calmness, confidence, and clarity under the acute stress of simulated police calls, and more rapid psychophysiological recalibration following these high-stress scenarios as compared to an untrained control group. Enhanced work performance in the trained group was also noted, as well as improvements in communication difficulties at work and in strained family relationships, two prominent sources of stress in the policing profession. Overall, the results of this investigation provided evidence that the HeartMath program was effective in reducing damaging physiological and psychological responses to both acute and chronic stress in police while positively impacting a variety of major life areas in a relatively short period of time.[51]

The HeartMath positive emotion-focused techniques are distinguished from other commonly used stress management techniques based on their capacity to readily induce a highly efficient and beneficial mode of physiological functioning known as *physiological coherence*. This mode is associated with increased efficiency and synchronization in the functioning of physiological systems. While the physiological coherence mode encompasses beneficial aspects of the "relaxation response," (e.g., reduced sympathetic activation and increased parasympathetic activity), it also provides additional physiological and psychological benefits not typically associated with relaxation (e.g., increased synchronization in ANS activity, increased vascular resonance and physiological entrainment, and improved mental clarity and cognitive performance).[45, 56-59] Additionally, the practice of techniques that increase physiological coherence has been associated with increased emotional stability and sustained favorable psychosocial outcomes, including increased caring and contentment and reduced stress, anxiety, depression, hostility, and burnout.[46, 49-51, 53] Studies conducted across diverse populations indicate that these techniques are easily learned, have a high rate of compliance, and are highly adaptable to a wide range of demographic groups.[60]

The Power to Change Performance program consisted of five training modules, which were delivered over two consecutive days.

1. *Risk Factors*: What they are, how to interpret them, and how they relate to health and wellness

2. *Freeze-Frame*: Shifting perception to transform reactions to potential stressors

3. *Coherent Communication*: Enhancing communication, teamwork, and goal clarity

4. *Power Tools for Inner Quality*: Creating a caring culture and increasing job satisfaction. (This module included the Heart Lock-In technique—an emotional restructuring exercise designed to reduce stress and increase physiological coherence; Appreciation:—taking time out in one's day to notice and be grateful for the positive aspects of one's life; and Neutral—learning to neutralize emotions.)

5. *Workplace Applications*: Applying the above tools in an organizational context

Several of the core techniques are described briefly in the following paragraphs. More detailed descriptions of the techniques, their conceptual basis, and their applications in organizational settings can be found elsewhere.[43, 56, 61, 62]

Freeze-Frame[43] is a positive emotion-refocusing technique designed specifically to enable individuals to intervene in the moment that stress is experienced, or, with practice, to prevent the stress response altogether. In essence, the technique enables people to consciously disengage from draining negative mental and emotional reactions as they occur. This process prevents or interrupts the body's stress response and often facilitates a perceptual shift, which enables problematic issues, interactions, or decisions to be assessed and dealt with from a broader, more proactive and emotionally balanced perspective. With practice, this tool can be used effectively in less than one minute.

The Coherent Communication module of the program provides practical tools that enhance communication between co-workers and improve team coherence and goal clarity. Lack of effective communication between co-workers and between managers and the workforce is a major source of stress, contributing to much of the internal emotional turmoil that preoccupies one's thought processes. This frequently leads to feelings of hostility, mistrust, and resentment between team members and has a negative impact on productivity, teamwork, and creativity. The Intuitive Listening technique[43] taught in this module facilitates the sharing of information with greater sincerity and effectiveness. Individuals learn to communicate more openly and honestly, and to stop inner dialogue in order to listen to others more deeply and intuitively. During the program, participants were assigned to practice the Intuitive Listening technique at home with a family member as well as with a person with whom they were in conflict.

Heart Lock-In[61, 62] is an emotional restructuring technique that enables people to establish and sustain positive affective states, and their psychological and physiological benefits, for longer periods. Using this technique, individuals learn to self-generate and maintain the physiological coherence mode, which has been linked with numerous health-related benefits.[56] Practice of this technique may be facilitated by music specifically created to promote stress reduction and emotional balance, which was provided to all participants in the program.[63]

Other tools covered in the Power to Change Performance program help individuals actualize attitudes of appreciation, care, and self-care in both personal and organizational contexts, and apply the key techniques and concepts learned in the program to increase planning and decision making effectiveness.[43]

The program also incorporated a heart rhythm education and feedback component, to facilitate learning and effective implementation of the stress reduction techniques.[64] Using a computerized heart rhythm monitoring and feedback system (Freeze-Framer®; Quantum Intech, Inc., Boulder Creek, CA), participants' heart rate variability patterns (heart rhythms) were displayed in real time as they practiced the Freeze-Frame and Heart Lock-In techniques. This enabled participants to see and feel for themselves how stress and different emotions affect their autonomic nervous system, and to objectively view and quantify the favorable shifts in autonomic function they could achieve by using the techniques. This process also facilitated the experience of the internal emotional shift necessary to increase physiological coherence (as reflected in a more sine wave-like heart rate variability pattern, a numerical "coherence ratio" score, or degree of success in playing one of several on-screen games designed to reinforce the coherence-building skills).

During the 3 months following the program, participants were encouraged to practice the tools daily. It was recommended that they do at least five 15-minute Heart Lock-Ins and three written Freeze-Frames per week, as well as using the Freeze-Frame technique for 30 seconds during each hour at work. Freeze-Framer heart rhythm coherence training systems were made available to experimental group participants for use at home and in the workplace, where feasible.

RESULTS

Baseline Comparisons

Tables 2 and 3 show the results of an ANCOVA, which was used to compare the baseline physiological and psychological data between the two groups. Taking a conservative approach, differences with a p value < 0.1 were considered significant. Overall, random distribution was successful in creating equally distributed groups. There were no significant differences between the groups in any of the risk assessment measures. The only significant differences in physiological measures were in S-IgA (an indicator of immunity), with the control group having a higher mean value ($p = 0.099$); and in the HRV measures the RMS-SD (an indicator of parasympathetic function) was lower in the control group ($p = 0.094$) (Table 2).

In terms of the psychological measures, there were no differences in any scales on the Brief Symptom Inventory or the Jenkins Activity Survey. There were differences in the following scales on the Personal and Organizational Quality Assessment: Anger ($p = 0.04$), Resentfulness ($p = 0.056$), and Intention to Quit ($p = 0.049$) were greater in the experimental group at baseline, whereas Work Attitude ($p = 0.021$), Manager Support ($p = 0.003$), Freedom of Expression ($p = 0.03$), and Confidence in the Organization ($p = 0.006$) were greater in the control group (Table 3).

An ANCOVA was also performed to compare the baseline data from the participants from the three different locations (Karl Holton, N.A. Chaderjian, and O.H. Close). There were a number of significant differences in the baseline variables. POQA scores on the Positive Outlook and Motivation scales were highest among the group from Karl Holton; this group scored significantly higher on these scales than the group from O.H. Close. The group from N.A. Chaderjian had the highest average systolic blood pressure (BP) (126 mm Hg), significantly higher than the O.H. Close group (117 mm Hg). (The Karl Holton group's systolic BP was 123 mm Hg.) The Karl Holton group's diastolic BP (84 mm Hg) was significantly higher than O.H. Close (77 mm Hg). (N.A. Chaderjian's diastolic BP was 83 mm Hg.) The group from N.A. Chaderjian also had an LDL level (158 mg/dL) that was significantly higher than O.H. Close (132 mg/dL). (Karl Holton's LDL level was 145 mg/dL.) Additionally, the N.A. Chaderjian group had the highest baseline heart rate (75 bpm) which was significantly higher than that of the group from Karl Holton (67 bpm). (O.H. Close's heart rate was 68 bpm.) This would indicate that overall, the participants from N.A. Chaderjian were experiencing more chronic stress than officers from the other two facilities.

Table 2. Baseline Physiological Characteristics

	Experimental Group (N=43)		Control Group (N=32)		
	Mean	SD	Mean	SD	p < 0.1
Age, y	39.47	± 7.70	40.72	± 8.12	ns
Gender, % male	67%		69%		ns
Height, in.	68.30	± 3.14	67.84	± 4.28	ns
Weight, lbs.	189.84	± 33.75	199.03	± 49.15	ns
Body Mass Index	28.44	± 3.54	30.12	± 5.51	ns
					ns
Cholesterol lowering medication status, % taking drugs	4.80%		13.30%		
Triglycerides, mg/dL	149.07	± 71.07	155.37	± 68.73	ns
Total cholesterol, mg/dL	217.45	± 40.56	220.27	± 38.08	ns
HDL cholesterol, mg/dL	43.08	± 10.06	46.11	± 8.23	ns
LDL cholesterol, mg/dL	148.98	± 40.30	140.27	± 36.56	ns
Total cholesterol / HDL ratio	5.39	± 1.58	4.82	± 1.33	ns
Glucose, mg/dL	103.00	± 21.39	103.13	± 16.23	ns
Cortisol burden, nM	30.94	± 9.99	31.36	± 11.67	ns
DHEA, ng/ml	5.11	± 2.09	5.14	± 2.03	ns
S-IgA, U/ml	11.25	± 5.58	15.24	± 12.32	0.099
Antihypertensive medication status, % taking drugs	7.30%		20%		
Systolic blood pressure, mmHg	122.39	± 13.33	121.26	± 11.08	ns
Diastolic blood pressure, mmHg	80.75	± 9.55	81.69	± 8.76	ns
Mean arterial pressure, mmHg	92.79	± 10.32	92.68	± 9.11	ns
Heart rate, BPM	71.23	± 10.89	73.23	± 12.72	ns
Interbeat interval, ms	867.69	± 144.36	843.56	± 128.83	ns
Standard deviation of RR intervals, ms	59.31	± 26.59	49.74	± 22.71	ns
RMS-SD, ms	38.20	± 28.90	26.97	± 13.71	–
Ln(RMS-SD)	3.42	± 0.66	3.15	± 0.58	0.094
High frequency, ms^2/Hz	192.36	± 296.43	82.93	± 67.93	–
Ln(High frequency)	4.40	± 1.34	3.95	± 1.21	ns
Low frequency, ms^2/Hz	398.15	± 383.12	357.17	± 407.99	–
Ln(Low frequency)	5.60	± 0.93	5.33	± 1.16	ns
Very low frequency, ms^2/Hz	620.50	± 626.39	513.84	± 631.15	–
Ln(Very low frequency)	6.04	± 0.89	5.69	± 1.07	ns
Total power, ms^2/Hz	1277.83	± 1138.74	1011.72	± 1016.59	–
Ln(Total power)	6.79	± 0.90	6.45	± 1.05	ns
Low frequency / high frequency ratio	4.84	± 4.21	5.01	± 3.37	–
Ln(Low frequency / high frequency ratio)	1.20	± 0.92	1.38	± 0.72	ns

Table 3. Baseline Psychological Characteristics

	Experimental Group (N=41)		Control Group (N=28)		
	Mean	SD	Mean	SD	*p* <
Personal and Organizational Quality Assessment (POQA)					
Positive Outlook	4.92 ±	1.02	5.02 ±	1.17	ns
Gratitude	4.68 ±	1.14	4.99 ±	1.34	ns
Motivation	4.23 ±	1.04	4.46 ±	1.27	ns
Calmness	4.11 ±	0.94	4.15 ±	1.02	ns
Fatigue	3.07 ±	1.06	2.90 ±	1.18	ns
Anxiety	2.67 ±	0.92	2.45 ±	0.53	ns
Depression	1.88 ±	0.90	1.74 ±	0.86	ns
Anger	2.05 ±	0.63	1.74 ±	0.52	0.05
Resentfulness	2.45 ±	0.69	2.14 ±	0.55	0.1
Stress Symptoms	2.78 ±	0.97	2.60 ±	0.84	ns
Work Attitude	5.18 ±	1.03	5.77 ±	0.93	0.05
Strategic Understanding	3.96 ±	1.05	4.23 ±	1.26	ns
Manager Support	4.98 ±	1.18	5.81 ±	0.92	0.01
Goal Clarity	4.59 ±	1.28	4.95 ±	1.15	ns
Job Challenge	5.30 ±	0.94	5.40 ±	1.33	ns
Value of Contribution	4.96 ±	1.06	5.44 ±	1.42	ns
Freedom of Expression	4.40 ±	1.17	5.06 ±	1.22	0.05
Work Intensity	5.00 ±	1.13	5.21 ±	0.98	ns
Productivity	4.90 ±	0.79	5.19 ±	1.11	ns
Communication Effectiveness	4.34 ±	1.24	4.46 ±	1.28	ns
Confidence in the Organization	3.29 ±	1.10	4.10 ±	1.16	0.01
Morale Issues	5.01 ±	1.47	4.67 ±	1.70	ns
Time Pressure	4.40 ±	1.26	4.29 ±	0.83	ns
Intention to Quit	2.98 ±	1.52	2.21 ±	1.50	0.05
Brief Symptom Inventory (BSI)					
Somatization	0.37 ±	0.36	0.34 ±	0.54	ns
Obsessive-Compulsive	0.78 ±	0.56	0.70 ±	0.67	ns
Interpersonal Sensitivity	0.49 ±	0.51	0.49 ±	0.69	ns
Depression	0.38 ±	0.40	0.35 ±	0.68	ns
Anxiety	0.41 ±	0.38	0.37 ±	0.43	ns
Hostility	0.51 ±	0.38	0.41 ±	0.59	ns
Phobic Anxiety	0.14 ±	0.23	0.16 ±	0.40	ns
Paranoid Ideation	0.61 ±	0.55	0.50 ±	0.41	ns
Psychoticism	0.27 ±	0.39	0.28 ±	0.63	ns
Global Severity Index	0.44 ±	0.28	0.40 ±	0.49	ns
Positive Symptom Distress Index	1.26 ±	0.26	1.23 ±	0.38	ns
Positive Symptom Total	17.63 ±	9.46	15.26 ±	11.59	ns
Jenkins Activity Survey (JAS)					
Type A – Overall score	231.39 ±	70.46	224.93 ±	84.45	ns
Speed and Impatience	177.20 ±	57.12	184.89 ±	71.68	ns
Job Involvement	203.00 ±	40.71	190.79 ±	38.37	ns
Hard-Driving and Competitive	115.83 ±	24.43	126.07 ±	32.03	ns

Comparison of Baseline Values to Reference Values

For comparisons to the general working population, pooled baseline data were compared to the norms established by authors of the individual psychometric surveys as well as to established normal ranges for the physiological data.[22] Table 1 shows the percentage of correctional officers with each risk factor and the expected percentage for each risk factor based on data from a reference group of working adults. For lifestyle habits, the correctional officers had a higher percentage of employees that were under-active in terms of physical activity (35% vs. 10%) and a higher percentage of absences due to illness (53% vs. 12%). In the health risks category the correctional officers had almost twice the percentage of employees with a diastolic blood pressure over 90 mm Hg than would be expected (20% vs. 11%), a higher percentage of employees with cholesterol levels of 240 mg/dl or greater (35% vs. 22%), and more employees who were more than 20% overweight (35% vs. 28%). The Risk Age Index, which is calculated from the difference between appraised and achievable ages projected by the health risk assessment, indicated that 83% of the correctional officers had this risk factor, compared to only 23% in the reference group. This index is a key indicator of the overall controllable health risk of the respondent.[22]

As law enforcement personal are known to under-report stress and stress symptoms,[51, 65] additional physiological measures that reflect chronic stress were also included in the study, although they were not used as part of the risk assessment. The hormone cortisol is well known to reflect stress levels. Individuals under prolonged stress often have a divergence in their DHEA/cortisol ratios, primarily due to elevated cortisol levels. In healthy individuals, short-term stressors lead to an increase in both DHEA and cortisol. However, in individuals experiencing long-term stress, the overall cortisol levels increase, thus shifting the ratio between cortisol and DHEA and resulting in a physiological state that is often referred to as "maladapted." When an individual is in the maladapted phase, short-term stressors will still increase cortisol levels; however, the DHEA levels typically remain unchanged. If the chronic stress remains (over years), both cortisol and DHEA levels start to decline. In this population of correctional officers, 21% had elevated cortisol values equal to or greater than 40 nM, the established cut-off value for high cortisol based on a reference database of over 150,000 individuals (Diagnos-Techs, Inc., Kent WA). This is double the expected number of individuals that would be predicted based on the general population, suggesting that this study sample has high stress levels. An additional analysis was performed to determine if baseline cortisol and DHEA levels were related to time on the job. As shown in Figure 1, it can be seen that officers with 2 to 5 years on the job have normal cortisol and DHEA levels; however, officers with 5 to 10 years on the job have higher cortisol levels, as do officers with 10 to 20 years on the job. It can also be seen that both cortisol and DHEA start to decline after 10 to 20 years on the job.

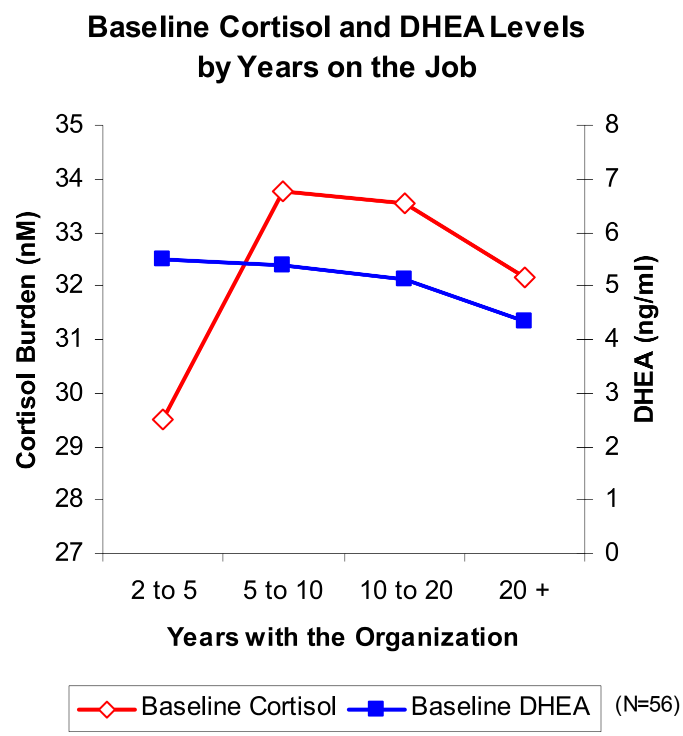

Figure 1. Baseline DHEA and cortisol levels in officers (experimental and control groups) with various numbers of years on the job. Whereas officers with 2 to 5 years on the job have normal cortisol and DHEA levels, officers with 5 to 10 years on the job have higher cortisol levels, as do officers with 10 to 20 years on the job. Both cortisol and DHEA begin to decline in officers after 10 to 20 years on the job.

From the heart rate variability analysis of each participant's baseline electrocardiogram (ECG), six measures commonly used in risk assessment were calculated. For a more detailed explanation of these measures and their clinical relevance, see the HRV Task Force Report.[66] Of the officers whose HRV and heart rate were analyzed, 8% were considered to be at increased risk for sudden cardiac death.[67, 68]

From the analysis of the ECG, one officer was identified as having significant ECG abnormalities. As this officer also had high triglycerides and other symptoms it is highly likely that this condition would have led to a heart attack, if not death, within the next year. This individual and his physician were immediately contacted by the study physician who was able to insure that the individual was evaluated, treated, and stabilized.

Between-Group Comparisons

The results of an ANCOVA analysis performed to compare pre-post changes between the experimental and control groups showed no significant differences on either the physiological or psychological measures. This is likely due to the fact that the total number of participants in the study was too low to provide the statistical power required to detect between-group differences. Due to budgetary constraints and cutbacks, the number of participants originally intended to be recruited into the study was cut by two-thirds. In addition, the control group exhibited directional improvements in a variety of the physiological and psychological measures, which contributed to the lack of significant differences in the between-group analysis.

Based on observations and reports from the worksite, a cross-contamination effect between the experimental and control groups was suspected to have contributed to the directional improvements observed in the control group. To test for the presence of such an effect, a post-study survey, conducted via a telephone interview, was administered to all control group participants. This survey included questions to determine whether control group participants had been exposed to any information about the content of the Power to Change Performance program through interactions with colleagues in the experimental group, or if their own behavior had been influenced by health- and stress-related behavioral changes that had been made by their experimental group colleagues following their training. Several questions were also included to assess other potential factors that might have contributed to the improvements observed in the control group.

The results of this survey provided clear evidence of a cross-contamination effect between the experimental and control groups. For example, 55% of the control group participants reported having heard about the Power to Change Performance program content before attending the training. Forty-five percent stated that hearing about changes their co-workers made to their diet, exercise, or the way they handled stress in turn motivated them to make similar changes. It was found that in two separate cases a husband and wife had been assigned to the training and control groups. There were also cases where managers who had attended the training program supervised employees in the control group.

The survey results also suggested that the training of the experimental group resulted in improvements in the overall organizational climate that were noticed by and influenced control group participants on a day-to-day basis. For example, 55% of the control group participants felt that their co-workers who had attended the program were noticeably less stressed. There was clearly an enthusiasm about the program that permeated the environment, as 100% of the control group participants reported that their co-workers had indicated that the program was benefiting them, and 100% also stated that they had been looking forward to attending the program.

In addition to cross-contamination issues, the survey revealed that simply the increased health awareness afforded by this study was likely also a factor that influenced the observed improvements in the control group. This is supported by the fact that 84% of the control group participants reported having been motivated to make changes to their diet and exercise routines as a result of having been made aware of their blood pressure, cholesterol, and other health indicators at the initial data collection point.

Within-Group Comparisons

Due to the cross-contamination effects, pre to post changes for the two groups were analyzed separately. The pre-post changes within each group were analyzed using paired-sample *t*-tests. The results are shown in Tables 4 and 5 and in Figures 2 and 3.

Analysis of experimental group pre-post changes

The experimental group demonstrated significant pre-post differences in numerous variables tested. In terms of physiological measures, the experimental group participants demonstrated significant reductions in total cholesterol ($p < 0.001$), LDL cholesterol levels ($p < 0.001$), the total cholesterol/HDL ratio ($p < 0.001$), and glucose levels ($p < 0.01$) from pre- to post-training. The Adrenal Stress Index showed a significant reduction in DHEA ($p < 0.001$). The group also exhibited significant changes in a number of cardiovascular variables, including significant reductions in mean arterial pressure ($p < 0.001$) and in both systolic ($p < 0.001$) and diastolic ($p < 0.01$) blood pressure, and a significant reduction in mean heart rate ($p < 0.05$). In measures of heart rate variability/autonomic function, they showed a significant increase in the low frequency/high frequency ratio ($p < 0.05$).

In terms of psychological and work-related measures, on the Personal and Organizational Quality Assessment the experimental group demonstrated significant increases in scales measuring productivity ($p < 0.01$), motivation ($p < 0.01$), goal clarity ($p < 0.05$), perceived manager support ($p < 0.05$), gratitude ($p < 0.05$), and positive outlook ($p < 0.05$), and significant reductions in anger ($p < 0.05$) and fatigue ($p < 0.05$). On the Brief Symptom inventory, the group exhibited significant reductions ($p < 0.05$) in hostility, interpersonal sensitivity (feelings of personal inadequacy, inferiority and self-doubt), paranoid ideation (fearfulness, suspiciousness and mistrust), and the positive symptom total—a measure of overall psychological distress. Finally, the Jenkins Activity Survey results for the experimental group revealed significant reductions in the global scale measuring the Type A behavior pattern ($p < 0.05$) and in speed and impatience ($p < 0.05$).

Analysis of control group pre-post changes

In terms of physiological measures, the control group showed significant reductions ($p < 0.05$) in total cholesterol, HDL cholesterol, and glucose levels. No significant differences were observed in measures of heart rate variability/autonomic function.

In terms of psychological and work-related measures, the control group showed significant reductions in work attitude ($p < 0.01$) and confidence in the organization ($p < 0.05$), and a significant increase in depression ($p < 0.05$), as measured by the Personal and Organizational Quality Assessment. There were no significant pre-post changes on the Brief Symptom Inventory or the Jenkins Activity Survey.

Table 4. Pre – Post Physiological Changes

	Experimental Group (N=43)				Control Group (N=32)			
	Paired Difference				Paired Difference			
	Mean	SD	*t*	*p* <	Mean	SD	*t*	*p* <
Weight, lbs.	-1.52	5.68	1.76	ns	-2.17	6.27	1.96	ns
Body Mass Index	-0.22	0.86	1.69	ns	-0.33	0.91	2.02	ns
Triglycerides, mg/dL	-12.64	44.81	1.83	ns	-6.30	48.28	0.68	ns
Total cholesterol, mg/dL	-17.73	29.61	3.79	0.001	-15.33	32.18	2.61	0.05
HDL cholesterol, mg/dL	-0.81	3.85	1.26	ns	-1.86	4.32	2.28	0.05
LDL cholesterol, mg/dL	-19.93	31.94	4.04	0.001	-11.00	30.84	1.92	ns
Total cholesterol / HDL ratio	-0.52	0.88	3.84	0.001	-0.05	0.84	0.35	ns
Glucose, mg/dL	-5.62	10.50	3.47	0.01	-4.50	11.56	2.13	0.05
Cortisol burden, nM	-3.45	12.14	1.33	ns	-3.45	12.14	1.33	ns
DHEA, ng/ml	-2.45	1.82	6.33	0.001	-1.06	3.25	1.34	ns
S-IgA, U/ml	2.68	6.54	-1.92	ns	-1.06	3.25	1.34	ns
Systolic blood pressure, mmHg	-5.74	9.06	4.06	0.001	-3.34	9.13	2.00	ns
Diastolic blood pressure, mmHg	-3.46	6.70	3.30	0.01	-2.01	6.97	1.58	ns
Mean arterial pressure, mmHg	-4.70	7.37	4.08	0.001	-2.60	7.81	1.82	ns
Heart rate, BPM	-3.29	9.01	–	–	-4.31	10.27	–	–
Interbeat interval, ms	38.65	106.68	-2.32	0.05	44.54	118.15	-1.96	ns
Standard deviation of RR intervals, ms	-3.53	21.25	1.06	ns	3.99	16.07	-1.29	ns
RMS-SD, ms	-2.37	20.19	–	–	2.15	11.89	–	–
Ln(RMS-SD)	0.01	0.46	-0.07	ns	0.06	0.44	-0.72	ns
High frequency, ms^2/Hz	-50.46	219.31	–	–	8.73	78.54	–	–
Ln(High frequency)	-0.08	0.83	0.60	ns	-0.03	0.85	0.21	ns
Low frequency, ms^2/Hz	75.96	280.30	–	–	153.37	454.43	–	–
Ln(Low frequency)	0.21	0.72	-1.89	ns	0.07	0.90	-0.39	ns
Very low frequency, ms^2/Hz	-6.97	903.03	–	–	33.19	404.76	–	–
Ln(Very low frequency)	-0.05	0.84	0.37	ns	0.29	0.83	-1.82	ns
Total power, ms^2/Hz	-4.75	1235.11	–	–	192.38	774.63	–	–
Ln(Total power)	0.04	0.71	-0.39	ns	0.22	0.81	-1.39	ns
Low frequency / high frequency ratio	2.01	4.82	–	–	2.03	5.38	–	–
Ln(Low frequency / high frequency ratio)	0.29	0.82	-2.27	0.05	0.10	0.62	-0.86	ns

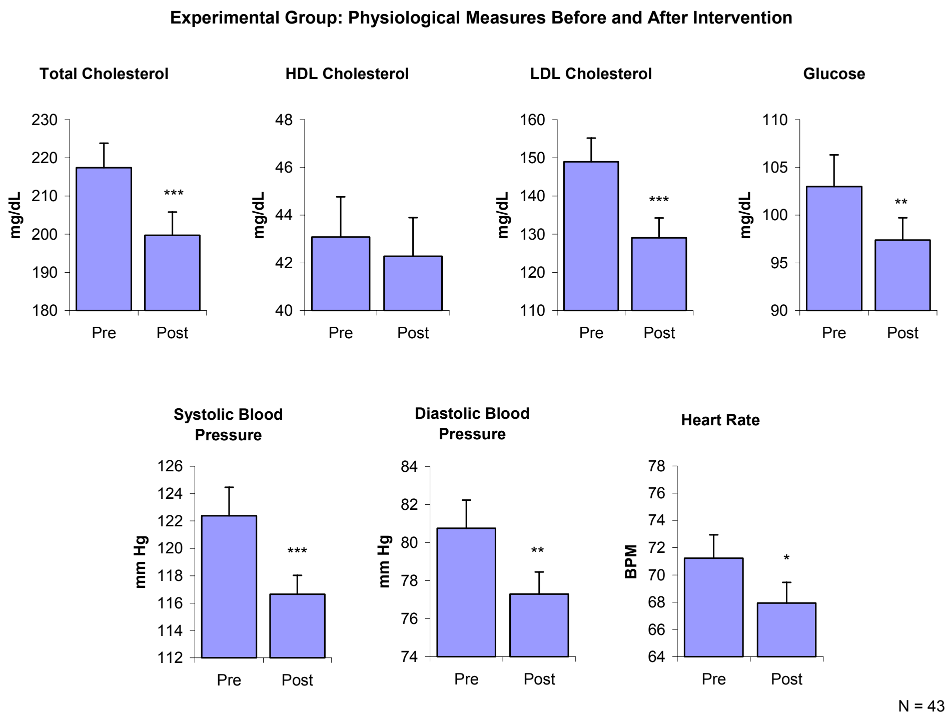

Figure 2. Bar graphs illustrate physiological variables in the experimental group, measured before and 3 months after the intervention program. The group showed significant reductions in total cholesterol, LDL cholesterol, blood glucose levels, systolic and diastolic blood pressure, and heart rate after the intervention. *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

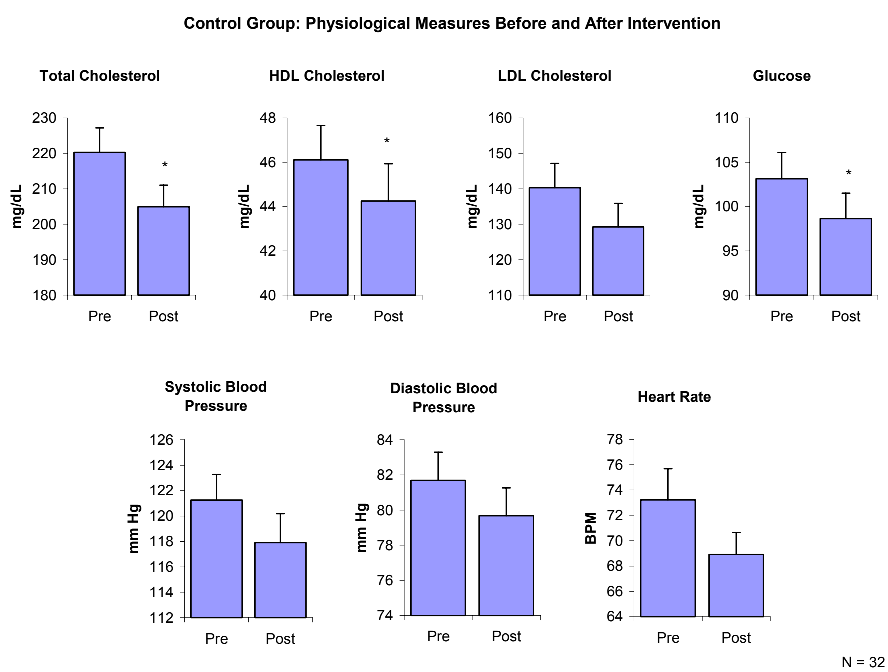

Figure 3. Bar graphs illustrate physiological variables in the control group, measured at baseline and 3 months later. The group showed significant reductions in total cholesterol, HDL cholesterol, and blood glucose levels at the 3-month measurement point. *$p < 0.05$.

Table 5. Pre – Post Psychological Changes

	Experimental Group (N=41)				Control Group (N=28)			
	Paired Difference				Paired Difference			
	Mean	SD	t	*p* <	Mean	SD	t	*p* <
Personal and Organizational Quality Assessment (POQA)								
Positive Outlook	0.33	0.89	-2.33	0.05	-0.01	0.83	0.08	ns
Gratitude	0.43	1.17	-2.36	0.05	0.27	1.26	-1.06	ns
Motivation	0.43	0.82	-3.38	0.01	0.13	0.91	-0.70	ns
Calmness	0.30	1.08	-1.78	ns	0.11	0.92	-0.62	ns
Fatigue	-0.37	1.16	2.03	0.05	-0.11	0.96	0.56	ns
Anxiety	-0.17	0.89	1.22	ns	0.23	0.87	-1.30	ns
Depression	-0.08	0.76	0.63	ns	0.24	0.49	-2.47	0.05
Anger	-0.19	0.56	2.18	0.05	-0.06	0.46	0.68	ns
Resentfulness	-0.16	0.86	1.18	ns	0.07	0.48	-0.77	ns
Stress Symptoms	-0.23	1.02	1.42	ns	-0.04	0.58	0.38	ns
Work Attitude	0.07	0.84	-0.53	ns	-0.37	0.54	3.47	0.01
Strategic Understanding	-0.09	1.12	0.53	ns	0.03	1.16	-0.14	ns
Manager Support	0.30	0.83	-2.29	0.05	-0.36	1.00	1.85	ns
Goal Clarity	0.33	0.90	-2.36	0.05	0.12	1.21	-0.48	ns
Job Challenge	-0.17	0.77	1.46	ns	-0.29	0.97	1.55	ns
Value of Contribution	0.02	0.95	-0.11	ns	-0.05	0.95	0.28	ns
Freedom of Expression	0.08	1.24	-0.43	ns	0.04	0.99	-0.23	ns
Work Intensity	0.16	0.82	-1.26	ns	0.08	0.78	-0.50	ns
Productivity	0.33	0.74	-2.84	0.01	0.03	1.02	-0.16	ns
Communication Effectiveness	0.29	1.22	-1.54	ns	0.42	1.41	-1.49	ns
Confidence in the Organization	0.03	1.12	-0.14	ns	-0.38	0.82	2.36	0.05
Morale Issues	-0.06	1.47	0.27	ns	0.02	1.76	-0.06	ns
Time Pressure	-0.20	1.08	1.21	ns	-0.13	1.28	0.54	ns
Intention to Quit	-0.04	1.49	0.16	ns	0.23	0.94	-1.25	ns
Brief Symptom Inventory (BSI)								
Somatization	-0.08	0.44	1.18	ns	-0.03	0.57	0.32	ns
Obsessive-Compulsive	-0.17	0.55	1.95	ns	-0.05	0.73	0.38	ns
Interpersonal Sensitivity	-0.19	0.55	2.16	0.05	-0.10	0.62	0.84	ns
Depression	-0.09	0.64	0.86	ns	-0.01	0.59	0.05	ns
Anxiety	-0.13	0.49	1.70	ns	-0.04	0.43	0.46	ns
Hostility	-0.15	0.43	2.13	0.05	-0.16	0.48	1.73	ns
Phobic Anxiety	-0.01	0.36	0.09	ns	-0.11	0.39	1.55	ns
Paranoid Ideation	-0.17	0.50	2.19	0.05	-0.01	0.41	0.16	ns
Psychoticism	-0.04	0.38	0.67	ns	0.00	0.51	0.02	ns
Global Severity Index	-0.11	0.37	1.88	ns	-0.05	0.44	0.62	ns
Positive Symptom Distress Index	-0.07	0.32	1.34	ns	0.00	0.39	-0.03	ns
Positive Symptom Total	-4.53	11.11	2.57	0.05	-0.67	9.20	0.38	ns
Jenkins Activity Survey (JAS)								
Type A – Overall score	-14.59	45.97	2.03	0.05	-13.79	52.03	1.40	ns
Speed and Impatience	-17.90	44.05	2.60	0.05	-14.61	39.86	1.94	ns
Job Involvement	-5.76	31.43	1.17	ns	-8.29	29.31	1.50	ns
Hard-Driving and Competitive	-0.71	22.79	0.20	ns	-4.89	19.88	1.30	ns

Correlation Analysis

A correlation analysis was performed to identify significant correlations between pre-post changes in psychological and physiological measures. The following significant correlations were found: Systolic blood pressure reductions were correlated with increases in DHEA ($R = -0.35$, $p < 0.05$), increases in S-IgA ($R = -0.37$, $p < 0.05$), and decreases in anger ($R = -0.33$, $p < 0.01$). Reductions in diastolic blood pressure were also correlated with reductions in anger ($R = -0.32$, $p < 0.05$). Reductions in cortisol were correlated with reductions in the JAS scale for speed and impatience ($R = -0.4$, $p < 0.01$).

Program Evaluations

Written program evaluations completed by all experimental group participants revealed some important insights, both in identifying the most prominent sources of workplace stress experienced by these officers and in assessing the intervention's perceived relevance, applicability, and effectiveness in meeting the needs of this population. A synthesis of participants' program evaluation responses is presented in the Appendix. Issues relating to managing and dealing with staff and co-worker interpersonal relations were most frequently cited as the greatest common challenge faced by participants in the workplace, followed closely by dealing with stress after an incident. Overall, the program was rated highly by the great majority of the officers and appears to directly address issues relevant to correctional officers and the goals of the organization. In their evaluations, 100% of the experimental group participants either "strongly agreed" or "agreed" that the program was well worth the time spent and that its content would be useful to them in their work. The Intuitive Listening technique, Freeze-Frame technique, and Freeze-Framer technology were most frequently cited as the aspects of the program that participants found most relevant. On a question asking what aspects of the program they would improve, the most common response was "None," followed by suggestions to increase the duration of the training. Finally, in the section of the evaluation that asked officers to express any additional comments or suggestions they might have, the most common recommendation, expressed by the majority of officers who participated, was that the program be provided for all staff.

Risk Factor Reduction Cost Analysis

An analysis was performed to determine the projected cost savings to the organization that would result from the reduction in employees' health risk factors. Separate calculations were performed to determine projected changes in health care costs and in absentee costs.

Health care costs

A number of health risk factors have been shown to be associated with higher health care costs (see Table 1). The presence of multiple risk factors provides a better prediction of future costs than any single factor.[18] Studies by Yen and colleagues established annual health care costs associated with multiple risk factors. It was found that annual health care costs for the group with zero health risk factors were only 37% of average; the group with 1 risk factor had costs 70% of average; employees with 2 or 3 risk factors had medical costs that were 105% of average; those with 4 or 5 risk factors had medical costs that were still higher at 139%; and those with 6 or more risk factors had the highest medical costs, at 301% of average.[22]

In examining the baseline data for the experimental group, it was found that 8% of this sample had only 1 risk factor, 49% had 2 or 3 risk factors, 38% had 4 or 5 risk factors and 5% had 6 or more risk factors. Of the control group, 13% had 1 risk factor, 43% had 2 or 3 risk factors, 39% had 4 or 5 risk factors, and 4% had 6 or more. At the completion of the study, 43% of the experimental group participants had reduced a sufficient number of their risk factors to place them into a lower projected cost status, whereas the percentage of control group participants who lowered their projected cost status was only 26% (Figure 4). For both groups these improvements were primarily due to reductions in cholesterol, diastolic blood pressure, and the risk age index. The experimental group also had risk reduction in systolic blood pressure, and improved life satisfaction and increased regular exercise.

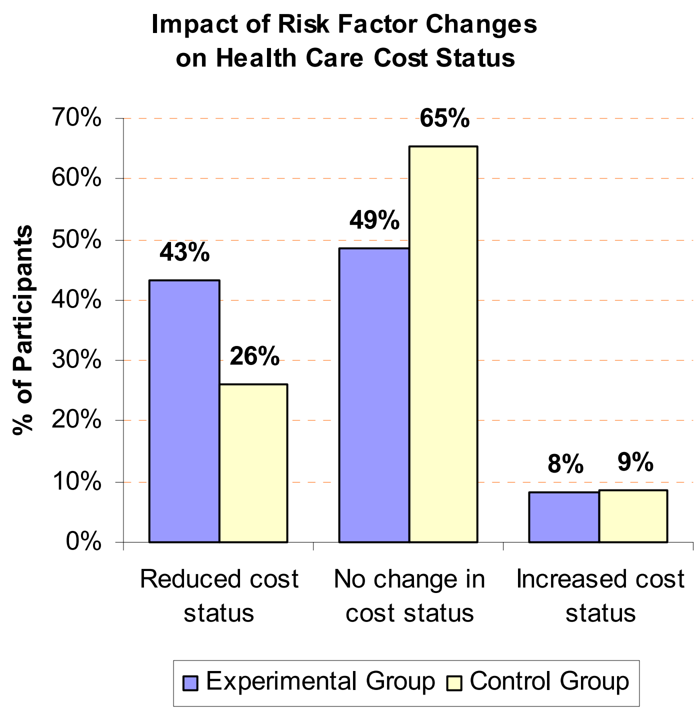

Figure 4. Illustrates changes in health care cost status, based on number of health risk factors in the experimental and control groups over the study period. Reductions in cost status were achieved by 43% of the experimental group 3 months after the intervention program and by 26% of the control group over this same time period.

An analysis was performed to calculate the projected health care cost savings that would result from the reduction in risk factors. Because actual annual medical costs were unavailable, we used the U.S. Department of Health and Human Services, National Center for Health Statistics' figure of $2,749, the average national health expenditure per capita for 2001 (the most recent year available) to represent the average annual medical cost per employee.[69] By multiplying the average health expenditure by each participant's risk-related proportion of this cost, the projected health care cost for each participant was determined. For example, a participant with 4 health risk factors, has a projected annual health care cost of $3,821 ($2,749 x 139% = $3,821). The mean difference between pre- and post-intervention projected health care costs was calculated for both the experimental and control groups.

Using this procedure, a pre-intervention average health care cost of $3,453 was projected for each employee in the experimental group. At the end of the study, the projected average health care cost per employee was reduced to $2,832, resulting in an average annual savings of $621 per employee.

The control group's pre-intervention projected average health care cost per employee was $3,361. At the end of the study, the projected cost per employee was reduced to $3,158, resulting in an annual savings of $203 per employee.

Absentee costs

Strong associations between health risk level, absence from work, and associated costs have been reported in several studies. In one such study involving over 6,000 workers, the high-risk group (5+ risk factors) had the highest annual absence-related costs, followed by the medium-risk group (3-4 risk factors), while the low-risk group (0-2 risk factors) had the lowest absence-related costs.

This same trend was evident in the data from the population studied here, despite the relatively small sample size: a greater number of health risk factors was related to a greater number of days away from work. On average, employees at low risk (0-2 risk factors) reported taking 3.6 sick days for illness or injury during the previous 12 months. Those at medium risk (3-4 risk factors) reported 5.5 sick days, and those at high risk (5 or more risk factors) took an average of 5.8 days per year.

By taking the low end of the approximate salary range categories reported by participants on the Personal and Organizational Quality Assessment (categories were in increasing $10K increments from $20K – $150K), the reported average salary for participants in this study was $60,000 annually, $5,098 monthly, or $237 per 8-hour day. By multiplying the average number of sick days associated with each subject's risk status by this $237 average day wage, we arrived at the projected annual cost of health risk-related absenteeism due to wage costs for replacement workers. Repeating the process for each participant's post-study risk status and taking the pre-post cost difference, we found an average $78-per-person savings in risk-related absentee costs in the experimental group. In contrast, the control group had an increased cost of $28 per person. Although the control group showed an overall reduction in risk factors at the end of the study, many of the individual participants had a reduction of only 1 risk factor, which did not produce sufficient change in individual health risk status to reduce risk-related absentee costs. It should be noted that these conservative projections do not take into account indirect costs associated with absenteeism, which are more difficult to quantify. Indirect costs can include overtime pay for the replacement employees, extra supervisory time to rearrange schedules, disability and worker's compensation, and decline in morale and lower productivity among workers who need to cover the absent employee.

When we combine the $621 in health care cost savings with the $78 in risk-related absentee cost savings, the total projected annual savings for the experimental group is $699 per employee. The control group saved $203 in health care costs due to the reduction in risk, but added $28 due to increased risk-related absentee costs, yielding a total projected annual savings of $175 per employee (Figure 5).

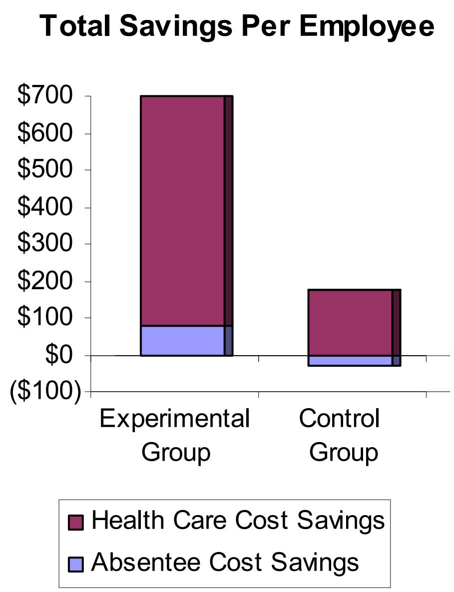

Figure 5. Bar graphs illustrate the total average savings per employee in health care costs and absentee costs realized during the study period by the experimental and control groups due to changes in health risk factors. The experimental group had an average total projected annual savings of $699 per participant ($621 savings in health care costs and $78 savings in risk-related absentee costs) due to reductions in health risk factors after the intervention. The control group had an average total projected annual savings of $175 per participant ($203 savings in health care costs and a $28 gain in absentee costs).

In studies of the long-term impact of health risk reduction programs, in which employees' actual health care costs were followed for up to 5 years before and 4 years after implementation of the program, it was found that the largest cost benefits occurred in the third and fourth years following the program.[70] Thus, there are data to suggest that with appropriate maintenance the annual cost savings realized by the stress and health risk reduction program implemented in this study will accrue for at least 4 years.

The cost to implement the training aspects of the program to larger populations (including labor and materials costs) would be approximately $231 per employee. The cost of the health risk measures (PWP, blood pressure, lipid panel, and body mass index) would be approximately $36 per employee. This means that for every $1.00 spent, $2.62 can be saved through reducing health risk factors during the first year alone, with accumulated saving of $5.24 for every $1.00 spent at the end of the second year. Ongoing savings can be realized with an appropriate health maintenance program.

Discussion

This study was initiated by the State of California Commission on Correctional Peace Officer Standards and Training (CPOST) to determine if the HeartMath Power to Change Performance stress and health risk reduction program was an effective intervention to help correctional peace officers reduce the high levels of stress they face on a daily basis; to determine if these officers have increased health risks; and if so, to determine whether these risks could be reduced by this intervention. The physiological measures were considered important aspects of the research, as law enforcement personnel have the tendency to under-report stress levels and stress symptoms.[51] It has been suggested by a number of researchers that law enforcement affords a professional environment that encourages emotional detachment from others as well as from workers' own feelings. This may explain officers' tendency to under-report their stress levels.[10, 71, 72] The repercussions of this clearly extend to officers' families, where it is reflected in poor relationships with spouses and children and the notably high rates of marital disruption and divorce known to exist within this profession.[10, 73, 74]

The fact that the officers in this study reported substantially more absences due to illness, had higher diastolic blood pressure, and had higher levels of the stress hormone cortisol than would be expected based on reference data all suggest that these officers are subjected to higher than normal levels of stress. Based on the analysis of the baseline data, it also appears that officers working in the different locations face differing levels of stress. The N.A. Chaderjian facility is regarded by the correctional officers as the most stressful and dangerous unit to work in, as it has the highest number of "incidents" of the three facilities from which participants were recruited for this study. The officers who worked in this facility had significantly higher average systolic and diastolic blood pressure, higher LDL cholesterol levels, and the highest baseline heart rate. It also appears from the analysis of time on the job and cortisol levels that long term employment can lead to elevated cortisol levels. Cortisol is a well established biochemical marker of stress, and chronically elevated levels of cortisol are associated with numerous negative health outcomes.

Overall the Power to Change Performance program appears to provide effective solutions that can help officers manage the unavoidable sources of stress they face, and reduce the impact of this stress on their health. The analysis of within-group changes indicated that numerous significant improvements were realized by the implementation of the intervention. The Personal and Organizational Quality Assessment showed significant reductions in fatigue and anger along with increased productivity, motivation, goal clarity, and manager support in the experimental group, but not in the control group. The Brief Symptom Inventory also showed that the experimental group experienced significant reductions in interpersonal sensitivity, hostility, and overall psychological distress, while the Jenkins Activity Survey showed significant reductions in the global Type A behavior pattern and in speed and impatience.

Physiological measures were also impacted. Total cholesterol and glucose were reduced in both groups, while LDL cholesterol fell in the experimental group. Heart rate, systolic, and diastolic blood pressure were also significantly reduced in the experimental group but not in the control group. We anticipated blood pressure reductions in employees who had elevated blood pressure based on findings from previous studies;[49, 52] however, this study also demonstrated significant reductions in blood pressure in the experimental group as a whole, which supports the perspective that the program reduced the officers' overall stress levels.

There was a significant decrease in DHEA in the experimental group in this study. One would typically expect a gradual increase in DHEA after a stress reduction intervention.[46] The finding that DHEA was decreased in this study sample after the short follow-up period combined with the finding that a higher number of officers than would be expected had high baseline levels of cortisol, suggests that these officers are under higher levels of stress than the general population. From a biochemical perspective, the goal of the techniques taught in the program is to reduce stress-induced activation of the hypothalamic-pituitary-adrenal axis, which controls the release of cortisol and DHEA. Both cortisol and DHEA are in turn controlled by adrenocorticotropic hormone (ACTH), and reduced emotional stress reduces the frequency and magnitude of ACTH secretion. Whereas in a less stressed individual or population a reduction in ACTH results in reduced cortisol and increased DHEA, in a *chronically stressed* individual or population, the reduction of ACTH leads to a reduction in *both* cortisol and DHEA. Thus, it is reasonable to conclude that the simultaneous reduction in cortisol and DHEA in the experimental group was due to intervention-mediated emotional stress reduction, which reduced ACTH. In the case of a chronically stressed individual, it typically takes between 6 to 9 months for the system to recover (i.e., for cortisol to decrease to normal levels and DHEA to increase); therefore, a longer follow-up period would be required to detect such changes in this study sample.

Limitations and Future Directions

A main limitation of this study was that the total number of participants was too small to provide the statistical power required to detect between-group differences associated with the intervention program. This, combined with the presence of cross-contamination effects between the two groups, precluded the possibility of a meaningful between-group analysis.

It is unfortunate that the control group was exposed to cross-contamination, which was clearly verified in the post-study questionnaire. On the other hand, it highlighted the desire and enthusiasm the officers had for such a program and the power of changes in the organizational climate to impact health risk factors. This is an important issue for future research designs, as a prevailing mindset in the research community is that only randomized controlled study designs should be considered valid methods of assessing an intervention's effectiveness.[18] While this may be true for a pharmaceutical trial, it may not be the best design for field studies conducted in organizational settings.

An important, stated goal of the Power to Change Performance program is to improve organizational climate.[43] This aspect of the program is one that may have particular relevance to the organizational context studied here, as climate issues have been shown to be one of the most significant sources of stress in law enforcement.[3] In fact, in the program evaluations, participants in this study reported the most challenging issue in the workplace to be managing staff and co-worker relations (see Appendix).

Another limitation of the current study was its relatively short follow-up period (90 days). Although significant reductions in a number of health risk factors were realized in this time period, it typically takes much longer for the physiological benefits of reducing stress to produce measurable outcomes. Thus, if the effects of the intervention are sustained, studies with a longer follow-up period could reasonably be expected to demonstrate additional reductions in health risk factors and increased health care cost savings.

A further limitation was our inability to include calculations of the projected cost savings directly due to decreased stress. Stress has been shown to be an independent risk factor that directly impacts health care costs. In a study that correlated individual health risk factors with actual health care expenditures, stress was shown to account for 8% of all health care expenditures.[20] However, the measures of stress used in that investigation were not considered appropriate for the more rigorous measurement of stress conducted in the present study, and in our analysis we chose to include only cost projections based on specific measures that had been previously correlated with actual cost savings. Thus, it is recommended that future studies extend over longer time periods and include measures of the direct financial impact of stress reduction, as well as actual measurements of health care utilization and costs.

CONCLUSIONS

In conclusion, the results of this study indicate that the HeartMath Power to Change Performance program is a time-efficient and cost-effective means to significantly reduce stress and health risk factors in a population of correctional peace officers, while enhancing employee productivity and psychological well-being. Based on these outcomes, reductions in annual health care and absenteeism-related costs are projected. Thus, by reducing the physiological, psychological, performance-related, and financial impact of high stress and health risks in this crucial and demanding profession, the program promises significant benefits both to the employees as individuals and to the organization as a whole.

Appendix

Experimental Group Training Evaluation

Summary of Comments and Feedback (N = 39)

	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
1) The content focused on session objectives	82%	18%	0%	0%	0%
2) Course materials were well organized and easy to follow	87%	13%	0%	0%	0%
3) The instructor demonstrated a thorough understanding of the subject matter	92%	8%	0%	0%	0%
4) The instructor explained concepts clearly	92%	8%	0%	0%	0%
5) The instructor created a comfortable environment in which to ask questions and express concerns	92%	8%	0%	0%	0%
6) The course content will be useful to me in my work	82%	18%	0%	0%	0%
7) This session was well worth the time spent	90%	10%	0%	0%	0%

# of Similar Comments	8) What aspects of this session were most relevant to you?
11	"Intuitive Listening" | "Effective listening"
9	“Freeze Frame and Freeze Framer”
6	“Health benefits”
4	“Getting in the Zone”
4	"Controlling emotions" | "Re-establishing control"
4	"Stopping stress on things I can't control" | "Dealing with stress in a more positive manner"
4	“Nutrition”
3	“Awareness of thoughts and attitudes and how they affect the physical body”
3	"Whole training" | "Entire course"
2	"Solving problems with the heart" | "Applying Freeze-Frame on resolving conflicts"
2	“Breathing”
2	“Focusing on a positive life moment”
1	“Comfortable approach in order to understand”
1	“Blood tests”
1	“Feeling of peace with the heart and mind”
1	“Good self-image”

# of Similar Comments	9) What aspects of this session would you improve?
14	“None”
6	"More time practicing the techniques" | "Another day of training for depth" | "Could be longer – very interesting"
4	“More time to do hands-on with the software”
2	“Providing this to every line staff and admin in the department”
2	“Intuitive Listening, health discussion”
1	“Being more patient and listening when someone wants to talk”
1	“Applying Freeze-Frame to routine of a day – family, work, social settings”

# of Similar Comments	10) Please describe the most challenging issue in your workplace that requires a training solution.
10	"Managing and dealing with staff" | "Co-worker interpersonal relations" | "Non-motivated staff"
9	"How to deal with stress after an incident” | "Dealing with the stress at work and not taking it home"
5	"Interacting with wards" | "Irrational wards that don't play within the rules"
2	“Quality management approach is nonexistent”
2	“Dealing with change without adding stress”
2	“Dealing with unknown job status”
1	“7K training is a joke”

# of Similar Comments	11) Other comments or suggestions
20	"Strongly recommend this training for not only peace officers but all personnel" | "All staff should be given the opportunity to experience the class" | "CPOST: Please implement to ALL staff"
5	"This was very valuable and should be beneficial if one uses it – both at home and work" | "Taught extremely valuable lessons to be a better human"
4	"Excellent stuff" | "Good job!"
3	"Would like follow-up training" | "What is next?"
2	“This is the very best training course I have ever had. It was worth every minute of it.”
2	"I learned how to focus on the problem – decreases risk of myself or somebody else getting hurt" | "Make safer decisions"
1	"Desperately needed in our workforce to be better leaders to our staff and wards"
2	“Most of the concepts in this training would be beneficial in dealing with negative situations and stress issues"
2	“I greatly appreciate this training and plan to share and incorporate it into my own life and the lives of others”
1	“Class reiterated the content that counselors in the Youth Authority are asked to convey: healthy living, effective communication, and productive lifestyle”
1	“Replace 7K with this”
1	"Good for mental/physical wellness" | "Relations with others" | "Deals with stress in a broad spectrum"
1	“My husband would like to take a training – would pay and travel to location. Please call us!”
1	“Interesting, fun, helpful”

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