

EFFECT OF BIOFEEDBACK-ASSISTED RELAXATION THERAPY ON THE  
PSYCHOPHYSIOLOGICAL MEASURES OF STRESSED-OUT  
WORKING PROFESSIONAL MOTHERS

Diana Carol Valdez, M.S., LPC, BCIAC

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APPROVED:

Cynthia Chandler, Major Professor  
Doris Coy, Committee Member  
Doug Norton, Committee Member  
Carolyn Kern, Coordinator of Counseling Program  
Ron Newsom, Chair of the Department of  
Counseling, Development, and Higher  
Education  
M. Jean Keller, Dean of the College of Education  
Sandra L. Terrell, Dean of the Robert B. Toulouse  
School of Graduate Studies

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This study was designed to determine the effectiveness of biofeedback-assisted relaxation therapy on reducing psychophysiological stress levels of working professional mothers. Participants were 14 working professional mothers from a major daily newspaper. Reported stress levels were measured with the 123 question Stress Profile (Nowack, 1990) three times during the eight week treatment study that was held at the women's workplace. A repeated measure ANOVA design was used to analyze the data and a partial eta squared ( $n^2$ ) was used to calculate effect size. As hypothesized, the study found a statistically significant reduction of reported stress levels ( $F=8.62$ ;  $p=.001$ ) and a statistically significant ( $F=3.65$ ;  $p=.01$ ) reduction in measured muscle tension across subjects. A large effect size was found for reduction in reported stress levels ( $n^2=.39$ ) and reduction in muscle tension ( $n^2=.21$ ).

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## CHAPTER 1

### INTRODUCTION

Research from the fields of medicine and psychophysiology demonstrate that excessive stress has damaging effects on the human body. Stress has been linked to heart disease (Cacioppo et al., 2000; Hallman, Thomsson, Burell, Lisspers & Setterlind, 2003), premature aging (Epel et al., 2004), lower immune defenses and common cold (Cohen, 1996), and hypertension (Markovitz, Matthews, Whooley, Lewis & Greenlund, 2004; Mills, Davidson, & Farag, 2004), and stress exacerbates diseases such as rheumatoid arthritis (Fifield et al., 2004), eating disorders (Kudielka, Von Kanel, Gander & Fischer, 2004), sleeping problems (Freeman & Gil, 2004) and skin disorders (Gupta & Gupta, 2004). The evidence may lead one to believe that all stress should to be avoided and exorcised from one's life. However, some forms of stress like the biology of the stress response is an innate survival mechanism for animals including humans, and this cannot and should not be eliminated, but it may be managed.

Importance of the stress response is demonstrated in Sapolsky's (2000) book, "Why Zebras Don't Get Ulcers." The stress response helps animals survive in the wild. When an animal, such as a zebra, perceives danger, such as a predator, the zebra's brain alerts the hypothalamus which sends the endocrine system into action, releasing stress hormones into the body. These hormones activate and mobilize the body's autonomic nervous systems (muscular skeletal, respiration, cardiovascular, vision) to prepare the zebra for fighting or fleeing (Sapolsky, 2000). Once safe, the zebra's body activates the *relaxation response* (Benson, Beary & Carol, 1974) and returns to a homeostatic balance

(Sapolsky, 2000). In other words, once the danger is gone, the zebra returns to its normal stress-free life and avoids stress-related illnesses or disorders such as ulcers.

Humans, similar to animals in the wild, have the same physiology and reaction to a perceived threat. Just as the zebra's body mobilizes to react to danger, the human body mobilizes as the brain alerts the hypothalamus of the danger and stress hormones are secreted to prepare the body for the *fight or flight* response (Cannon, 1935). Humans, however, differ from zebras, in that humans may activate this stress response even in the absence of a real threat. If the threatening situation (real or imagined) dominates one's thoughts or behaviors, stress hormones are continually secreted throughout the body. The body's autonomic systems recognize the elevated stress hormones and prepare to return to homeostatic levels. However, with continuous threat perception, the stress hormones overpower the body's systems and, slowly, cells and organs begin to breakdown and, literally, die (Selye, 1978; Epel et al., 2004). Selye (1978) referred to this process as the "general adaptation response" and believes it leads to many stress-related illnesses and diseases.

Stress research has a long, fruitful history that dates back to the early 1900s. The groundbreaking research conducted by pioneers, such as Cannon (1935), Selye (1978) and Benson (1974), restricted research study to animal and male subjects. Until about 15 years ago, the majority of stress research on humans was conducted on men (Taylor et al., 2000). As a result, the concept of fight or flight, observed in male subjects, was generalized, possibly erroneously, to the female population. Although women release the same stress hormones when presented with a perceived threat, they also release oxytocin, a hormone attached to lactation. While the stress hormones are inciting the body's

systems and getting animals ready to fight or flight, oxytocin may have a calming affect. Men release oxytocin, as well, but in significantly lesser amounts and the high levels of male testosterone are thought to counteract the positive effects generated by oxytocin (Taylor et al., 2000). A theory referred to as *Tend and Befriend* suggests women have a different response to stress that more aligns with caring for their young and surrounding their neighborhood (family) with friendly support (other women) in order to survive the environment (danger) (Taylor et al., 2000).

Taylor (2002) speculates, in her book *The Tending Instinct*, that survival of the species meant that females had to learn how to protect their young from danger. Animals, as well as humans, pass down the survival mechanisms most important to protecting their young (tending). That answers some questions about how and why female animals and female humans surround themselves with other females (befriending). There is strength in numbers and the strength may be needed to protect the young and fight off predators or protect self and fight off stress (Taylor, 2002).

Researchers have found a statistically significant difference in response to stress between genders. When men are stressed, they tend to aggress toward the stressor in either an overt or covert manner. Overt aggression might be exemplified by men at work who may complain about a situation or quit their job, or, covertly they may withdraw and seek comfort with drugs or alcohol (Torkelson & Muhonen, 2004). In contrast, when women are stressed they tend to seek support from other women (befriend) and talk about their stress (Taylor et al., 2000; Taylor, 2002). Professional women and especially working professional mothers may deal with their stress by caring for their homes and children (tend) (Taylor et al., 2000; Taylor, 2002).



## Statement of the Problem

Very few scientific investigations have been conducted about working women/mothers, the variety of stressors they endure, and the types of treatment available to alleviate stress-related symptoms. No investigations have been found that address biofeedback-assisted relaxation therapy of working women/mothers. Only one journal article was found that incorporated the term *supermom*, used in the 1990s, to describe the emerging phenomenon of the working professional mother (DeMeis & Perkins, 1996). Supermom was the woman who could work a fulltime job and come home to care for her children, home and spouse (DeMeis & Perkins, 1996). Working mothers were almost idealized as this perfect being, someone who could keep several balls in the air in a magical appearance of womanhood. However, the stress of the job, stress of the housework, stress of taking care of the children, stress of taking care of the spouse and somehow taking care of herself hasn't been so magical. Brent Bost (2001) a gynecologist in Beaumont, Texas, coined the term *hurried woman syndrome* and wrote a book detailing the chronic problems emerging from chronic stress. Bost writes that all women are susceptible to fatigue, weight gain, and low libido, three elements of the hurried woman syndrome, but his concept is derived from his treatment of working professional mother – women who have simultaneous multiple roles and multiple tasks to fulfill (Bost, 2001).

As noted earlier, research on women and stress is a relatively new frontier. Research examining the unique stressors of working professional mothers and how they deal with their stress is almost nonexistent. The tend and befriend theory was synthesized from research conducted mainly on animals and generalized to humans (Taylor et al.,

2000). The hurried woman syndrome is a concept supported by observational evidence from treating hundreds of patients a year for 15 years as a gynecologist (Bost, 2001). It has not been subjected to objective scientific research and investigation.

### Purpose of the Study

The purpose of this study is twofold; (1) to examine the concept of working professional mothers, the many stressors they encounter daily and the toll potential stress-related illnesses may be taking on their lives and, (2) the effectiveness of biofeedback-assisted relaxation therapy in treating or reducing this kind of stress. This study hopes to add to the current research on the understanding and treatment of stress-related symptoms and illnesses by using biofeedback-assisted relaxation therapy to treat working professional mothers.

### Review of Related Literature

#### *Stress and Illness*

After more than 70 years of stress research in the medical and psychophysiological fields, investigators have found that excessive stress may lead to a number of stress-related illnesses and diseases in animals and humans. Stress has been linked to heart disease (Cacioppo et al., 2000; Hallman et al., 2003), premature aging (Epel et al., 2004), lower immune defenses, and common cold (Cohen, 1996), hypertension (Markovitz et al., 2004; Mills et al., 2004), and exacerbates illnesses and diseases such as major depressive disorder (Farabaugh et al., 2004), rheumatoid arthritis (Fifield et al., 2004), eating disorders (Kudielka et al., 2004), sleeping problems (Freeman & Gil, 2004) and skin disorders (Gupta & Gupta, 2004).

*Heart disease.* Coronary heart disease, short of death, may be the most damaging effect of chronic stress on humans. In one study, 97 female patients aged 40-65 with coronary heart disease reported a greater level of burnout and were less able to cope with the stressors in their lives compared to a healthy matched group of 97 women (Hallman et al., 2003). Burnout was assessed in this project because researchers believed that burnout comes from prolonged or chronic stress situations and encompasses external, environmental and internal unhealthy pressures.

The terms burnout and vital exhaustion may be used interchangeably when referring to stress-related illnesses or diseases (Hallman et al., 2003). Burnout usually refers to work overload, where vital exhaustion is linked to family and financial stress. Whichever term is used, this study found that the lack of healthy coping strategies and lack of resources can have a detrimental impact on women's health and make them more exposed to physical and emotional collapse such as coronary heart disease (Hallman et al., 2003).

In their literature review, the investigators found that women are frequently in jobs where they have little control or power to make decisions that affect their circumstances; and, at home, they are the main caregivers of children and have most of the responsibility of household chores and get little time to relax or time for themselves. They also found that there is great need for more studies on gender differences of coping with stress, and more studies on women and stress in general (Hallman et al., 2003).

One of the largest studies on heart disease, Coronary Artery Risk Development in Young Adults (CARDIA), started with 5,115 participants aged 18-30 from four states, Alabama, Illinois, Minnesota and California. Researchers measured job strain in 1987-

1988 (Year 2 examination) and again in 1995-1996 (Year 10 examination). After attrition for various reasons, the analysis was made on 3,200 participants: 847 white men, 908 white women, 596 African-American men and 849 African American women (Markovitz et al., 2004).

The researchers found that an increase of job strain, defined as “a demanding and stressful work environment with little latitude, flexibility or options for coping with these demands,” (p. 4), is associated with increased high blood pressure (Markovitz et al., 2004). Contradictory to one of their hypotheses, the researchers found that chronic job stress does not lead to higher levels of blood pressure. The researchers speculated that there may be a sensitization process happening within the sympathetic nervous system during chronic job stress that decreases the stress response (Markovitz et al.).

*Premature aging.* The latest findings from a study done in 2004 found that stress literally kills off telomeres, a part of cellular structure, which leads to premature aging (Epel et al., 2004). This is the first evidence-based link between stress and aging. Researchers studied 39 women age 20-50 who have been caring for a child with a serious chronic illness. They found that chronic stress destroys telomeres, the caps at the end of chromosomes. Every time the cell divides, the telomeres get shorter until they stop functioning and the cell dies (Epel et al., 2004).

As a part of this groundbreaking research, Epel and her colleagues found that perception of stress was a key factor in how women coped. The more stresses a woman perceived in her life, the worse she scored on level of stress. The higher the level of stress, the greater damage was found to the telomeres (Epel et al., 2004).

*Lower immune system.* Stress is a frequently studied variable relating to the suppression of various aspects of the immune system and its response (Cohen, 1996). In a number of his own studies in this area, Cohen found that psychological stress can lead to lowered immune response to fight off a cold. He explained that when perceived demands (real or imaginary) exceed coping ability people self-report they are stressed and they experience a negative emotional response (Cohen, 1996). This response leads to lower immune functioning in three ways; 1) by directly influencing nerve fibers connected to immune tissue that shuts down immune cells; 2) release of stress hormones such as epinephrine and cortisol that in large doses can destroy cells and organs; and, 3) through unhealthy behaviors used to reduce or cope with stressors like smoking, drinking, eating too much and not getting proper sleep and rest (Cohen, 1996). All of these factors have a direct link to lowered immune functioning (Cohen, 1996).

In a four year long study, Cohen (1996) pre-tested 420 healthy participants on stress levels and coping, injected them with cold viruses, and quarantined them for several days. He found that people who get sick with colds or respiratory infections have higher levels of perceived stressors and negative affect than those who don't get sick (Cohen, 1996). Why this matters is that respiratory infections are a major cause of morbidity and mortality among older adults (Cacioppo et al., 2000). Chronic stress of care giving adds to the decrease in immune functioning. People with low immune functioning become sick with respiratory infections more often (Cacioppo et al.).

Consistent with prior literature, the investigators found that 27 caregivers, compared to 37 non-caregivers, expressed higher levels of depression and higher levels of perceived stress (Cacioppo et al., 2000). They also describe their health as having

declined over the last 5 years, find life less exciting and expressed less satisfaction with life in general (Cacioppo et al., 2000). In their literature review, Cacioppo and team found that caregivers are also more isolated than non-caregivers, which in line with the social support literature, may add increased stress to the caregiver.

In another study looking at immune function and stress, researchers used 10 newspaper reporters, 5 men and 5 women, in a busy newsroom to examine how music affected the immune system and reported stress-levels of the participants. Researchers used secretory immunoglobulin A (IgA) analysis to assess immune function (Brennan & Charentski, 2000). Saliva samples and a reported stress level were assessed four times during the 90 minute experiment. To their surprise, researchers found a statistically significant decrease in reported stress level during the music and a negative statistically significant correlation between IgA and stress. They found an increase in IgA but it was not statistically significant (Brennan & Charentski, 2000). In an earlier study, Charentski and colleagues found a statistically significant increase in immune function when music was applied to a larger sample size of subjects inside a quiet room (Charentski, Brennan & Harrison, 1998). The researchers were surprised at the statistically significant reduction in self-reported stress level given the experiment was conducted in a busy and noisy newspaper environment. They concluded from this that using music even in a hectic environment like a newspaper appears to reduce stress which could lead to less illness; more relaxed workers and improved work performance (Brennan & Charentski, 2000).

*Potential relationship to other disorders.* In some of the latest research, psychological stress has been found to exacerbate illnesses and diseases such as major

depressive disorder (Farabaugh et al., 2004), rheumatoid arthritis (Fifield et al., 2004), eating disorders (Kudielka et al., 2004), sleeping problems (Freeman & Gil, 2004) and skin disorders (Gupta & Gupta, 2004).

When looking at a link between major depressive disorder (MDD) and perceived stress, Farabaugh et al. (2004) found in his six-year investigation of 298 outpatients that depressed women (n=163) had statistically significant higher levels of perceived stress than depressed men (n=135). These findings were contained primarily to the subtypes of MDD atypical and MDD with anger. They also found a connection between depression and day-to-day hassles in that not just major life events may cause depression but just everyday stressors may cause depressive symptoms (Farabaugh et al.).

A link has been found between stress and problems with rheumatoid arthritis (Fifield et al., 2004). The study followed 27 sufferers through 20 days of work using a work diary. They found higher levels of job strain (high demand/low control) caused more pain for people with rheumatoid arthritis.

In a stress study using 316 volunteers with a history of major dermatological or medical disorder, researchers looked at various skin problems such as pain to itching or burning sensations in 22 regions or areas on the body. They concluded that stress-related symptoms often affect the scalp region (59.5 %) and the most described symptom was itching (69.3%) (Gupta & Gupta, 2004). Women (n=243) reported significantly higher ratings compared to men (n=73) for several symptoms including crawling sensation, pain, moderate to severe itching (Gupta & Gupta, 2004).

In another study using 46 binge eating college women, researchers found that higher levels of stress were associated with binge eating (Freeman & Gil, 2004). The

researchers also found that women who did not use social support were more prone to binge eat, and lack of coping had a correlation to binge eating (Freeman & Gil, 2004). And still another study that used 709 participants (616 men and 93 women) found a link between stresses and sleep problems. The longitudinal cohort study findings suggest that over commitment at work interferes with restful sleep for men and over commitment as well as perceived job reward contributed to sleep problems for women (Kudielka et al., 2004).

### *Women and the Stress Response*

Two months after terrorists flew hijacked passenger jets into the World Trade Centers in New York City on September 11, 2001, creating one of the most, if not the most, stressful national emergency in our history, researchers found that women were twice as susceptible to instances of post traumatic stress syndrome as men (Pulcino, Galea, Ahern, Resnick, Foley & Vlahov, 2003). In the aftermath of the terrorists attack, investigators interviewed 988 people (514 women and 474 men) living in Manhattan and found that factors that contributed to this finding were motherhood, concern for the community and past unwanted sexual contact such as rape or assault (Pulcino et al., 2003).

Investigators found that women who are primary caretakers of children were more prone to PTSD, perhaps because mother's perceive themselves as having the extra burden of protecting and caring for their young, so the anxiety of the a traumatic event like 9-11 extends from the individual (mother) to the children (Pulcino et al., 2003). They also found that women with a large social network of friends and family did not report



elevated signs of PTSD supporting the premise that women with more social contacts are less prone to stress-related illnesses (Pulcino et al., 2003).

The above study suggests that women experience and process stress differently than men, a premise that initiated a ground breaking synthesis of animal and human stress research that was published in 2000. The study found that women maintain emotional attachments to their women friends and mobilize their friendships during stressful times (Taylor et al., 2000). Investigators call this stress response Tend and Befriend theory.

In the study, Taylor et al. (2000) and team, concluded that the fight or flight stress response may not characterize or generalize well to women. The majority of research exploring the fight-or-flight response was conducted on male rats (Taylor et al.).

The team found that women release the stress hormones when they perceive danger, just as men do, however they also release oxytocin, a hormone related to lactation (Taylor et al., 2000). This hormone, reinforced by estrogen, tends to work against the sympathetic nervous system which activates during a stress response to a perceived threat and readies the body for action, run or fight. Oxytocin, associated with the parasympathetic nervous system, or the resting-digesting response, decreases stress and activates the relaxation response (Taylor et al.). Men also release oxytocin but its effects are muted by testosterone (Taylor et al.).

The investigators compared the bio-behavioral mechanisms behind tend and befriend theory to the attachment/care giving system. This stress-related system has been explored because of its connection to maternal bonding and child development (Taylor et al., 2000). In their study, women seem to have more psychological distress stemming

from stressful events than do men, but just because they are reporting more distress, do not mean their bodies are processing more stress (Taylor et al., 2000).

In their literature review, Taylor et al. (2000) reported that stress research on men and women exposes the most robust gender differences in adult behavior. When stressed, the desire to emotionally and physically connect with others is significantly stronger among women than among men. Women seek out their female friends when they are stressed to communicate about the stressor, thus maintaining the social support network vital to this “befriending” behavior (Taylor et al.). Taylor emphasizes the importance of this connection:

The present analysis is suggestive of health implication for females. If a down regulated stress response in females produces relaxation and affiliation, this may help to explain the seven-and-a-half nonspecific years that women live longer than men. The tend and befriend pattern of behavior may be the countering balance that reduces stress-related diseases and illnesses in women, as well as episodes of violence, such as homicide and suicide, dependence upon stress-reducing substances such as alcohol or drugs; stress related accidents and injuries; and cardiovascular reactivity that can lead to CVD. (p. 424)

As reported earlier, men release oxytocin but its effects are muted by testosterone meaning that they do not receive the possible health benefits that were found in the above study (Taylor et al.). Stress continues to manifest itself in men through violent behavior, withdrawal through drugs and alcohol, more accidents and injuries and more incidence of cardiovascular disease (Taylor et al.).

Another finding in their report is that positive physical contact such as touching and hugging, may release oxytocin which, in turn, has anti-stress properties (Taylor et al., 2000). The oxytocin connection, however, is only theory at this time. Another study, hoping to add to the theoretical connection between oxytocin and emotions, the researchers explored how positive and negative emotions affected hormone (oxytocin, prolactin and ACTH) levels in women. Focused on oxytocin levels, the team found no difference in oxytocin levels between the negative and positive induced emotions (Turner et al., 2002).

*Stress, women, and age.* Research in the area of women, age and stress has found that younger women (18-29) reported more stress, have less healthy personality traits and more health problems where middle aged women (30-45) have far more stressors than other women, but may have healthier personality traits that contribute to managing stressors better. Older women (46-66) have fewer stressors and the highest healthy personality traits (Kenney, 2000).

Kenney found in her review of literature that women can deal with life stressors more effectively if they use inner resources to attain harmony and balance in their lives. As women's lives become more complex and chaotic, many women experience an overload of stressors that weaken their 'inner-balance' and contribute to reduced immune system functioning and stress-related illnesses (Kenney, 2000).

Furthermore, Kenney found that some psychosocial factors are linked to stress reactions that may alter the immune system, lower resistance to infections and predispose women to various health problems (2000). Out of 299 women, 40 percent reported their daily hassles were: trying to stay on a diet, managing household responsibilities, getting

help from partner, no emotional support from partner, finding time to relax and running errands/commuting children. Middle-age women reported greater stress from daily hassles than younger or older women. A large percentage of middle-age women were married (62%), and worked fulltime jobs (68%) outside the home (Kenney, 2000).

Kenney (2000) reported:

In this study, middle-aged women had significantly more daily hassles and overall stressors than younger or older women, which were probably related to their multiple roles and responsibilities, as wives, mothers, employees, students, and caretakers of elderly parents. With these multiple roles, middle-aged women reported more stressors related to managing home responsibilities, running errands/commuting children, not receiving adequate help or emotional support from their partner, and not finding time to relax. (p. 646)

Kenney emphasized that because of these greater burdens, including being concerned about the quality of and maintaining their marriage, women experience more anger and depression. Furthermore, she reported that middle-aged women tend to be less assertive and have more trust and love than other women. As a result, they may have met their family's needs but neglected their own (Kenney, 2000).

Even with the reported significance of major daily hassles, and unhealthy personality traits, middle-aged women scored slightly above the mid-point on the inner balance scale which may account for the fewer reported health problems in this group. Possibly, middle-aged women believe they need to be "superwoman" in order to meet the needs of their family and work obligations. Their healthy personality traits may have counterbalanced their unhealthy personality traits (Kenney, 2000).

Kenney found that women in more traditional jobs, such as clerical or service workers, where demands were high and control was low, reported more physical problems. Women with demanding family and job responsibilities, who had higher education and incomes, had higher stress levels than less educated women, regardless of their greater resources (Kenney, 2000).

Married professional women who felt they lacked authority, control and influence in their jobs, had greater incidence of health problems and decreased marital functioning and satisfaction. Today, women's major stressors are related to their roles as mother, wife, and employee. Their perception of their partner's lack of emotional support and lack of help with household chores and care of the children is detrimental to their health (Kenney, 2000).

Related to Kenney's study, Cohen et al. (1997) found that part of the problem is that women don't make time for themselves - they work outside the home, put in a full day's work, and basically come home to another job. They don't have time or don't make time to relax.

*Family stress.* Bird used a national longitudinal survey of a representative large sample of 1,256 adults to assess the amount of household labor on depression. She found that women who performed more than half of the household chores were more prone to depression and other psychological distress (Bird, 1999).

There are differences between men and women when it comes to psychological distress. Women report higher levels of psychological distress which includes worry, depression, demoralization and anxiety (Bird, 1999).

Housework is a productive event, involves physical activity and leads to a clean and pleasing living environment, which can reduce psychological distress (Bird, 1999). However, housework comes with no pay, no recognition and no appreciation. As a result, more household labor performed, induces higher rates of depression (Bird, 1999). When household labor is equal, women have similar incidents of depression as men.

It has been found that women managers have higher levels of the stress hormone norepinephrine in the evening hours. Unlike men, when women come home at night, they are less able than men to relax and decompress from the busy working day, partly because of household responsibilities and children (Bird, 1999).

Bird (1999) found that time spent on housework and percentage of house work is positively associated with distress. Women on average, perform 65 % of the housework (about 40 hours of labor a week), where as men do 35 % of the housework (Bird, 1999).

Distress levels even out between men and women as the household labor percentages reach the 50/50 proportion. Thus, women would need to decrease their household labor by 15% and men would need to increase their household labor by 15% in order to decrease psychological distress for women (Bird, 1999).

One study found in their literature review that 13.3 million people are spouses or adult children of disabled older people and therefore potential caregivers (Moen, Robison, & Fields, 1994). Also, women workers are more likely than men to be caregivers and that care giving is negatively associated with satisfaction in employment, marriage and health. They suggested that the role of caregiver is a very stressful and complicated job with little or no relief until the loved one's health improves or declines to the point of death (Moen et al., 1994).

The study concluded that there is an increase of informal care giving in this country and women are providing it. There is also a correlation between education and care giving in that women who are more educated and have a career are more apt to pay for formal care giving than women with less education (Moen et al., 1994).

*Job stress.* Job stress or occupational stress is an expensive and perplexing issue among business and industry. Ten years ago, the estimated cost of stress-related illnesses to American companies was about \$150 billion annually in absenteeism, injury and accidents. That figure is \$300 billion now, according to the National Women's Health Information Center (2004), and growing.

There have been many studies looking at occupational stress and ways to improve conditions for employees. However, most of the research examining occupational stress has focused on men (Gross, 1997). Of the studies that do include women as subjects, most women are working in lower status jobs. There are very few studies that include professional working mothers as subjects (Gross, 1997).

Caulfield and colleagues found that 26 percent of Australian workers report job stress as the number two reason for work-related injuries and illness, behind physical strains and sprains (Caulfield, Chang, Dollard, & Eishaug, 2004).

A common finding in their search for job stress interventions was that work stress had a negative effect on families and home life. It is not a big leap to realize that occupational stress is going to spill over into other factors of a person's life. Work stress negatively affects marital cohesion and family interactions (Caulfield et al., 2004).

Caulfield and colleagues found that work stress also creates feelings of overload and strain which can lead to increased family conflict, withdrawal from family involvement and even adjustment problems for children (Caulfield et al., 2004).

Men differ from women in the type of coping strategies they use. Men more often use problem-focused coping strategies and women more often use emotion-focused coping strategies. As well, men reported using drugs or alcohol as a way of coping (Torkelson & Muhonen, 2004). Also, people in higher levels of management use problem-focused coping strategies and people at lower-levels use emotion-focused strategies (Torkelson & Muhonen, 2004).

The researchers gathered evidence from 279 sales people (managerial and non-managerial positions), looking at the effect that gender and job level had on coping strategies of people in high stress jobs. They found that people who used emotion-focused coping strategies (seeking emotional social support) had a positive effect on health problems (Torkelson & Muhonen, 2004).

Only one gender-related difference was found in the managerial level. Women managers use the emotion-focused coping strategies more than men managers (Torkelson & Muhonen, 2004). At the lower-levels, several differences were found and the most important was that women sought out other people to vent and get support. Women engaged with their surroundings. Men, on the other hand, used alcohol and drugs in order to cope and disengage (Torkelson & Muhonen, 2004).

In a review of literature of work stress and hypertension, investigators found that both women and men with high-status jobs show significantly higher blood pressures than women and men with low-status jobs during daily life and during laboratory mental



stress testing. Married women show higher ambulatory blood pressure than single woman (Mills, Davidson, & Farag, 2004).

Behavioral medicine is in its infancy of investigating the complex ways in which interactions with work, home and other life circumstances alter pathophysiological processes and result in diseases and illnesses such as hypertension or upper respiratory illnesses (Mills et al., 2004).

Mills and his colleagues (2004) suggest more research is needed about job strain and work stress-related issues, as well as interventions. This study hopes to accomplish a small part of this needed field of work, using biofeedback-assisted relaxation therapy to help with work-stress and home-stress related health issues in women.

#### *Stress Management and Treatment of Stress-Related Illness*

In a systematic review of the stress management intervention literature, Giga and colleagues found 74 international studies published between 1990 and 2001. Of those, very few used proper methodical research involving scientific evaluations. And the use of many objectives, structures and target groups, the results were often conflicting (Giga, Cooper & Faragher, 2003).

They found interventions are categorized into three levels: Organizational level, organizational-individual level and individual level. Organizational level programs are aimed at the source of most job-related stress such as communication, training, physical and environmental issues and job redesign. At the individual level, which is where most stress management programs are focused, options include time management training, employee assistance programs, relaxation training, exercise programs, cognitive-behavioral therapy and biofeedback-assisted relaxation therapy (Giga et al., 2003).

The National Women's Health Information Center (2004), a project of the U.S. Department of Health and Human Services, reported that several stress management modalities were found to be viable tools to help reduce major and chronic health problems. Some of the strategies proposed by the center include learning how to relax through modalities such as yoga, deep breathing, meditation, and massage therapy. The center also suggests adopting healthier eating, sleeping, exercising and self-care behaviors and mental self-care such as talking to friends, and/or getting professional help.

Kenney (2000) emphasized those individual stress management strategies that integrate physical, behavioral, cognitive and emotional therapies to deal with stressors directly, alter women's responses to stressors or relieve the symptoms. When practiced, the stress management strategies may alter or change unhealthy stressors, and strengthen immune systems (Kenney, 2000). Her study, using 299 women aged 18 to 66, helped design a survey used to detect harmful stress levels in women. Her belief is that you first have to identify the symptoms before you can treat the symptoms (Kenney, 2000).

The stress management strategies listed above may be useful and effective in reducing stress and subsequently reducing stress-related illnesses and disorders. This study aims to add further empirical evidence that self-regulatory methods, such as biofeedback-assisted relaxation therapy, will help working professional mothers control psychophysiological systems that produce the stress-related symptoms and help reduce stress-related illnesses.

*Biofeedback-assisted relaxation therapy.* Biofeedback-assisted relaxation therapy is a non-invasive therapeutic modality based on the principles of learning theory. Biofeedback therapy is used to help one self-regulate one's peripheral nervous system,

once believed to be impossible because many of the systems come under the involuntary branch, called autonomic nervous system, of the central nervous system (Schwartz, 1995). Biofeedback attempts to bring the unconscious into consciousness and help people self-regulate these systems and decrease or ameliorate stress-related symptoms that may lead to stress-related illnesses and diseases (Schwartz, 1995).

Schwartz (1995) defines biofeedback as:

A group of therapeutic procedures that utilizes electronic or electromechanical instruments to accurately measure, process and ‘feed back’ to persons information with reinforcing properties about their neuro-muscular and autonomic activity, both normal and abnormal, in the form of analogue or binary, auditory and/or visual feedback signals. Best achieved with a competent biofeedback professional, the objectives are to help persons develop greater awareness and voluntary control over their physiological process that are otherwise outside awareness and/or under less voluntary control, by first controlling the external signal, and then with internal psychophysiological cues. (p. 29)

*Uses for biofeedback.* Biofeedback is used to treat such stress-related illnesses and diseases such as hypertension (Goodie & Larkin, 2001), panic disorder (Meuret, Wilhelm & Walton, 2004), anxiety (Wenck, Leu, & D’Amato, 1996), migraines (Vasudeva, Claggett, Tietjen, & McGrady, 2003), and tension headaches (Rokicki et al., 2003). It also has some efficacy for asthma (Lehrer, 2004) and chronic pain such as fibromyalgia and irritable bowel syndrome (Schwartz, 1995).

High efficacy has been found in several studies using biofeedback therapy to treat migraine headaches and tension headaches (Rokicki et al., 2003; Vasudeva et al., 2003).

However, Rokicki et al. (2003) reported that although EMG biofeedback therapy has been extremely efficacious for tension headaches, the function underlying treatment, the way it improves tension headaches is still not completely clear or supported completely by research (Rokicki et al., 2003).

In one example, investigators found a 39% reduction in head pain, depression and anxiety for migraine sufferers, compared to 7.9% reduction in head pain for a control group. The investigators used 40 people with migraine headaches, divided into a treatment and control group and measured them on blood flow velocity to see if reductions in migraine pain could be explained by the decrease of blood flow in the middle cerebral artery or absence of aura. They found that neither variable had statistically significant importance in pain reduction of migraine headaches. The investigators concluded the positive results from the biofeedback/relaxation training with migraine headaches may be due to a lessening of anxiety and depression (Vasudeva et al., 2003).

There is high efficacy with biofeedback in treating hypertension and cardiovascular and hemodynamic responses (Goodie & Larkin, 2001). In one study, heart rate variability biofeedback training helped reduce cardiovascular and hemodynamic responses to a mental stressor (Goodie & Larkin, 2001). The team used 25 college students (males) divided into two groups. One group received heart rate biofeedback training prior to playing with a video game. The control group received no training or treatment. The group with the biofeedback training had statistically significant differences on their heart rate responses while playing the video game. The researchers found that when students learned to relax before playing a stressful video game, they

were able to maintain lower heart rates during play time as compared to the group who had no biofeedback training (Goodie & Larkin, 2001). The conclusion is that people can self-regulate and control the anxiety producing symptoms during an anxiety producing event.

In a study investigating anxiety, Wenck, Leu & D'Anato (1996) found that biofeedback successfully treated anxiety in adults as well as children. It is especially successful in treating test anxiety, reducing physiological symptoms and lowering anxiety in children. The investigators randomly assigned 150 children (7<sup>th</sup> and 8<sup>th</sup> grade students) who had been identified as anxious by their teachers, into two groups – intervention and no intervention. Treatment group received six electromyography (EMG) and six thermal biofeedback therapy sessions over a six week period. The investigators found a statistical significant reduction in state and trait anxiety scores in the treatment group compared to the control group (Wenck et al., 1996).

In a composite case study investigating biofeedback therapy and panic disorders, Meuret et al. (2004) found that the use of a pCO<sub>2</sub> biofeedback capnometry monitor enhances the effectiveness of breathing training. They believe that the respiration rate of previous breathing therapies such as “take a deep breath” for panic, may be adding to the panic state by slowing the respiration rate and increasing hyperventilation. Breathing training during the study included shorter inhalations followed by longer exhalations. The monitor helps one slow down exhalation which is optimal for relaxation training.

### Summary

Stress-related illnesses and diseases are an evidence-based reality today - ranging from small irritants to deadly consequences. Working professional mothers experience an

expansive range of stressors that include an often oppressive working environment to an overwhelming home life that may include caring for the home, children, spouse and sometimes other family members such as parents. Research shows that even today, working professional mothers do the majority of household chores and take care of the children before and after a long work day, while their husbands relax after coming home from work (Bird, 1999). Working professional mothers rarely get a break from their daily multiple roles and commitments as a wife, mother and fulltime employee.

Working professional mothers appear to carry multiple burdens that may add to their daily stressors and stress-related symptoms (Bost, 2001). Perhaps many of these mothers are experiencing the many stress-related illnesses or diseases that come from chronic stress. Experimental evidence points to the fact that women experience stress differently than men (Taylor et al., 2000). The fight or flight response, that has been touted as the animal and human stress response to a perceived threat, has been replaced with tend and befriend as the female stress response to a threat (Taylor et al., 2000).

Furthermore, the research looking at efficacy of biofeedback has been extensive and relatively thorough. Since the mid-1960s, research in this field has covered topics such as writer's cramp, incontinence, attention deficit disorder, brain injury, asthma, menopausal hot flashes, cerebral palsy and torticollis (Schwartz, 1995). However, there have been no studies examining biofeedback's efficacy working with stress levels in working professional mothers – a population, research shows that experiences overwhelming degrees of stress. This study hopes to add this element to the already rich history of empirically-based, efficacious applications for biofeedback-assisted relaxation therapy.

## CHAPTER 2

### METHODS AND PROCEDURES

The purpose of this study is to examine the effectiveness of biofeedback-assisted relaxation therapy in treating the stress of working professional mothers. This study hopes to add to the current research and understanding on treatment of stress-related symptoms using biofeedback-assisted relaxation therapy and adding the key concept of working professional mothers.

#### Research Question

1. How effective is biofeedback-assisted relaxation therapy in treating the psychophysiological stress of working professional mothers?

#### Research Hypotheses

1. There will be a statistically significant reduction in stress levels among the 14 participants of working professional mothers as measured on the Stress scale of the Stress Profile inventory.
2. There will be a statistically significant reduction in muscle tension (EMG) among the 14 participants as measured over eight biofeedback treatment sessions.
3. There will be a statistically significant increase in finger temperature among the 14 participants as measured over eight biofeedback treatment sessions.

#### Definition of Terms

*Stress*: Selye (1956) describes stress as the “nonspecific response of the body to a demand,” and stressor as the demand itself. For purposes of this study, reported psychological stress levels were measured with the use of the Stress Profile instrument

(Nowack, 1990) and physiological stress levels were measured with the Infiniti Procomp biofeedback instrumentation.

*Biofeedback:* Schwartz (1995) defines biofeedback as, “A group of therapeutic procedures that utilizes electronic or electromechanical instruments to accurately measure, process and ‘feed back’ to persons information with reinforcing properties about their neuro-muscular and autonomic activity, both normal and abnormal, in the form of analogue or binary, auditory and/or visual feedback signals.

*Biofeedback-assisted relaxation therapy:* A non-invasive therapeutic modality based on the principles of learning theory. Biofeedback therapy is used to help one self-regulate ones peripheral nervous system, once believed to be impossible because many of the systems come under the involuntary branch or autonomic nervous system, of the central nervous system (Schwartz, 1995).

*Self-regulation:* bringing under conscious, voluntary control the central and peripheral nervous system dynamics such as skin temperature, muscle tension, breathing rate and brain waves.

*Electromyography (EMG):* Sensors used to measure, process and feedback information about muscle tension during biofeedback training.

*Thermistor:* A temperature skin sensor used to measure, process and feedback information about skin temperature during biofeedback training.

## Methods

### *Participants*

The research participants were 14 working professional mothers employed at a major daily newspaper in Texas. A flyer was posted throughout the business and



participants called the researcher to become a part of the study. Originally, 16 women volunteered for the study, however, ironically, two mothers dropped for reasons related to stressful lifestyles.

The subject pool included 10 married women with spouses and children at home, three single mothers and one married woman whose adult child was not living in her home. The number of minor children in the household ranged from 1 to 5. Six of the mothers were professional outside sales representatives, two were professional newspaper editors, and two were professional assistants – one to a vice president and the other to a manager who were both responsible for most of the newspaper's revenue. The other participants included a photographer, an inside sales representative, a manager in information services, and an auditor. Twelve of the participants were Caucasian, one African-American and one Hispanic. Ages of the participants ranged from 25 to 52 with half in their 40s, four in their 30s and two in their 50s. None of the participants had been exposed to biofeedback therapy prior to treatment.

### *Measurement*

The Stress Profile – instrument (Nowack, 1990) was selected for this study because it measures stress on several different scales including job, home, and self-care. It was designed in the late 1980s to assess employee stress and health risk behaviors within organizational health promotion and wellness programs. The 123-item instrument measures 15 subscales: Stress, Global Health Practices, Exercise, Sleep/Relaxation, Preventive Hygiene, Nutrition/Eating, Social Support, Type-A Behavior, Cognitive Hardiness (high involvement with and commitment to work and family as well as self, view life's changes and risks as challenges and opportunities for growth and sense of

control over significant events and outcomes in life), Intrusive Positive Thoughts, Intrusive Negative Thoughts, Avoidance and Problem-Focused Coping, Psychological Well-Being, Global Coping Index, and Response Bias. The instrument has been standardized on 1,111 men and women. The average internal consistency reliability across all scales was .76 with a range of .67 to .93 on the subscales.

The Stress Profile instrument (SPI) contained the needed scales for assessing the lifestyle stress-levels of the working professional mothers used in this study. Scales most useful for this study are: Stress, Type-A Behavior, ARC item cluster (alcohol, recreational drugs and cigarettes), and Intrusive Negative Thoughts. T-scores of 60 or above on any of these scales denotes possible health risks associated with the scale. These four scales have practical significance when working with clients who may have stress-related illnesses or disorders. As noted earlier, the internal consistency reliability of the subscales ranged from .67 to .93. Reliability on the Stress scale was .72. Type-A Behavior scale was .76, and Intrusive Negative Thoughts scale was .72 (Nowack, 1999).

The Stress scale of the SPI was used to assess the affect of biofeedback therapy in this study. The six items that constitute the Stress scale measure self-reported stressors in distinct categories: health, work, personal finances, family, social obligations and environmental and world concerns. The participants are asked to rate how frequently they experienced stress in each of these six categories over the most recent 3-month period. High t-scores (60T or higher) on this scale suggest relatively high perceived levels of work and life stress over the preceding 3 months. Low scores (40T or lower) on this scale indicate generally low perceived levels of stress, even when major life events are present that might be considered highly stressful. This is because health status is more closely

associated with and likely to be affected by high and low perceived levels of stress than by the simple presence of major life events or changes (Nowack, 1999).

The other areas will be discussed as an overview of findings from the SPI and assessment of healthy versus unhealthy practices among the participants.

### *Apparatus*

Psychophysiological assessments and training was conducted with the Procomp+encoder using Biograph Infiniti software by Thought Technology (2005). A Hewlett Packard laptop computer provided mobility for the biofeedback equipment. Three biofeedback sensors– a thermistor (temp), an electromyography (EMG) and a respiration sensor – were used to measure psychophysiological systems during assessment and training. These sensors collected physiological information from the participant and transferred the information to the data base within the biofeedback software. The respiration sensor was used only for breathing training.

### *Procedures*

A repeated measures ANOVA design, which will be described more thoroughly later, was used in this study. Two of the advantages of this design over classic ANOVA designs are that fewer subjects are needed to show significance and the group serve as its own control (Girden, 1992).

Because of the number of participants and the anticipated treatment scheduling problems, the participants were divided into two groups (both receiving the same treatment). After an initial introduction to the study, each participant read and signed an Informed Consent document (Appendix A). The participants completed the entire Stress Profile instrument (SPI) three times during the study - 1) before treatment, 2) during

treatment, and 3) after treatment. After the initial SPI measure, both groups underwent a psychophysiological assessment using biofeedback software to get accurate finger temperature, frontalis muscle tension (EMG) baseline, and respiration rate. These baselines were taken to assess accurate self-reported and biological stress-levels and determine which area (Temp or EMG) would be used for training during biofeedback sessions. After the initial assessment, both groups began treatment. A second SPI was completed at the end of three treatment sessions and a third after eight treatment sessions. All 14 participants completed eight biofeedback treatment sessions within eight weeks.

By design, all treatment sessions were conducted at the newspaper in a makeshift treatment/counseling room supplied by the newspaper. The sessions were performed in the same room during the working day to provide convenience for the working mothers and validity and reliability over time for the treatment modality and outcome of the research study. The secure environment was comfortable with a reclining couch, low lights and continuous white noise provided by the air conditioning system. The one complaint most participants had was that it was very cold in the room (68-70 °F), perfect for office work, but maybe not as conducive for biofeedback therapy. Blankets were provided for comfort. The ideal temperature of a room for biofeedback therapy should be 72-74 °F (Peek, 1995).

All treatment sessions were performed in the same room during the working day to provide convenience for the working mothers and validity and reliability over time for the treatment modality and outcome of the research study. All participants were connected to sensors on the frontalis muscles (EMG), distal pad of their left index finger (thermistor sensor), and around their waist (respiration sensor) just above their naval. The

participants were asked to get comfortable in the chair, close their eyes and relax as much as they can during the 10 minute baseline assessment. They were asked to keep all facial movement, swallowing, or body movement to a minimum during the baseline assessment.

There are many types of biofeedback equipment and it is difficult to assess how high is high for EMG (muscle tension) readings among the various biofeedback instruments (Peek, 1995), however, biofeedback training for EMG attempts to reduce muscle tension in the frontalis area to 1.0 microvolt ( $\mu\text{V}$ ) or less. Anything above that number is considered moderate to high muscle tension. High EMG measurements may indicate high muscle tension due to stress or anxiety (Schwartz, 1995). Seven women in this study had EMG muscle tension averaging from 5.0-10.0 $\mu\text{V}$ .

Cold hands and feet may be an indication of stress and muscle tension which may constrict blood flow to the hands and feet. Low finger temperature may predict high stress activity in clients (Schwartz, 1995). Biofeedback temperature training attempts to increase hand temperature to 90 °F and above. Six women had finger temperatures ranging from 70 to 80 °F on average. One participant had a finger temperature of 72 °F and muscle tension around 7.0 $\mu\text{V}$ . On the Biograph Infiniti system, used in this study, some of the participants were able to reach EMG levels below 1.0 $\mu\text{V}$  and a few were able to maintain 95 °F or higher during the study.

It was determined to train on the area most needed by each participant. Some of the women had EMG baselines above 10.0 $\mu\text{V}$  with temp as high as 96 °F, while others had EMG above 10.0 $\mu\text{V}$  and temperatures as low as 72 °F. A main script was developed that used a breathing and muscle tension awareness design (Appendix B) and

incorporated guided imagery and visualization related to the targeted sympathetic system (EMG or temperature) being trained. The participants were asked in the first session what images or scenes helped them relax most. For participant with low skin temperature, autogenic phrases were used along with imagery or visualization of warm events or places. For example, the progressive relaxation script was followed by a guided imagery of a beach scene under hot sun and warm sand if the participant had very low temperature readings. The beach scene was used in some EMG training because participants reported the idea of the beach as being a relaxing image or place for them.

In the first session, participants were given daily homework logs (Appendix C), a copy of “Quickie Mini” relaxation tips (Appendix D), a copy of a breathing exercise (Appendix E), and a relaxation CD to use at home between sessions. The participants were instructed on the importance of home practice between sessions and shown how to record daily practice on the homework log. The researcher demonstrated the “Quickie Mini” relaxation tips and the breathing exercise. And, each participant was given a CD of relaxation exercises specific to their main area for training (temperature or progressive muscle relaxation/breathing) and asked to listen to the CD at least two or three times a week. Homework compliance was assessed at the beginning of each session. Three women brought a completed homework log to the sessions weekly. Seven participants reported practicing relaxation exercises at home but not recording the information on the homework log, and, four reported having no time to do relaxation exercises in between sessions, but did report that they used the breathing exercises when they felt stressed.

The participants were instructed to maintain current activities such as exercise, dieting, or other self-care activities, and not to initiate new activities. They were briefed

on the purpose of the study and all questions were answered at the conclusion of the project.

### *Analysis*

A repeated measures analysis of variance (ANOVA) design was used to calculate possible statistical significance among the three individual measurements obtained on the Stress scale of the Stress Profile Inventory (dependent variable), and the mean scores (dependent variable) of the muscle tension (EMG) measured in microvolts ( $\mu\text{V}$ ) and finger temperature (Fahrenheit), two physiological systems trained and/or observed during the eight biofeedback treatment (independent variable) sessions.

A repeated measures ANOVA design has many advantages over a simple pretest-posttest design. One of the advantages is that it provides researchers the ability to measure change over time (Willet, 1994). Repeated measures analysis requires subjects to be measured on more than two occasions. With a pretest-posttest design, only two measures or two points in time are analyzed. Repeated measures design allows researchers to capture growth or decline during treatment by measuring subjects while the treatment is being applied (Girden, 1992). More measures of the independent variable over time increases the chances of finding statistical significance. As in the case of this study, the participants were measured before treatment, during treatment and after treatment, a classic repeated measures design.

Another advantage of repeated measures design is that it allows for a smaller sample size than does an ANOVA or simple pretest/posttest design. Repeated measures analysis can yield significant results with as few as 6 participants (Girden, 1992).

The power of a repeated measures analysis is found in the way it decreases error in the analysis by blocking or partitioning out the variation due to individual differences. When this error is blocked or removed from the analysis process of the data, researchers have a greater chance of finding statistical significance (Willett, 1994).

#### *Limitations of Study*

The findings of the current study may only be generalized to a small population of women who work at major daily newspapers. It is hoped that continued research with this population within other work environments will produce similar results.

Another limitation of this study may be the location of biofeedback training. The researcher went to the participant's work place for treatment sessions. This may prove to be an artifact in that place of business may not be the ideal place for biofeedback sessions. Most biofeedback therapy and research is conducted in a clinical environment. This study was conducted at a place of business.

Another limitation is sample size. This study used 14 women. It is hoped that the repeated measures design will compensate for the small sample size.



## CHAPTER 3

### RESULTS AND DISCUSSION

This chapter will provide results on the stated hypotheses as well as provide information related to the results ascertained through the Stress Profile instrument (SPI) and the biofeedback therapy. The discussion portion of this chapter will describe some qualitative aspects of the research that may have been pertinent to the findings but were not quantitative measures and therefore were not used in calculating statistical significance.

A one within repeated measures ANOVA was used to calculate hypotheses 1, 2 and 3 using an alpha level of .01 for the first hypothesis and .05 for the following two as a criterion to either accept or reject the hypothesis. A partial eta squared ( $\eta^2$ ) was used to determine effect size and the strength of the findings. The partial eta squared is an estimate of the amount of variability in the dependent variables explained, or accounted for by individuals defining the independent variable (Thompson, 2004). If statistical significance is found, eta squared helps determine how much influence the dependent variable had on the outcome. In the field of educational research, an effect size of .01 is considered small, .05 is medium and .08 is a large effect size (Cohen, 1988).

#### Hypothesis 1

After eight biofeedback therapy sessions, a statistically significant reduction in reported stress levels on the Stress scale of the SPI (see Table 1) was found at the alpha level of .01 ( $F=8.61, p=.001$ ). The hypothesis that there will be a statistically significant reduction in stress levels is retained. The results of the analysis met the repeated

measures ANOVA assumption of sphericity ( $p=.70$ ). A  $p$  value of more than .05 meets the assumption.

The study also found a large effect size ( $n^2=.39$ ) indicating that there is practical significance for using biofeedback-assisted relaxation therapy in an office environment.

Table 1  
*Repeated Measures ANOVA Summary Table on the Stress scale of the Stress Profile Instrument Across Eight Sessions of Biofeedback Therapy*

Source of Variation	Sum of Squares	<i>df</i>	<i>MS</i>	<i>F</i>	* <i>p</i>	<i>n</i> <sup>2</sup>
Individuals	2144.41	13	164.95			
Occasions	672.90	2	336.45	8.62	.001	.39
Error	1015.10	26	86.02			
Total	3832.41	41				

\*Computed using  $\alpha=.01$ .

The means of stress levels, as reported by the Stress scale of the SPI (see Table 2) decreased from 64.75 (a level considered a health risk) to 55.14 (a level below health risk). The numbers indicate that there was a large difference between the first assessment and the second assessment (after three sessions) of 6 points and a smaller difference between second assessment and last assessment of 3 points, indicating that benefit of treatments occurred quickly during the first few biofeedback sessions.

Table 2  
*Mean Scores of the Stress Scale on the Stress Profile Instrument*

	N	Mean	Standard Deviation
First	14	64.75	8.95
Second	14	58.42	8.21
Last	14	55.14	9.76

*Note:* A decrease in the mean score indicates decrease in reported stress levels.

## Hypothesis 2

As shown in Table 3, the study found a statistically significant reduction in frontalis muscle tension (EMG) at the alpha level of .05 ( $F=3.64$ ,  $p=.01$ ). The hypothesis that a reduction in muscle tension will be found is retained. These results were found after using the Greenhouse-Geisser correction for degrees of freedom. The initial calculation of the EMG mean scores did not meet the repeated measures ANOVA assumption of sphericity ( $p=.04$ ). The  $p$  value of .05 or greater must be found to meet the assumption. Sphericity assumes that variance at each measurement occasion will be equal. When that assumption is not met, a corrected degrees of freedom ( $df$ ) must be used to determine statistical significance and the corrected  $df$ , usually lower than the original  $df$ , makes it more difficult to find significance. A  $df$  correction of 3.51 was used to compute statistical significance.

Table 3  
*Repeated Measures ANOVA Summary Table of the Mean Scores of Muscle Tension (EMG) Across Eight Biofeedback Sessions*

Source of Variation	Sum of Square	$df$	$MS$	$F$	* $p$	$n^2$
Individuals	297.49	13	164.95			
Occasions	12.67	3.51	3.61	3.65	.01	.21
Error	45.18	45.61	39.04			
Total	355.34	62.12				

\*Computed using  $\alpha=.05$ .

The study also found a large effect size ( $n^2=.21$ ) indicating that there may be practical significance for use of biofeedback-assisted relaxation therapy in treating reported stress levels of working professional mothers. As the muscle tension decreased over eight sessions, so did the reported stress levels on the Stress scale of the SPI.

Table 4 shows the EMG means of the eight biofeedback sessions. The frontalis muscles are recorded in real time across eight 20-minute sessions using microvolts as the measurement unit. The average of the sessions was used from each participant and those averages were used for the final analysis. Those means are reported below.

Table 4  
*The Mean EMG Across Eight Biofeedback Sessions*

	Mean	Std. Dev.	N
EMG1	4.82	1.86	14
EMG2	4.77	1.99	14
EMG3	4.78	1.85	14
EMG4	4.46	2.13	14
EMG5	4.27	1.81	14
EMG6	4.36	1.80	14
EMG7	4.17	1.50	14
EMG8	3.79	1.44	14

\*EMG is measured in microvolts.

### Hypothesis 3

After eight treatment sessions, no statistical significance was found (Table 5) in the movement of finger temperature ( $F=.66, p=.69$ ). The hypothesis that an increase in finger temperature will be found is rejected. Although the mean of finger temperature went up across treatment from 84.65 to 87.76 °F, the overall analysis found no statistically significant difference.

Table 5  
*Repeated Measures ANOVA Summary Table of Mean Scores of Finger Temperature*

Source of Variation	Sum of Square	df	MS	F	*p	$\eta^2$
Individuals	2024.98	13	155.77			
Occasions	189.85	7	27.12	.69	.69	.04
Error	3688.02	91	40.53			
Total	5902.85	111				

\*Computed using  $\alpha=.05$ .

There was fluctuation in finger temperatures among the participants across the eight sessions (Table 6). Four participants maintained very warm hands (above 90 °F) across the sessions and two maintained very cold hands (below 80 °F) across the sessions. The remaining eight fluctuated from session to session, some starting session one with 90 °F and ending sessions eight with 80 °F. Cold hands seemed to be common among the participants. Biofeedback therapy attempts to help a client increase her hand temperature to 95 °F. It is highly likely that the room temperature of 68-70 °F (which is below or acceptable range for biofeedback) inhibited progress on raising finger temperature.

Table 6  
*Mean Hand Temperature Across Eight Biofeedback Sessions*

	Mean	Std. Dev.	N
TEMP1	84.65	8.24	14
TEMP2	86.24	7.28	14
TEMP3	83.90	8.50	14
TEMP4	87.18	6.45	14
TEMP5	86.14	7.95	14
TEMP6	87.61	7.06	14
TEMP7	86.92	6.34	14
TEMP8	87.76	7.13	14

\*Temp is measured in degrees.

#### Other Scales

The SPI highlights four scales that help clinicians determine if clients are at risk for developing stress-related illnesses or disorders (Nowack, 1999). The high risk scales are Stress, Type-A Behavior, ARC (alcohol, recreational drugs and cigarettes) and Intrusive Negative Thoughts. As seen in Tables 7, 8 and 9, with the exception of the Stress scale, there was no significant difference calculated for the remaining three scales.

Table 7

*Repeated Measures ANOVA Summary Table of Mean Scores on the Type-A Behavior Scale of the SPI*

Source of Variation	Sum of Square	df	MS	F	*p	n <sup>2</sup>
Individuals	456.71	13	35.13			
Occasions	165.33	2	82.66	2.21	.13	.14
Error	971.33	26	37.35			
Total	1593.37	41				

\*Computed using alpha=.05.

Table 8

*Repeated Measures ANOVA Summary Table of Mean Scores on the Alcohol and Drugs Scale of the SPI*

Source of Variation	Sum of Square	df	MS	F	*p	n <sup>2</sup>
Individuals	99.71	13	7.67			
Occasions	3.47	2	1.73	.28	.75	.02
Error	159.85	26	6.14			
Total	263.03	41				

\*Computed using alpha=.05.

Table 9

*Repeated Measures ANOVA Summary Table of Mean Scores on the Intrusive Negative Thoughts Scale of the SPI*

Source of Variation	Sum of Square	df	MS	F	*p	n <sup>2</sup>
Individuals	7010.66	13	539.28			
Occasions	203.47	2	101.73	3.13	.06	.19
Error	843.19	26	32.43			
Total	8057.32	41				

\*Computed using alpha=.05.

However, as shown in Table 7 and 9, the effect sizes ( $n^2=.14$ ) for Type A Behavior and ( $n^2=.19$ ) for Intrusive Negative Thoughts are relatively large meaning that the study may have shown some practical significance on the outcome of those two scales

even though they found no statistical significance. Table 10 displays the drop in Type-A behaviors from 65.21 to 60.64 occurring mainly between the mid-point and end-point scores. And, Table 11 shows that Intrusive Negative Thoughts declined from 52.43 to 47.50 after eight treatment sessions.

Table 10  
*Mean Scores of the Type-A Behavior Scale on the SPI*

	N	Mean	Standard Deviation
First	14	65.21	13.16
Second	14	64.36	10.18
Last	14	60.64	11.86

*Note:* A decrease in the mean score indicates decrease in reported Type-A behavior.

Table 11  
*Mean Scores of the Intrusive Negative Thoughts on the SPI*

	N	Mean	Standard Deviation
First	14	52.43	15.35
Second	14	48.07	15.00
Last	14	47.50	11.97

*Note:* A decrease in the mean score indicates decrease in reported negative levels.

Although the decline is small, hence no statistical significance found, the effect sizes calculated may indicate that biofeedback therapy may help reduce negative thinking and possibly, Type-A behaviors which adds to stress-related illnesses and disorders.

One interesting point, although the means on the Type-A Behavior scale decline across time (Table 10), the post mean score among the participants of 60.64 is considered above normal and a potential health risk. According to the SPI, the Type-A Behavior scale measures a full range of expressed Type-A responses, including internalized anger, expressed anger, time urgency, working quickly, impatience, job involvement, striving for achievement and hard-driving and competitive behaviors (Nowack, 1999). As noted

in Chapter 1, Type-A characteristics can contribute to the development of a number of illnesses, including coronary heart disease (Hallman et al., 2003; Markovitz et al., 2004).

No statistical significance or practical significance was found for ARC. Seven participants scored 60 or above on this scale and five were below 40. Of the 14 participants six reported smoking cigarettes (rarely to always), nine reported drinking two or more cups of coffee a day (rarely to always), six reported drinking two or more alcoholic beverages a day (rarely to always), and three reported using nonprescription/recreational drugs (rarely).

### Discussion

As predicted, this study found statistically significant evidence that biofeedback therapy can help reduce psychophysiological levels of working professional mothers when used in the workplace. A statistically significant reduction in stress levels as measured on the Stress scale of the SPI, showed an average t-score drop from 64.75 to 55.14 among the 14 participants. The initial average measure of 64.75 t-score lies in the unhealthy range for the Stress scale on the SPI. A Stress scale t-score of 60+ indicates a possible lifestyle that may pose a health risk. The final average measure of 55.14 t-score is about five points below the unhealthy range and more in the average range for the scale (Nowack, 1999).

This study also found statistically significant evidence that biofeedback therapy can help reduce tension in the frontalis muscle area on working professional mothers when used in the workplace environment. Although a reduction of 1.03 $\mu$ V may not appear to be statistically significant, the average EMG measure after session one of 4.82 $\mu$ V for all 14 participants decreased by 25 percent to 3.79 $\mu$ V by the eighth session.



There seemed to be a correlation between Type-A Behavior and stress levels among these 14 mothers. Out of 14, 11 had Type-A t-scores at 60 or above across the three measures meaning that at pretest, midpoint and posttest these 11 mothers had Type-A Behavior in the range (above 60) that was considered a health risk according to the SPI design (Nowack, 1999). From these 11, 10 had stress levels on the stress scale of 60+. The one mother who had a high Type-A Behavior but low stress levels (46 on all three measures) was the only mother of the group who did not start the project with a stress scale of 58 or higher. (A t-score of 60+ is considered a health risk.) All but one of the mothers scored very near or past the health risk level for stress and 11 scored near or past the health risk level for Type-A Behavior.

One participant, who was experiencing some serious health problems with her husband and the caretaker of her mother, scored 80+ across all three SPI measures on the Type-A Behavior scale. However, she was able to decrease her stress level on the Stress scale from 80+ (pre) to 46 (post). Another participant, a mother of five, did not have a significant drop on her Stress scale levels (67 to 63 which is still in the health risk quadrant) but was able to reduce her Type-A Behavior from 80+ to 64 (still above healthy levels, but far below dangerous levels.)

The study was not without its challenges. Several of the participants had to cancel sessions because of sickness either with themselves or their family members, primarily their children. This was not a study addressing the relationship of stress and lower immune status, like the work of Cohen (1996, 1997), but this was an interesting observation. Stress has been found to lower the body's ability to fight off common viruses such as colds (Cohen et al., 1997) and cause more tension headaches, migraines

and other stress-related illnesses and disorders. Some of the complaints reported by these mothers were colds/flu, headaches, fatigue, pain (especially in the neck and shoulders), insomnia, and anxiety. A few of the mothers reported disorders that could be exacerbated by stress such as rheumatoid arthritis and irritable bowel syndrome. One of the mothers had a frightening experience when she was asked to come back by her physician for a second mammogram. The second mammogram allayed her fears but the experience turned one biofeedback session into a talking session.

The simple miracle of this study was that there was 16 working mothers signed up for a research project that none of them had time to do. To these women, it was unimaginable that they could fit another activity into their already very busy lives. Ironically, two women dropped out early in the process because of stress-related problems that impaired their ability to give even 30 minutes a week to the project. The 14 remaining mothers were able to complete eight sessions of biofeedback therapy, practice some homework including “Quickie Minis” relaxation exercises, breathing techniques and listen (one or more times) to the relaxation CD supplied at the beginning of the project. Only three women were able to complete the homework logs and return them one per week as requested. The others mentioned during sessions that they had been practicing quickie minis and other relaxation methods during the research period but did not record them. A few mothers expressed not having time to do anything outside the sessions except for deep breathing exercises. “I have to be honest,” stated a mother of three, “I haven’t done anything you asked me to do but this is working. I look forward to these sessions.” Thus, compliance with homework was not necessarily a major contributing factor in the successful outcome of the EMG biofeedback treatment.

However, increased homework compliance may have led to better temperature biofeedback results.

A unique aspect of this study was bringing the treatment sessions to the participants. In many research studies using biofeedback therapy, participants are asked to come to a clinical setting for treatment sessions. In this study, the treatment sessions were conducted on site at the newspaper's main offices which proved to be a successful option for the study. Almost all the mothers complained about busy lives and not having enough time for everything. If the study had not been set up at the business site, it might not have worked. Many of the women said that if the site was at another location away from the newspaper, they would have not been able to participate in the study – time was tight for them.

Job stress was very high for most of these women. The nature of the business of a daily newspaper can be very high stress. A new product is produced everyday come rain or shine or tornados, for that matter. Those in support positions may get caught in the cross fire of major problems inherent to a daily product like a newspaper (computer crashes, missed deadlines, printing problems, missed or late deliveries, advertising or editorial mistakes, collection problems). Employee health and comfort may not be a priority. In this case though, the newspaper senior management provided the opportunity for this study. They willingly created a makeshift therapy room for the treatment sessions, and gave the researcher unlimited access. The study ran eight weeks and the researcher was there almost every day. Many of the women did not want to stop treatment and it seemed that there was a positive correlation between perceived job stress and the ongoing treatment sessions.

This research project highlights an area of biofeedback treatment that is rarely if ever investigated or performed – biofeedback-assisted relaxation therapy in a workplace environment. This project sought to show that biofeedback therapy could be brought to a business campus and used successfully as a viable tool against work-place stress. Granted, it was one project with 14 stressed mothers. More research projects are needed with many more women and men in order to conclusively determine the efficacy of using biofeedback-assisted relaxation therapy in the workplace. However, this project was a step in the right direction – practical research that can be applied to real-life stress symptoms. Basically, moving the research from clinical, sterile labs into the real environment where the real stress thrives.

APPENDIX A  
CONFIRMATION OF RECEIPT OF NOTICE OF PRIVACY AND INFORMED  
CONSENT

# **Effects of Biofeedback-Assisted Relaxation Therapy on Stress Levels of Working Professional Mothers**

*Diana Valdez, MS, LPC, BCIAC*

*University of North Texas*

## **Consent Form**

### **Introduction**

You are invited to be in a research study to test the effectiveness of learning self-regulation of your body's systems such as muscles, body temperature and breathing. This self-regulation will be applied using biofeedback therapy. You were selected as a possible participant because you are a working professional mother with minor children and a spouse living at home.

You are being asked to take part in a research study for mothers with stress. It is important that you read and understand several general principals that apply to all who take part in this study: (a) taking part in the study is entirely voluntary; (b) personal benefit may not result from taking part in the study, but knowledge may be gained that will benefit others; (c) any significant new findings that relate to your treatment will be discussed with you; (d) you may withdraw from the study at any time without penalty or loss of any benefits to which you are otherwise entitled. The nature of the study, the risks, inconveniences, discomforts, and other pertinent information about this study are discussed below. You are urged to discuss any questions you have about this study with Ms. Valdez, the principle researcher on this project.

We ask that you read this document and ask any questions you may have before agreeing to be in the study. This consent form may contain words that you do not understand. Please ask Ms. Valdez or Dr. Cynthia Chandler to explain any words or information that you do not understand.

This study is being conducted by the University of North Texas, Counseling Department, in Denton, TX.

### **Background Information**

The purpose of this study is twofold; (1) to examine the concept of working professional mothers, the daily stress they encounter and the toll potential stress-related illnesses may be taking on their lives and, (2) the effectiveness of biofeedback therapy in treating this kind of stress. This study hopes to add to the current research on the understanding and treatment of stress-related symptoms and illnesses by using biofeedback therapy.

### **Procedures**

You will be one of 15 to 20 participants in this study who will undergo eight sessions of biofeedback therapy in a four week period. The sessions will be about 30-45 minutes long. You will be asked to take a Stress Profile and undergo a 15-minute measure of your muscle tension, body temperature, heart rate and breathing using the biofeedback equipment. This will take about 1 hour. There will be a four week waiting period before we begin the eight sessions of treatment twice a week.

At the end of the treatment sessions, you will take the Stress Profile and undergo the 15-minute measure of your body's systems mentioned above. This information will be used as the basis for the study and will be shared with only the participant.

### **Risks and Benefits of Being in the Study**

The study has the following risks: First, for a short period of time, the study will add more stress to your

schedule in that during the treatment sessions, you will be asked to meet with the researcher twice a week for a 30-minute biofeedback session. To compensate for this schedule, all sessions will be scheduled at your convenience at your place of business.

Second, you may experience some frustration and anxiety as your body adjusts to self-regulation. Training your body for self-regulation of your muscles is similar to learning a new sport or skill. It takes practice outside of the sessions/lessons.

A benefit of the study is self-regulation of your muscle tension which is a part of your body's stress and relaxation responses. You may learn to control (self-regulate) your body's response to daily stressors, and as a result, lessen your chances of developing stress-related illnesses and diseases.

### **Confidentiality**

Confidentiality is a very important element to all research using human subjects. In this study, all participants will be coded using a number. No identifiable information will be used in the process of the research or in the finished project. Everything said and all data collected from each participant will be kept confidential and used only as a coded subject within the dissertation.

If you have any questions about confidentiality, please discuss this with Ms. Valdez before the study begins.

### **Voluntary Nature of the Study**

If you decide to participate, you have the right to discontinue your participation in this study at any time, for any reason.

Please ask any questions you may have now. You will be given a copy of this form to keep for your records.

### **Statement of Consent**

I have read the above information. I have asked questions and have received answers. I consent to participate in the study.

Signature \_\_\_\_\_

Date \_\_\_\_\_

Signature of Investigator \_\_\_\_\_

Date \_\_\_\_\_

APPENDIX B

MUSCLE TENSION AWARENESS WITH BREATHING SCRIPT



## Muscle Tension Awareness with Breathing

Begin by taking in a deep breath...Now, as you exhale, let your eyes close...Feel that this time is just for you.

Take three deep abdominal breaths. Feel as if you are releasing all the thoughts and tension of the day with each exhalation...Allow your abdomen to expand on the inhalation...and contract on the exhalation. Let go of tension and tightness as you exhale.

Expand...and contract. Expand...and contract. Expand...and contract.

To enter into a deeper state of relaxation, you will soon tense the entire muscular system until your whole body is tense. Then you will exhale and relax all at once.

### **(Pause Biofeedback recording)**

Shift your attention to your feet...Curl your toes and feel tension spread into your calves. Press your knees together and feel the tightness in your thighs. Squeeze your buttocks and tighten your pelvic area. Make two fists and feel the tension spread into your arms. Raise your shoulders and create tension in your neck. Take a deep breath and tighten your stomach and chest. Tense your jaw and gently squeeze your eyes shut. Experience tension all over your body.

Now exhale and let your body relax all at once (**Start recording**)...Let go and unwind...Feel that warmth and heaviness of deep relaxation penetrate your muscles. Feel your muscles releasing...letting go...unwinding.

Relax your face...Feel your forehead smooth out...Soften your eyes...Relax that spot between your eyebrows...Let all facial expression fall away.

Relax the corners of your mouth...Allow your jaw to hang slack and your lips to part slightly...Allow your neck to be so relaxed that a gentle breeze blowing through the room would rock your head from side to side.

Lower your shoulders...Relax your hands, turning your palms up...Relax your forearms and upper arms.

Allow your chest to sink down deep into the floor or chair...Let your stomach be so soft that it gently expands on the inhalation and contracts on the exhalation, receiving each breath freely. Allow your hips and buttock muscles to let go and unwind.

As you sink down deeper into relaxation, let go of your thighs and calves...Let your knees separate...Relax your feet and toes.

Now, bring your attention back to your breathing. Take a long, deep breath.

Picture your lungs and heart...Feel their pace becoming slow and free of tension...See if in this stillness you can feel your heart beating. If you like, place your fingers from your right hand on the pulse of your left wrist to feel the rhythm, or just imagine what your heart would look like as it beats.

Begin to slow your breathing tempo to approximately three heart beats to each inhalation and five heartbeats to each exhalation.

Continue taking deep breaths. Feel and picture your heart beating...three heart beats as you inhale and five beats as you exhale.

With each breath, feel yourself breathing in relaxation...With each breath, feel yourself release tension and tiredness...inhaling relaxation...exhaling tension.

**(Begin guided imagery or visualization)**

Continue breathing and relaxing for the next couple of minutes.

When you are ready, stretch, open your eyes and slowly bring your awareness back into the room. You feel relaxed yet refreshed, rejuvenated, alert and fully alive.

**End**

APPENDIX C  
DAILY HOMEWORK LOG



## APPENDIX D

### QUICKIE MINI STRATEGIES FOR RELAXATION

## “Quickie-Mini” Strategies for Relaxation

As a part of your biofeedback therapy, you should set aside a part of your day, three times each week, during which you practice these relaxation techniques and any other homework that your biofeedback therapist will assign.

**General Instructions:** Sit comfortably with your feet planted on the floor, side by side, about shoulder width apart. Remember to keep breathing at a steady pace.

**1) Shoulder Shrug** – As easy as it sounds! Move your shoulders up together, as if to say “I don’t know,” and hold them there for five seconds. Release. Do this again with each shoulder, holding for five seconds and then releasing.

**2) Neck Stretch** – Gently stretch your neck from side to side, holding on each side for five seconds. Also, gently stretch your neck to the front and back, holding each position for five seconds. Be sure to rest your neck in its normal, upright, relaxed position for five seconds between each stretch.

**3) Shoulder Rolls** – Gently roll your shoulders forward, both separately and together. Gently roll your shoulders backward, separately and together.

**4) Monster Face** – Make your most horrible monster face and hold for ten seconds. Be sure to leave a space between your teeth to avoid clenching your jaw muscle. Release. You may want to do this in front of a mirror for an extra laugh during the day!

APPENDIX E

HOME PRACTICE BREATHING EXERCISE INSTRUCTIONS

## HOME PRACTICE – BREATHING EXERCISE INSTRUCTIONS

1. Breathing exercises to be conducted alone in a quiet room away from all distractions (phone off hook if you are the only one at home).
2. Light should be low and indirect. No overhead lights, unless dimmed. Just a small wattage lamp that is behind or to the side. Sit up as straight as possible in a chair that is very comfortable and that provides good support for your back and, if possible, your head.
3. Face a clock or watch which is at eye level and large or close enough for you to see comfortably without moving your head forward or straining your eyes.
4. While watching the second hand, begin to observe and count your breathing. Make no attempt to change your breathing at this time. Simply observe it and count the breaths. Make a mental note of the number of breaths you counted during the first minute and then begin counting again for the second minute. If the number of breaths for the second minute is the same or less, only try to remember the number from the first minutes (that is, keep in mind only the highest number of breaths for the first and second minutes). Body scan #1 (Scan your body from head to foot and notice if you have any tension in your body. If so, focus on that tension and mentally let it go.)
5. For the next three minutes, place your hands on chest and abdomen and attempt to breath diaphragmatically (abdomen moves predominately) while counting the breaths for each minute. Make a mental note of only the lowest number of breaths of the three. Body scan #2 (scan your body for tension and mentally let it go).
6. Put your hands in a comfortable position down at your side, or resting on the chair arms or in your lap. Continue to breathe diaphragmatically and, as it feels comfortable, try to gently slow the pace of your breathing. **DO NOT FORCE IT IN AN UNCOMFORTABLE WAY BY TIGHTENING YOUR CHEST OR STOMACH!** Count your breaths each minute for the next five minutes, making a mental note of only the lowest number of breaths as above. Body scan #3 (same as above).



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