Differentiating Successful from Less Successful Males and Females in a Group Relaxation/Biofeedback Stress Management Program

ABSTRACT

Managing stress in post-COVID requires a program that can efficaciously and cost-effectively address a large number of people who have differing experiences and needs, and that has adaptability for internet presentation. An in-person group stress management program of 141 adults in community clinics with approximately 15-20 per group attended 10 training sessions across 5 weeks with pre-post personality measures as well as documenting 5 weeks of home practice, symptoms and medication use. The average group improvement in well being was 80% following training in breathing, Progressive Muscle Relaxation, Autogenic Training, visualization, Quieting Response, and Alphagenics, with individual temperature biofeedback provided during the last 5 classes. Pre to post ANOVA differences found Spielberger STAI trait anxiety and Eysenck EPI neuroticism significantly decreased. EPI extraversion increased only in females. Males and females equally preferred Autogenic Training (55%). The most successful males and females were older, practiced more, reported greater increases in self confidence, and attributed more of their success to the group and/or instructor. Success of the program may also be associated with excellent home practice compliance, being a part of a group, and increases in self confidence/efficacy.

Introduction

Stress management interventions are predominantly provided when people are reporting medical or mental health issues such as clinical levels of depression or anxiety. It would be much more effective to offer these services proactively before people are beginning to experience symptoms that may lead to illness, especially now when more people are experiencing stress symptoms during and after the Covid-19 pandemic. The cost of one-to-one sessions is prohibitive for many people, particularly if one considers that any intervention generally needs follow-up and reinforcement of their practice. Previous group programs have demonstrated efficacy and these will be presented in the discussion section as they relate to the major findings of this paper and to clinical practice.

The purpose of this paper is to share the research findings from a successful, educational-based group relaxation and biofeedback-assisted stress management program. This group program began in 1978 in two Ontario universities and continues to be highly subscribed and rated. There have been 12 trained instructors who taught approximately 10,000 people across more than four decades. This program has been extended to teachers' organizations, medical health teams' wellness programs, sports teams, veterinarians, farmers organizations, and small and large businesses within multiple communities.

Based on our experience we recommend a group format as it is not only more cost effective but also provides the additional benefits of participants feeling they are not alone or different from others and realizing everyone does not learn the same way but can learn from each other, all of which can enhance self-esteem and motivation. The instructor is also able to clarify content and receive questions from the group that may not arise in one-to-one sessions. Typically, clients report that being in a group reinforces a commitment to attend, learn, and practice as well as providing a respite that is looked forward to as valuable.

Included in this article is a summary of male and female participants' subjective experiences, changes in scores on standardized psychological inventories, a detailed review of male and female pre-post psychophysiological profiles, and tracking of their home practice and stress symptoms. A further examination compared the 30% who were most successful with the 30% of their counterparts who were least successful.

Design and Content of the Program

This community-based program consisted of an introductory meeting then 10 one-hour training sessions across 5 weeks with a follow-up session after 1 month. Normally there were no more

than 20 people per group across different seasons of the year. All participants signed University-required consent forms. Those few clients who specified a medical problem with tension headaches, anxiety, migraines, etc., were required to obtain their physician's approval to participate.

This study is a sample of seven consecutive groups taking the stress management program that was provided to university and community individuals in exchange for minimal fee for service and co-operation in research. Research requirements included completing subjective and personality inventories, weekly tracking of practice, medications, and stress symptoms, and taking part in two psychophysiological stress profiles.

Each lesson consisted of a brief review of the previous lesson, a discussion of clients' questions, progress, symptoms, or difficulties in home practice, then practicing of the main technique for the current lesson and a brief discussion on its application in daily life. Individual temperature biofeedback was provided within the last 5 classes using small, inexpensive portable digital thermometers. Daily home practice was highly encouraged at each session. The twelve-session program covered the following topics (a detailed program outline is at https://www.selfregulationskills.ca/programs/12-session-outline/).

SESSION 1 :

- Introduction, history, intake questionnaires, past findings/research
- Discussion of eustress / distress / thrive
- Review of benefits for participating in the program
- Overview of the program's deep/long techniques (20 - 30 minutes) for restoration and brief techniques (6 seconds to 1-3 minutes) for integration into daily life, and how to practice at home

SESSION 2 :

- Discussion of the benefits of diaphragmatic breathing
- Guided training of diaphragmatic breathing
- Review of how to practice brief and deep techniques in daily life

SESSION 3 :

- Review of practice since the previous session
- Discussion of muscle tension and how to release it
- Guided training of Progressive Muscle Relaxation (Jacobson, 1978) - introduction & 16 muscle groups
- Encourage increasing awareness of muscle tension during daily activities

SESSION 4 :

- Review of practice since the previous session
- Guided training of Progressive Muscle Relaxation for special areas, eg. waist and low back; shoulders, neck & face, and modifying it for specific situations

SESSION 5 :

- Review of practice since the previous session
- Guided training of Differential Muscle Relaxation while doing activities (Jacobson, 1978)
- Demonstrate the role of posture on neck and shoulder muscle relaxation, for example when working on computers and devices

SESSION 6 :

- Review of practice since the previous session
- Discussion of Autogenic Training (adapted from Luthe & Shultz, 1965)
- Guided training of Autogenic Training – the 6 standard phrases

- Discussion of the role of passive attention (Benson, 1976)
- Providing examples of self-monitoring and changing demanding self-talk phrases like *should / must / got to*

SESSION 7 :

- Review of practice since the previous session
- Guided training of Autogenic Training - lying down and seated; adding supportive phrases
- Discussion of how to transfer Autogenic Training into daily life
- Demonstrating and practicing hand warming (peripheral skin temperature) with discussion of the value of biofeedback in learning self awareness & control (fingertip temperature biofeedback continues through all the remaining classes)

SESSION 8 :

- Review of practice since the previous session
- Discussion of Alphagenics (Zaffuto & Zaffuto,1974)
- Guided training of Alphagenics, encouraging awareness of mind and body sensations during various levels of relaxation

SESSION 9 :

- Review of practice since the previous session
- Discussion of imagery for relaxation
- Guided training of imagery / visualization while lying down

SESSION 10 :

- Review of practice since the previous session

- Discussion of imagery in mental rehearsalGuided training in mental rehearsal for coping and performance enhancement

SESSION 11 :

- Review of practice since the previous session
- Discussion of Quieting Response (Stroebel, 1982)
- Guided training in Quieting Response
- Discussion of Open Focus (Fehmi & Fritz, 1980)
- Guided training in Open Focus
- Discussion on further integrating the practices into daily life

SESSION 12 :

- One-month follow-up
- Creation of a personal action plan for continued training, choosing favorite techniques, and tips on sticking with it

Procedures

Clients

Participants were representative of a community clinic where the majority of people were not under medical supervision. In this sample of seven consecutive groups there were 141 clients who completed psychological inventories and stress profiles in addition to attending the group stress management program. There was no significant difference in age between the 80 women (mean = 32.3 years) and 61 men (mean = 29.6 years) who ranged in age from 15 to 67 years. The clients were university students (57%) and community members (43%), and they reported cognitive (36%) and/or somatic (54%) stress symptoms or wished to learn self-regulation skills (10%).

Instruments

The Eysenck Personality Inventory (EPI, Eysenck & Eysenck, 1968) assessed the traits of introversion-extraversion (outgoing impulsive social inclinations of a person) and neuroticism-stability (emotional lability and over-reactivity). General trait anxiety was assessed using the trait scale of the State-Trait Anxiety Inventory (STAI, Spielberger et al., 1970) and the Cognitive-Somatic Anxiety Questionnaire (CSAQ, Schwartz et al., 1978) was used to measure the cognitive and somatic aspects of trait anxiety.

Clients also participated in a psychophysiological stress profile before and after the program which included a baseline and stressors followed by recovery. Stressors included anticipatory stress, cognitive, emotional, and physical (noise) stressors. The psychophysiology findings will be reported in paper two.

Clients were instructed on how to complete records of their medication use and the type, duration, and intensity of symptoms for 7 days pre-program and continuing daily throughout the program, and then again for 7 consecutive days at one month after the last class. For data analyses, the researchers calculated a symptom level total by multiplying the hours of duration by the intensity for each symptom episode.

Data from the Sample Group

The data for each variable were assessed for linearity and if not normal, a transform was completed. Generally, a mixed two-way ANOVA was performed, with sex as the group factor and pre to post scores as the repeated factor. Simple main effects were used to test if scores changed significantly within each gender. F levels at $p<.05$ level were used for significance in all measures. Full details of the statistical procedures, with graphs and interpretations, are in the unpublished paper found at https://www.selfregulationskills.ca/clinic-research/.

As noted by Kroese (2019) success is not the opposite of failure so one should study both the success and failure of programs. Thus, the data were reanalyzed to see if there were differences between those who rated the program being very successful (n = 27 females and 24 males; average rating = 128% improved) compared to those who reported the least success (n = 15 females and 13 males; average rating = 18% improved).

Subjective Evaluation of the Program by Females and Males

The participants' evaluation of the program showed no significant sex differences in the following four measures:

1) Both males and females rated the program at 3.1 on a 5 point Likert scale that ranged from 1 ("nothing gained") to 5 ("succeeded beyond my expectations/goals"), signifying it was "meeting my goals or making definite progress".

2) Self-reported improvement in well-being was measured on a scale of +300% to -300%, with the zero point representing how the client felt emotionally and physically before the program began. At the conclusion of the program, females reported feeling physically and emotionally better by an average of 81% and the males had an average of 79% improvement. One month following the program the females reported their improvement in well-being was at 90%, while males reported improvement at 74%.

3) Both sexes reported that a positive contribution to the changes in their skills, stress levels, or behaviours was due to the social support or social interaction with other people in the class and/or the instructor. Females reported a 37% contribution and males had a 32% contribution from social support.

4) At the end of the program females reported an average increase in self-confidence of 44.5% from learning these skills, while males reported an average increase of 42%.

Psychological Inventories for Males and Females

The ANOVA for pre post STAI scores showed there was a significant reduction in trait anxiety for both males (M=-5.06, p<.001) and females (M=-6.78, p<.001) (see Fig. 1). Males and females were not different from each other in their STAI scores or the amount of their changes in STAI scores.

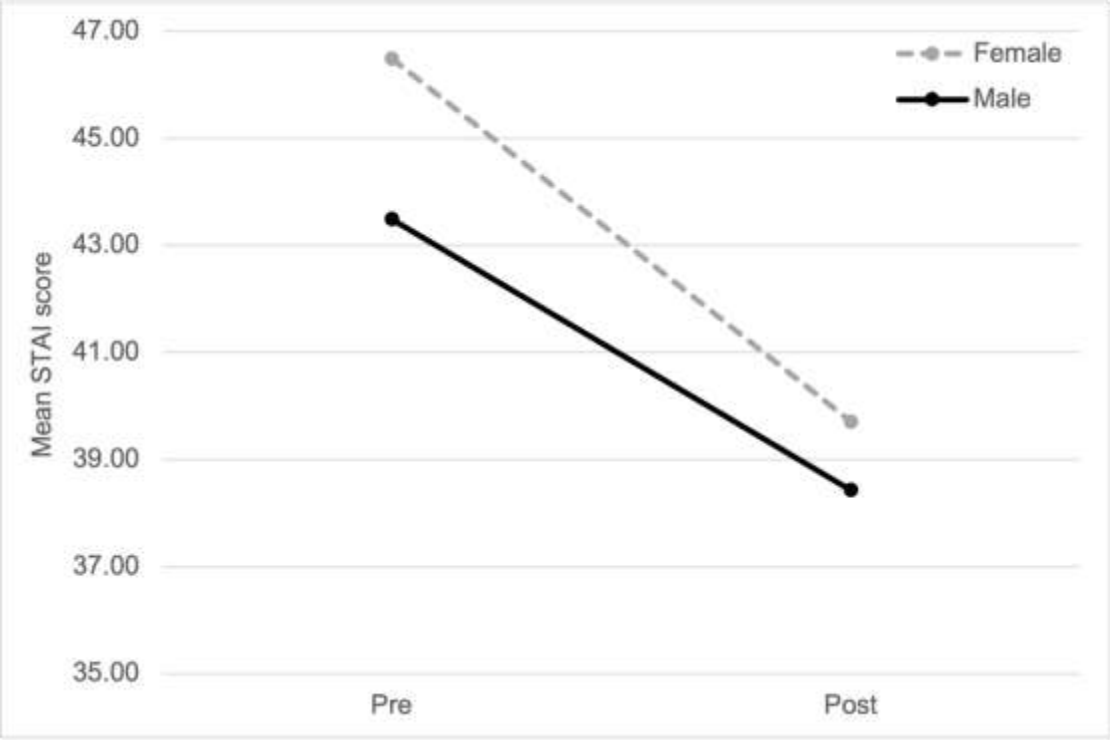

Fig. 1 STAI Trait Anxiety scores for females and males showed significant decreases from pre to post stress management program for both males and females

The distribution of the CSAQ (cognitive or somatic anxiety) scores was positively skewed, thus a non-linear transformation was applied to create a normal distribution.

The CSAQ inventory was administered once, pre-program, with the cognitive scores significantly higher than somatic scores for both females (M=1.67, p=.005) and males (M=2.69, p<.001). There were no sex differences, nor differences in the sex by type of anxiety interaction.

Males and females were not statistically different from each other in their initial EPI extraversion, or the amount of their changes in their pre to post extraversion score, however females had a statistically significant increase in extraversion after the program (M=0.95, p=0.006) but not the males (see Fig. 2).

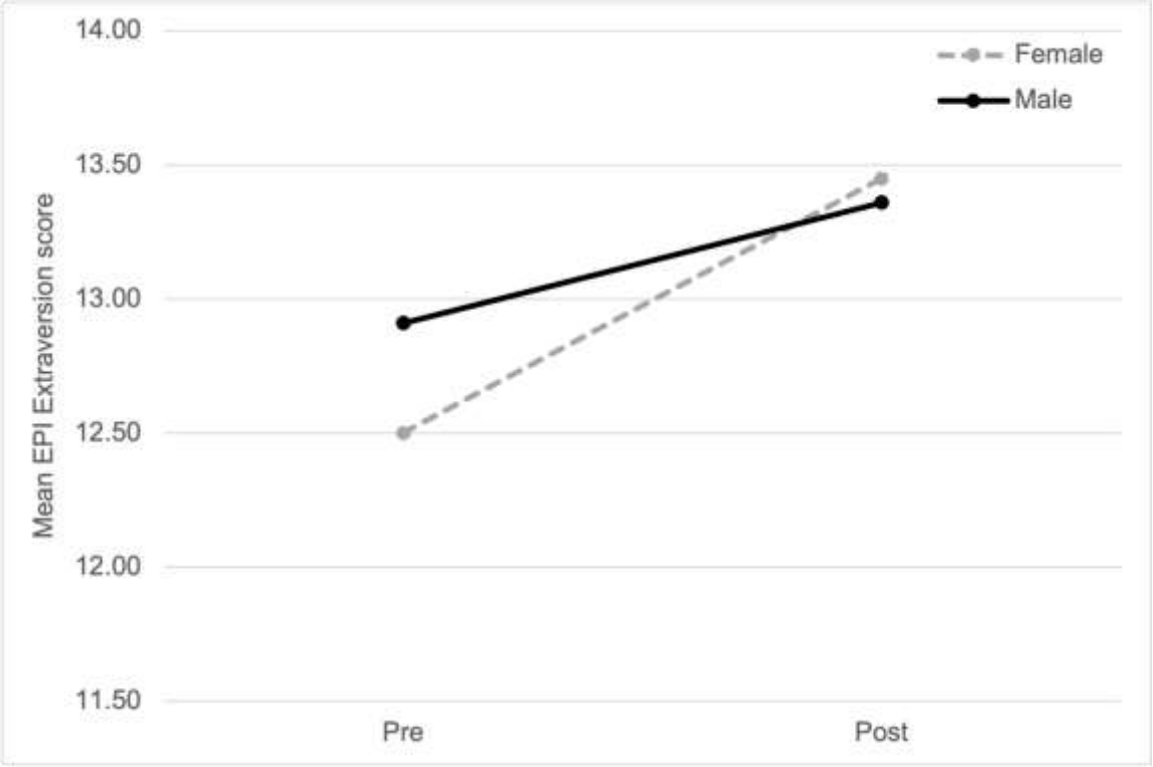

Fig. 2 EPI Introversion/extraversion pre to post scores indicate only females significantly increased in extraversion

The ANOVA for pre to post EPI neuroticism scores showed there was a significant decrease in neuroticism for both males (M=-1.64, p=0.003) and females (M=-2.17, p<0.001) (see Fig. 3).

Males and females were not different from each other in their neuroticism scores or the amount of their changes in neuroticism.

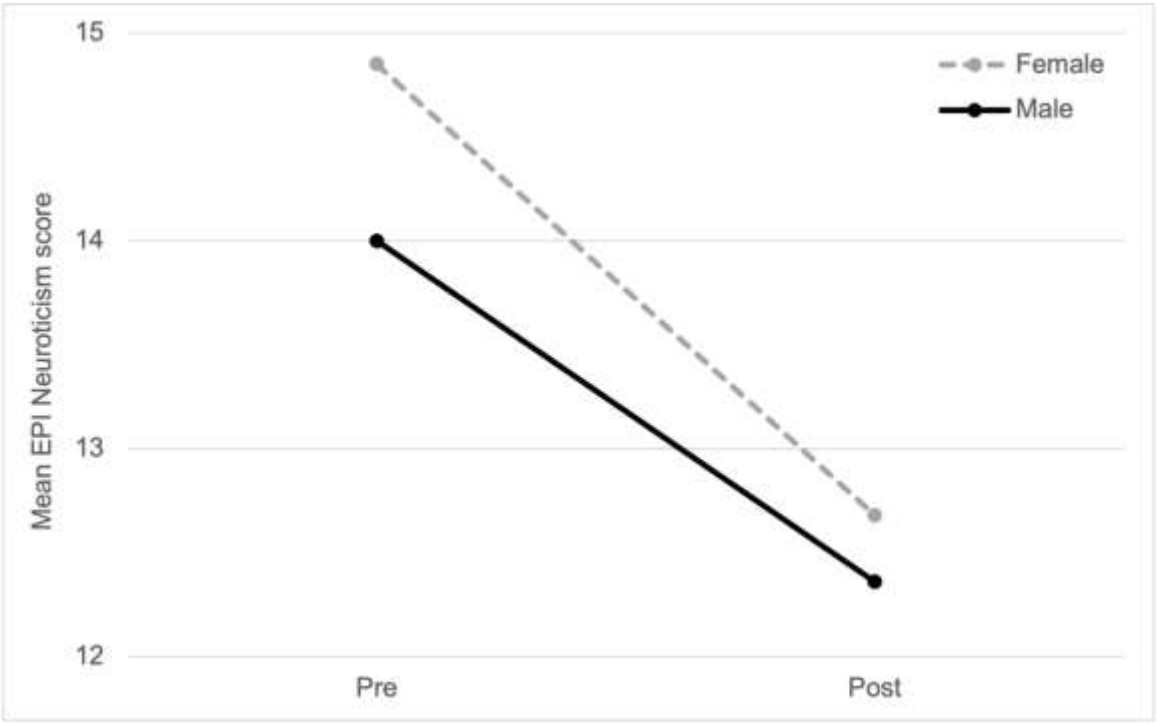

Fig. 3 EPI neuroticism/stability pre to post scores show females and males significantly reduced neuroticism

Physiological Measures for Males and Females

Skin Temperature

Skin Temperature values were negatively skewed, but applying a power 9 transformation resulted in an approximately normal data distribution and thus Anova was used.

Skin temperatures increased significantly post-intervention for both females (M=1.94, p=0.028) and males (M=1.64, p=0.05) (see Fig. 4).

Males and females were significantly different from each other in their temperatures, F(1,128)=1.29, p=0.01, but males and females were not significantly different in the amounts their temperature changed.

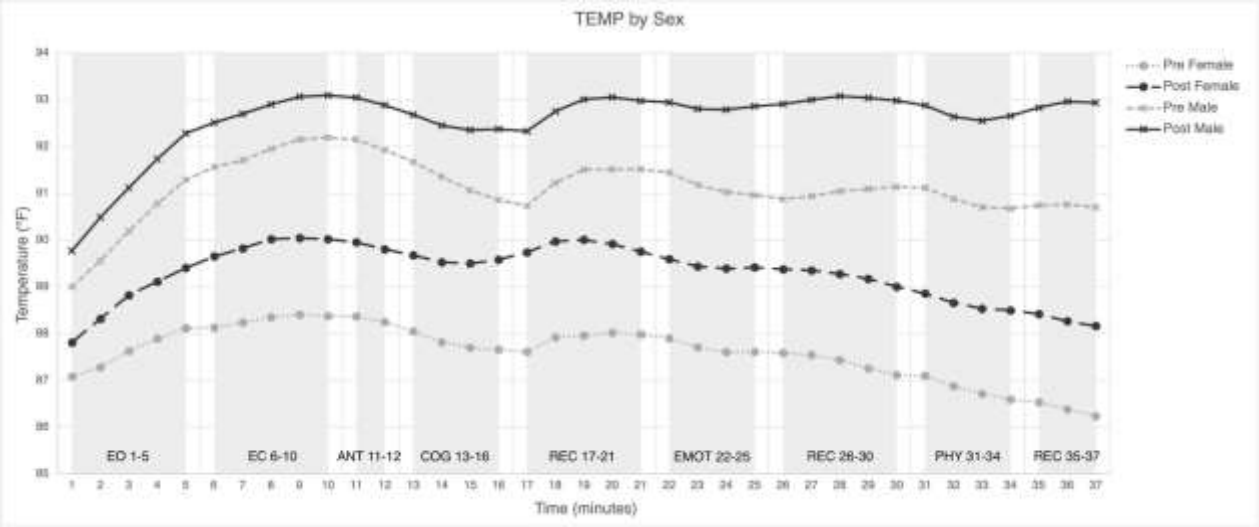

Fig. 4 Skin temperature is significantly different between males and females, and both males and females had significantly higher temperatures post program

Possible differences in responses of males and females to the stressors were further investigated by a Mann-Whitney U test for both the reaction and then the recovery for each of the stressors. A Bonferroni correction was applied to adjust for the repeated measures to determine the appropriate level of significance.

Compared to males, the females showed significantly larger decreases in temperature during the physical stressor (p=.002), and less recovery from that physical stressor (p=.022) in the pre-program profile, and during the emotional stressor (p=.015) and physical stressor (p=.010) in the post-program profile. They also displayed less temperature recovery following the emotional (p=.015) and physical (p=.001) stressors in the post-program profile. Males had a more significant decrease than females during the post profile cognitive stressor (p=.021).

Heart Rate

There were no significant heart rate differences post-intervention for females and males. Females had significantly higher heart rates, $F(1,110)=13.39$, $p<0.001$, but males and females were not significantly different in the amounts their heart rate changed.

Surface EMG

Both males and females had very low upper trapezius sEMG levels which may be partially attributed to narrow band sensors (Shaffer & Neblett, 2010) but more likely due to participants lying down during the stress profiles. Removing five outliers resulted in the sEMG values showing a normal distribution.

Surface EMG increased significantly post-intervention for the females ($M=0.12$, $p=0.033$) but not males ($M=0.06$, $p=0.34$).

Male and female sEMG values were not significantly different from each other in the amount they changed from pre to post program. (see Fig. 5)

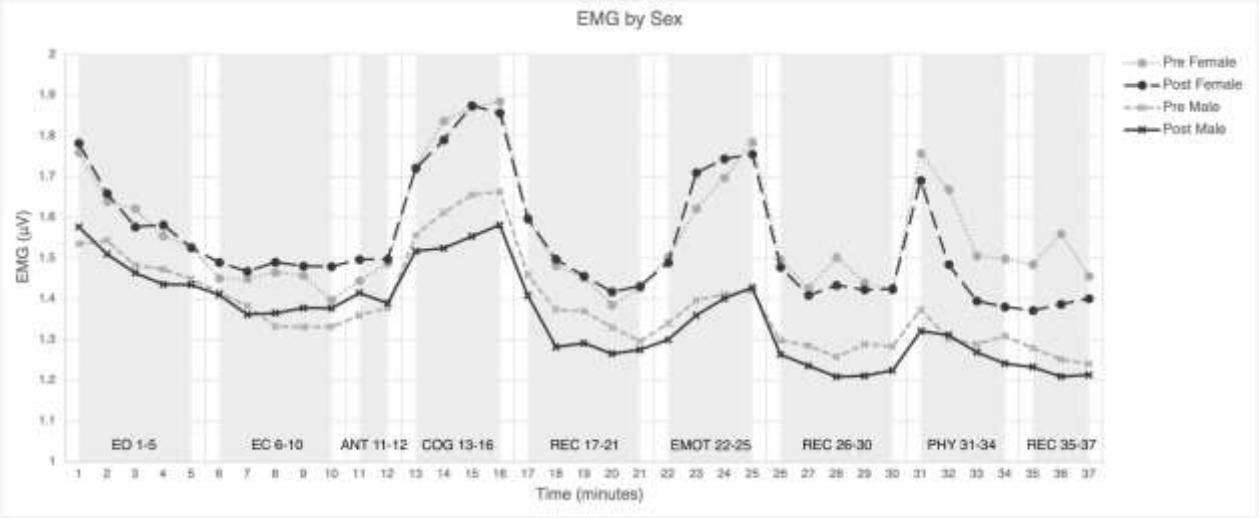

Fig. 5 Upper trapezius muscle tension is low in both males and females, noticeably responding to each of the stressors, and was not significantly different post program

Home Recordings for Males and Females

With the data from home recordings of symptoms, medication, and minutes of training, no statistical analyses were conducted due to the small sample size with repeated measurements. The data were graphed to observe trends.

Females appeared to have more symptoms than males over the weeks of the program with the female average score of 67 symptoms/week and the male average score of 56 symptoms/week as noted in Fig. 6. Pre-program there were no significant sex differences in the number of years with symptoms or the severity of symptoms. Interestingly, one month after the program there was a continued decline with the males' symptoms decreasing a further 7% and females decreasing 19% from their average levels during the program.

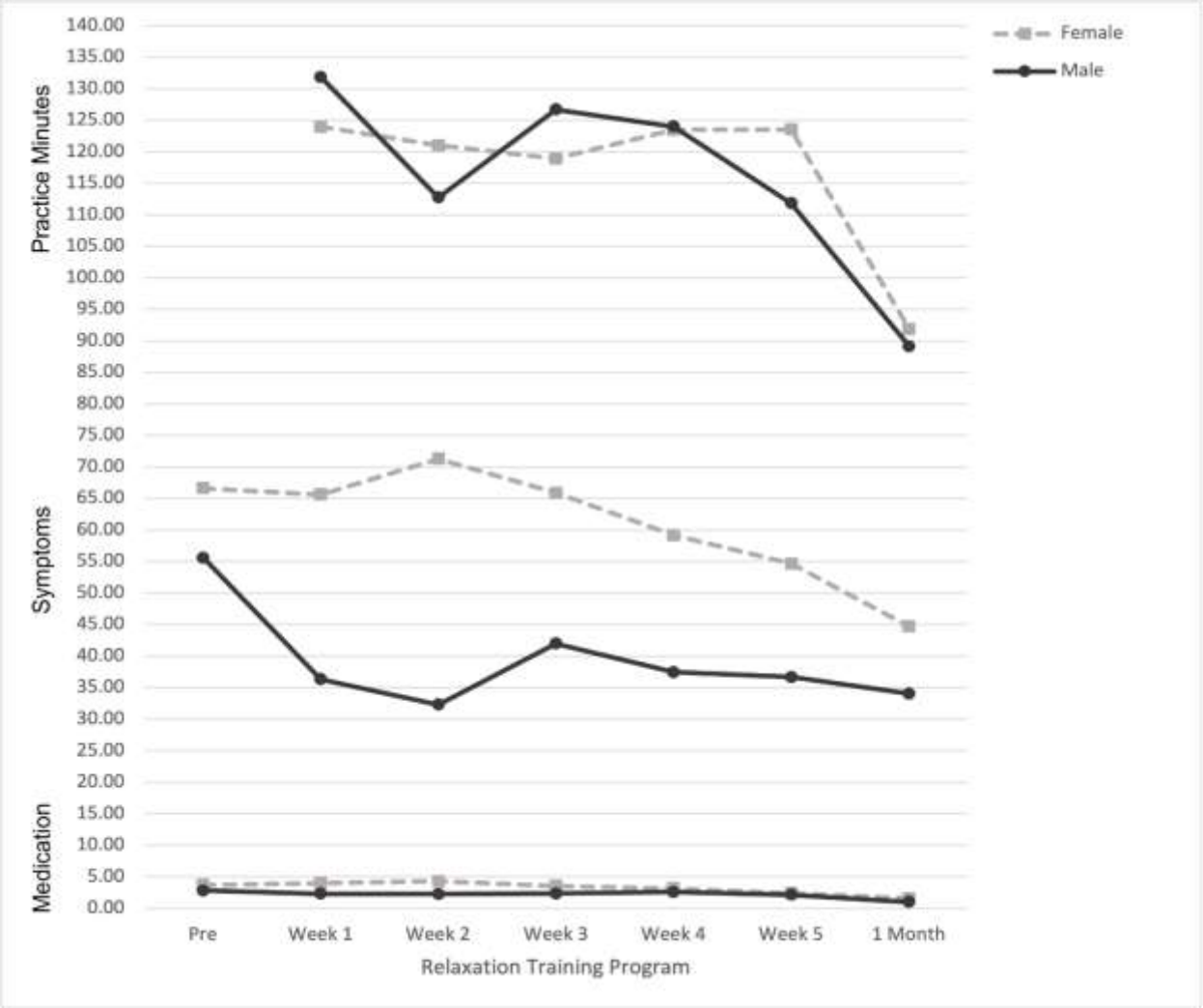

Fig. 6 Home training throughout the program showed males and females had consistently high practice minutes. Both males and females reduced the number of symptoms, although females continued to have higher symptoms, and both groups had a low rate of medication use throughout the program

Medications

Females appeared to use more medication during the program averaging 3.5 medications/week while males averaged 2.4 medications/week (see Fig. 6). Both groups showed a pattern of reduction in medications throughout the program and a further decline after the program. One

month post-program, the males' medication average had decreased 42% and females had decreased 54% from their average levels during the program.

Home Training

There appeared to be no significant difference in home training minutes over time between females and males (see Fig. 6) who practiced an average of 122 minutes/week. One month following the programs, both were practicing an average of 90 minutes/week, a decrease of approximately 25% from practice during the program.

Technique Preference

The technique most preferred by males and females (56%) was Autogenic Training. The second most popular choice for females was Alphagenics (15%) while for males it was Progressive Muscle Relaxation (16%). The third choice for females was PMR (10%), while males chose Alphagenics (11%) and Quieting Response (11%).

Evaluation of the Program by Most vs Least Successful Males and Females

Those who rated their improvement in wellbeing as 100% or greater (27 females, mean = 130% improvement, and 24 males = 125% improvement) were considered the most successful group; those who rated improvement from 50% - 99% were moderately successful and were not used in the data comparison; and those who reported feeling less than 50% improvement were classified as least successful. Of those who were least successful, the 15 females averaged 21% improvement and the 13 males averaged 15 % improvement. A two-way ANOVA, success (top vs bottom) by sex (female vs male), was utilized for comparisons using the $p<.05$ level for significance.

The successful females and males were older than their less successful female and male counterparts (F= 10.91 p< .002). There were no differences between success groups in the number, severity, or length of time of symptoms, or medications taken prior to the beginning of the program.

The most successful males and females more frequently rated the program as 'succeeding beyond my expectations/goals' compared to those who were less successful (F=8.58 p<.005). The most successful participants attributed part of their success to social support/interaction with others in the class and/or the instructor (average = 45%) at twice the amount of those in the least successful group (average = 19%) (F=15.74, p<.0005). Additionally, the most successful reported more than twice the increase in self confidence (55%) compared to those who were least successful (22%) (F=12.67 p<.001).

Psychological Inventories by Most vs Least Successful Males and Females

There were no differences in the STAI or EPI inventories between the most and least successful groups. There was an interaction between CSAQ cognitive anxiety and sex (f=w4.23 p<05) with the successful females having lower cognitive anxiety than those who were least successful while the most successful males had higher cognitive anxiety than the least successful males.

Physiological Measures by Most vs. Least Successful Males and Females

Females in the most successful group had higher temperature and heart rates pre and post program compared to those in the least successful group. There was a trend for the men in the least successful group to have higher temperatures post-program.

The females in the least successful group had higher sEMG in the pre-program profile but they

did show a trend toward reduced sEMG from pre to post profile. The males in the least successful group had a pattern of lower sEMG pre-program compared to the successful group, and there appears to be a small reduction in sEMG in the post profile for the more successful males.

Home Recordings by Most vs Least Successful Males and Females

Due to the relatively small sample size with repeated measures that would result from statistical analysis, the data for home training minutes, medications and symptoms by success group across the time were graphed to identify trends (Fig. 7). The number of symptoms of the least successful females varied weekly but trended downward and were consistently higher than the most successful females whose symptoms showed little change. The symptoms of the male groups were initially at similar levels but over time the most successful males trended downward while the less successful males trended upward.

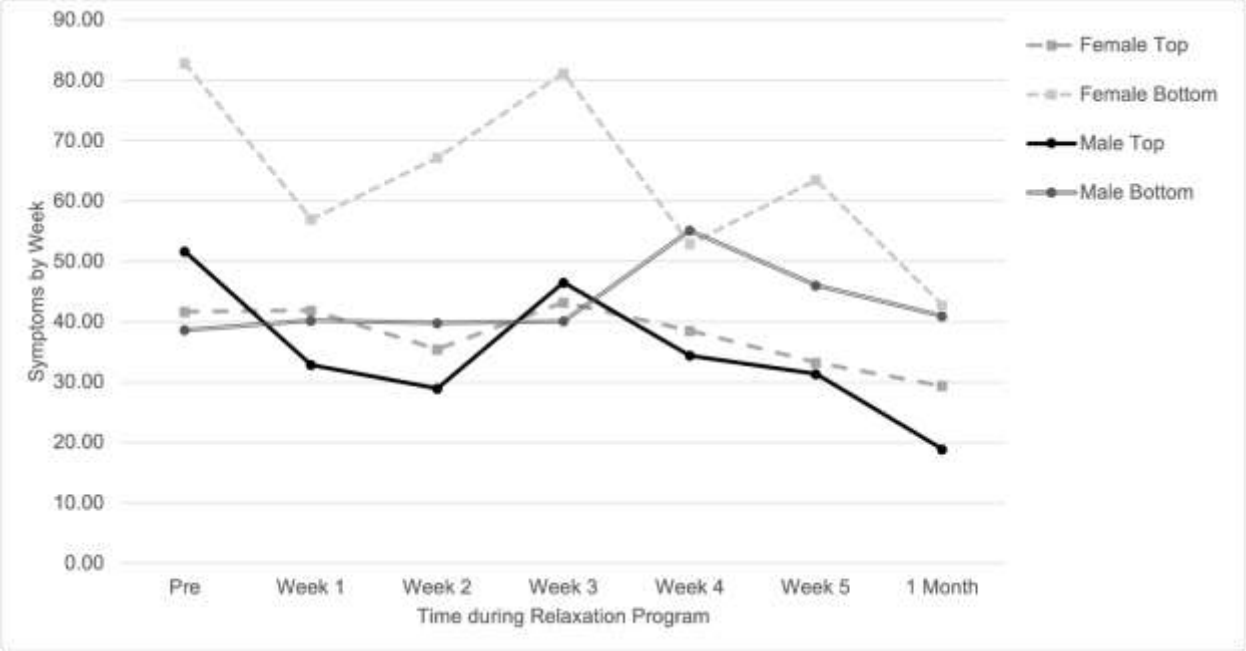

Fig. 7 Symptoms for most and least successful male and female groups indicate the least successful females had the largest number of symptoms. The number of symptoms across the time of the program for successful and less successful females is higher than their male counterparts. Only the least successful males did not have a reduction in symptoms across the time of the program.

The most successful female group reported taking more medications during the program compared to the others (Fig. 8). The lowest amount of medication use was by the least successful males. Throughout the program the females trended downward in medication use but not the males.

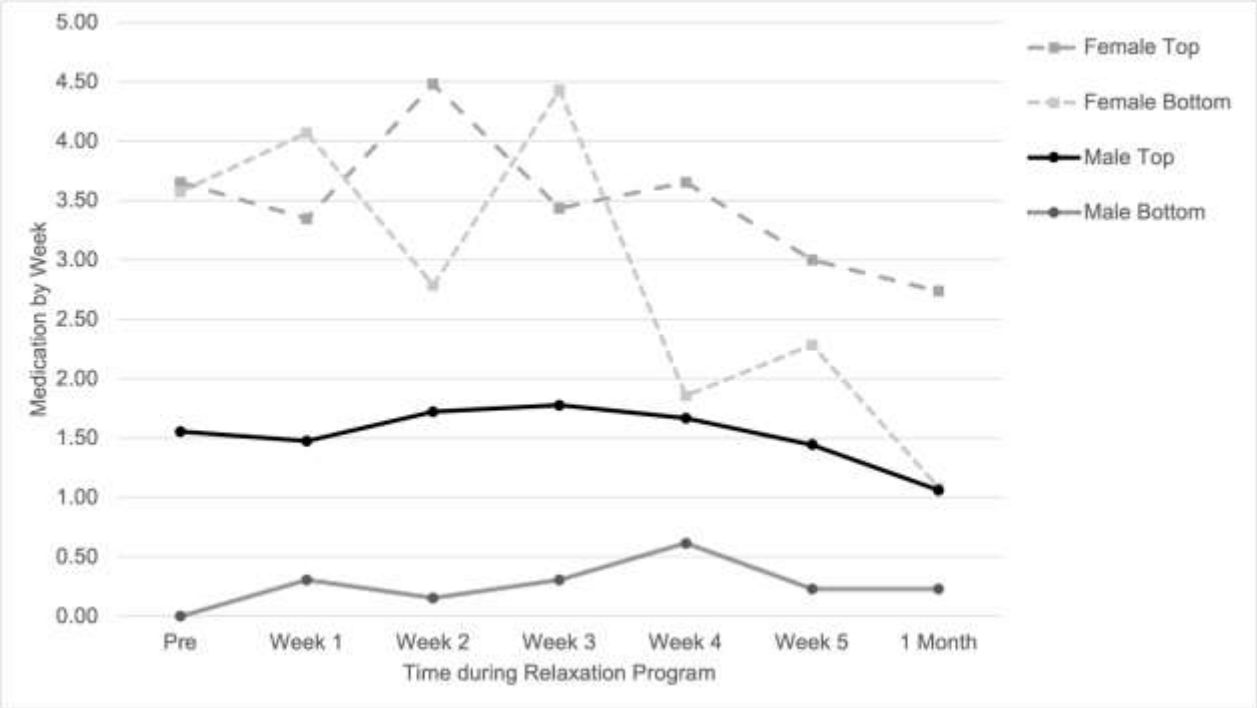

Fig. 8 Both successful and less successful female groups reported more medication use than their male counterparts but showed reduction towards the end of the program, unlike their male counterparts

While the home training practice was consistently high for all participants, the pattern (Fig. 9) suggests that the most successful male and female groups consistently practiced more minutes than the least successful males and females. The more successful males practiced approximately 50 minutes more weekly, females 30 minutes more weekly, than their least successful counterparts.

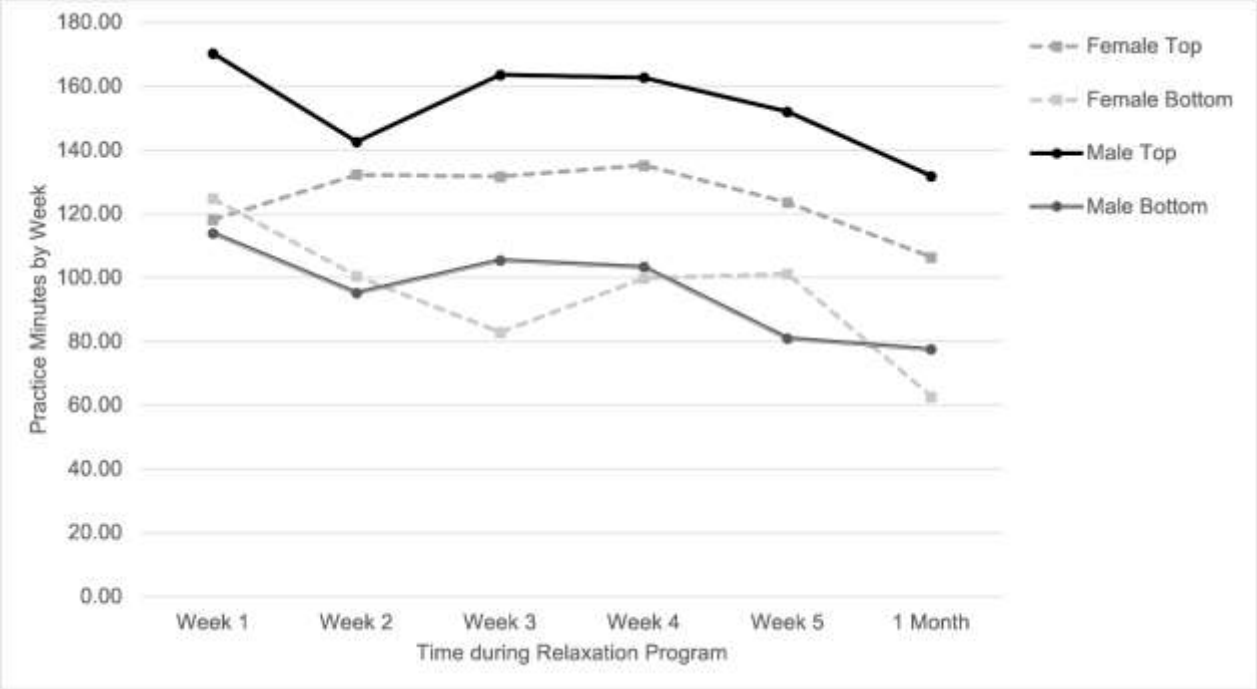

Fig. 9 The number of minutes of practice per week remained high throughout the program for all groups with the most successful groups practicing more time than their least successful counterparts

Discussion

The data presented here are a sample from a community stress management clinic as opposed to a research paradigm and thus, there were no active control groups. Consequently, it is possible that the changes reported may be due to actual treatment effects, or possibly regression toward the mean, passage of time, expectancy, attentional effects, or other factors. Brown et al.

(1998) report that ‘nonspecific’ factors may affect results, including the belief they could control their own lives, opportunities to talk to others, finding out ‘you are not alone’, and gaining hope.

The program was well attended, with males and females equally attending 80% of the sessions. with the return of 73% of the attendees at the one-month follow-up class. We attribute the high return rate to their interest in getting a post-program psychophysiological profile, their commitment to helping the research program, or the incentive of a $20 refund for completion of forms.

Participants Evaluation of the Program

The first measure of evaluation indicated that male and female participants were successful in meeting their goals with 80% feeling physically and emotionally better which is higher than Bird et al. (1985) and De Anda (1998). Interestingly, at the one-month follow-up females reported even further improvement than at the final class, males had a slight decrease in improvement since the final class. In similar programs, Stangle and Lowinger (1998) found benefits were sustained at a 3 month follow-up and Nakagawa Kogan et al. (1984) reported a continuation of gains made by nurses at the one year follow-up. Perhaps the improvement persisted due to the continued practice or improved self-awareness of stress symptoms.

The benefits of providing group classes are reinforced by these participants indicating that some of the improvement in their skills, stress levels, or behaviors was due to the positive contribution of social support/interaction with other people in the class and/or the instructor. Further, the most successful male and female groups reported higher contributions from social support than did the least successful groups. Although Baum and Grunberg (1991) found that women generally report more social support and greater use of support networks than do men, in this sample the males and females had similar benefits. Terp et al. (2019) emphasize the importance of being part of a group and that the group also acts as a facilitator for behavioral change perhaps by creating

community, social identification, and support. Research on brain mechanisms link social integration or social support with reduced neural threat responses and stress buffering (Ditzen & Heinrichs, 2014), bolstering the idea of group stress management programs as a possible treatment strategy.

Instructors significantly impact success in stress management programs. Taub and School's (1978) subjects had more success at hand warming with "friendly" rather than "impersonal" biofeedback therapists. Lashley et al. (1987) found that verbal reinforcement from a live group leader facilitated temperature biofeedback training, and group cohesion developed readily under conditions of feedback and/or verbal reinforcement. Duckro (1989) also reports better results when the therapist interacts in an encouraging rather than an aloof manner, and when the therapist expects a successful outcome. The instructor's voice quality and speech rate impacted success in muscle relaxation training in females with self-reported anxiety (Knowlton & Larkin, 2006). When participants perceived the therapist's voice as helpful in achieving a relaxed state, they were more likely to engage in home practice, a variable positively related to outcome (Wittrock et al., 1988). Pillette et al. (2021) recently found that non-tense participants had higher performance on Brain-Computer Interface mental imagery tasks when training with female experimenters, while tense participants had higher performance when training with male experimenters.

Both males and females reported an improvement of approximately 43% in their self-confidence from learning these self-regulation skills, with the more successful men and women reporting twice as much of an increase in confidence as their less successful counterparts. While the program did not target self-confidence, the opportunity to try techniques may have enhanced self-awareness which contributed to increased self-control (Pekrun, 2006) and achievement which then increased self-confidence. Further, Glass and Levy (1982) found that perceived success in biofeedback and self-regulation training led to more positive mood, stronger causal

attributions to effort and less to task difficulty, and expectations for future effective self-control. Further research on the relationship between feelings of success and self confidence needs to be explored in an attempt to improve elements of the program to effect positive change.

We hypothesize that having a program housed and supported by the University, with support and referrals from local health care agencies, gave it significant credibility as being valuable. Also, with longevity in the community came word-of-mouth support which then filtered into local news media and health care organizations. These factors perhaps increased participants' commitment to the program and expectations of success.

Pre- Post Changes in Psychological Variables

STAI (Trait Anxiety)

The significant decrease in trait anxiety, for both males and females, was expected and is reasonable, considering that this was the basis of the program, and has been previously reported (Eppley et al., 1989; Kiselica et al., 1994; Aritzeta et al., 2017). Although trait anxiety is generally higher in females (Yamasue et al., 2008; Moser et al., 2016), this was not true in this sample.

Even those who reported less success in the program significantly decreased trait anxiety, supporting the use of cost-effective stress management group programs for the general population.

There were no significant differences between females and males, nor by level of success, on the CSAQ somatic anxiety scale while Steptoe and Kearsley (1990) found higher somatic as opposed to cognitive anxiety in female and male athletes, meditators, and sedentary controls. DeGood et al. (1985) and Jin et al. (2014) showed both females and males had higher cognitive anxiety scores compared to somatic scores which was true for participants in this study.

Interestingly the successful females had lower cognitive anxiety than less successful females while more successful males had higher cognitive anxiety than males who were least successful. Perhaps this style of group program better fits males with high cognitive anxiety, or possibly females with high cognitive anxiety have other factors present that influence their success in this type of group program. Since the nature of the population, gender, cultural differences, motivation, and social experiences may have an impact on whether anxiety is experienced in a cognitive or somatic manner, the stress management program needs to contain physical and psychological management skills.

EPI Extraversion/Introversion

Females, but not males, had significantly increased extraversion scores post program but there were no differences due to degree of success. The initial mean EPI introversion/extraversion scores for females and males were lower than an English or American population (Eysenck & Eysenck, 1968) but similar in introversion/extraversion scores to university students in the same province in Canada (Skinner & Peters, 1984). Since extraversion has been linked to subjective well-being, positive emotionality and to task focus coping (Diener, 2000; Matthews & Zeidner, 2000) it is noteworthy that females improved but it would be important to determine why males did not.

EPI Stability/Neuroticism

Both females and males significantly lowered their neuroticism scores, and there were no differences related to degree of success. As neuroticism has been shown to be related to negativity (Matthews & Zeidner, 2000) and coping (Austin et al., 2010) this is an important improvement outcome particularly since the initial scores place them close to “outpatients in treatment for anxiety syndromes” on Eysenck norms, suggesting they were perceiving a need for assistance. The decreases in neuroticism may be related to their decreased trait anxiety and the

class structure where exercises focused on the individual's perception of and control of mind/body responses to stress and did not pathologize the state. They were also able to integrate their self-regulation skills into daily life which reinforced their self belief in the possibility of change. This change is similar to that of Brown et al. (1998) who found that not just the "worried well" enroll in public stress management program and even the least distressed are capable of benefiting from such interventions.

The findings of no differences in personality measures by degree of success for both males and females suggest that personality may play only a minor role in determining the success of a group stress management intervention.

Pre- Post Changes in Physiological Variables

"One of the earliest findings in the study of gender differences in stress responses was that reported distress is not always parallel to physiological response and that women appeared to report relatively more distress" (Baum & Gruneberg, 1991). Mauss et al (2004) concluded that a relaxation program decreased anxiety but not physiological responses while Chang (2011) noted that anxiety was quickly lowered but it was only after years of practice that there was a reduction in biological changes. Our findings match these.

Finding male fingertip temperature consistently warmer than females corresponds to previous research (Lucas & McIlvaine,1985; Sargent et al,1986; Montgomery, 1988). Blanchard et al (1989) cite their group mean for 56 combined normal males/females as 88.6 F during the stress profile baseline (eyes closed), similar to the 88.2 F mean for the females in this sample, however the males at baseline (eyes closed) had a mean temperature of 91.6 F. Blanchard et al (1989) found those with vascular headaches had significantly lower hand temperatures across stress profile conditions and in this sample twice as many women compared to men had vascular

headaches. Interestingly, McGrady (1996) found 17 white males in medical school had cooler hands (79.8 F) than 10 white females (84.6 F) prior to biofeedback training but they were not different after training. Generally adult females have colder hands than males due to hormonal influences, differences in vascularization, and perhaps other factors (Violani & Lombardo 2001). However, since females switch from having warmer to cooler shoulder skin temperatures than males at around age 16-17 (Pronina et al, 2015) we wonder if female children/young adults have warmer hand temperature than males. Reporting of biofeedback or stress profiles should include separate data for age and sex.

Males and females showed significantly warmer hands in the post profile compared to their pre profile. Hand warming improvements may have been enhanced by the fact that temperature biofeedback was practiced in the program's last 5 training sessions. This biofeedback could have provided more skill acquisition or motivation (Wilson et al, 2004; Peper et al, 2015). Arena & Hobbs' (1995) analysis of stress profiles found that with the exception of frontal EMG during a cold pressor stresso**r**, stress profiles are stable over time. Since the profiles were collected throughout the year, the post program increase in temperature is not likely due to time of year effects but more likely due to the training effect from the program, especially since temperature biofeedback was practiced under supervision.

The pattern of temperature responses during the profiles is interesting. First, compared to males, females showed significantly larger temperature decreases during the physical stressor in the pre-program profile and during all stressors in the post program profile. Secondly, they also displayed less temperature recovery following emotional and physical stressors in the post program profile. Willmann et al (2012) found that male finger temperature recovery following a moderate cognitive stressor seems to be related to trait anxiety level and they suggest extending this research to females. Females showing less recovery may be related to their cognitions as

Brosschot et al (2006) note that perseverative cognition “expands the temporal duration of a stressor beyond the traditional reactivity period to include anticipation and recovery, thereby being the source of prolonged physiological activation and somatic complaints”. Temperature has long been associated with emotion (Ziegler & Cash, 1938), as well as in recent research (De Zorzi et al, 2021), and is also associated with concentration (Serrano-Mamolar et al, 2021). Perhaps the different response and recovery patterns between males and females reflects differences in the amount of anxiety, stress, emotion, concentration, perseverative cognition or task success during the stressor.

Since males show significantly lower heart rate than females in laboratory studies (von Scheele et al, 2005; Koenig & Thayer, 2016; Rattel et al, 2020) and home environments (van Kraaij et al, 2020) our similar findings were expected. While some of the difference may be due to fitness levels, Dua & King (1987) found a trend to consistently higher heart rates in self-reported worriers across all stress profile conditions and although worry was not measured in this study, perhaps it contributed to the higher female heart rates.

While McAdoo et al (1990), Baum & Grunberg (1991), and Ordaz & Luna (2012) report females display more heart rate reactivity during all stressors, that was not found here. Physiological stress reactivity and recovery after stressors are influenced by complex, interacting physiological and psychological processes such as fitness (Forcier et al, 2006; Jackson & Dishman, 2006), reciprocal coupling of the sympathetic and parasympathetic nervous system (Weissman & Mendes, 2021), optimism, autonomy and mastery (DuPont et al, 2020), worry (Segerstrom, 1999), rumination (Watkins & Roberts, 2020), rehearsing failures and engaging in self-denigrating thoughts (Roger & Jamieson, 1988).

Although females had a higher sEMG in the post program stress profile, their microvolt levels are so low it is probably not clinically meaningful. Females have a pattern of higher sEMG (pre and

post program) compared to males, similar to Krantz et al (2004) who reported that females had higher mean sEMG during baseline and recovery periods. The lack of statistical significance in this sample is possibly because of the small surface area measured or the position of lying down.

Females pretty well came back to their baselines after stressors, while males went lower than initial sEMG baselines, as also found by Krantz (2004). Further, Krantz found females had more muscle response for the Stroop but not arithmetic or cold pressor stressors. Since most studies have been grouping males and females together, it would be important for future studies to assess female male differences in sEMG responses to cognitive and emotional stressors and recovery from stressors.

Like others (Ford et al, 1983; Hoehn-Saric et al, 1997; Hoareau et al, 2021) who have reported that physical measures fail to correlate with psychological measures, these participants' subjective improvement in well-being is much higher than any objectively measured physiological changes between the pre and post stress profiles. Even more interesting is that when confronted with the mismatch between perception and actual psychophysiological behavior, clients express disbelief (Schilling & Poppin, 1983).

Male Female Differences

While the program was equally effective for males and females, there were some significant differences in their stress symptom intensity, psychological, and physiological responses to the program. Males having warmer hands and lower heart rate than females might simply be due to biological differences. However, trends appear to show that patterning of responses to stressors and recovery from stressors in temperature and sEMG is different between males and females. Because Brosschot et al (2006) observed that perseverative cognition expands the temporal duration of a stressor beyond the traditional reactivity period to include anticipation and recovery,

it is important for future work to look separately at male and female cognitions and how they impact anticipation, stressor response, and recovery from stressors.

Arena & Hobbs (1995) cite early research that associated high anxiety with increased physiological responses. Conrad & Roth (2007) also note higher muscle tension in those with anxiety. This holds true in the present study as females with higher sEMG levels prior to the program had higher STAI trait anxiety and also reported higher symptoms and medication use. Krantz et al (2004) report that sEMG and sympathetic nervous system activity are related and may be responsible for higher anxiety and more stress related problems. One component of anxiety is worry and Dua & King (1987) found that worriers did not let go and recover (heart rate) after the worry stressor; worry may have been a factor in the poor recovery following stressors in these stress profiles. Rumination which perpetuates worry has multiple negative consequences impacting anxiety, depression, insomnia and other health states (Watkins & Roberts, 2020).

Home Recordings of symptoms, medications and minutes practiced across 10 weeks

The benefit of data measurements across time is that a pattern can be established which allows for checking consistency over time. In this study one can see the trend that both males and females improved in symptoms and medication across the program but at different periods in time. Learning may progress differently for males and females as illustrated by Pillette et al. (2021) who used EEG- Brain-Computer Interface mental imagery tasks and found that males started at a lower performance level and then improved while females started at a higher level and decreased in their abilities across trials. This is a reminder that not everyone responds at the same pace.

Our finding that females report more symptoms than males agrees with that of Krantz et al. (2004). There is a clear pattern of females decreasing symptoms and medication starting at week

2 and continuing throughout the remainder of the program and into the one month follow-up. When viewed by degree of success, the largest decrease in symptoms was for the least successful females. They initially reported the most symptoms and had half that amount at one month post-program, yet this reduced level was still more than the symptoms of the high success groups. Perhaps still experiencing a significant level of symptoms post-program, despite having the greatest decrease of symptoms, led to their lower rating of improvement in wellbeing from the program.

Some people appear to improve immediately while others take more time, whether due to expectancy, a Westinghouse effect, keeping a diary, or the breathing training in the program's first week.

Females had significantly more medication use than males, similar to findings in the systematic review by Shaghaghi et al. (2014). Neither the successful nor less successful males decreased medication use and surprisingly, the largest decrease in medications was in the females who had the least success. They also had the greatest decrease in symptoms, so it is possible that the decreased medication use is associated with experiencing fewer symptoms but was not sufficient for them to feel much improvement in well being.

Females averaged 17.5 minutes of home practice per day and males 14 minutes/day. The most successful males and females practiced more than their least successful counterparts which may account for their reported success in this program as others (Carmody & Baer, 2008; Huppert & Johnson, 2010) report that those practicing more would benefit more. Hillenberg and Collins (1983) found those who consistently practiced PMR at home over 5 weeks reported less daily general anxiety and tension compared to those not doing home practice. Perhaps the pre-post reduction in trait anxiety in our participants was also related to consistent home practice. Eisen (2005) found those with higher practice compliance had significantly greater reductions in

multiple stress indices, whether they were attending an in-person group relaxation program or going at their own pace in an individual on-line program. The decrease in practice in the second week by 3 of the 4 success groups (a pattern we have seen before in our clinical practice) may correspond with a decrease in symptoms that week or perhaps a sense that the program will be helpful and less practice is needed. This pattern of early or no improvement may be important for both the instructor and the client to be cognizant of to avoid discouragement, quitting, or prematurely assuming the problem is resolved.

Future research should attempt to measure the quality of the practice, preferably with psychophysiological monitoring of the various modalities (temperature, muscles, etc.) which would document changes and the proximity to criteria of full physiological relaxation as well as enhance motivation and increase stress reduction. Wearable technologies make this increasingly feasible.

While practice time had reduced to approximately 90 minutes/week at the one month follow-up, they continued to practice despite no longer meeting as a group, and reported improved well-being continuing at almost the same level as at the final class. Like King (1980), transfer of skills was practiced within class sessions to encourage an integration into home and real-life conditions. In addition to the $20 incentive given for completing weekly home training forms and attending the one month follow-up, the act of recording daily practice minutes and symptoms may reinforce training. Practicing self-regulation can improve how they feel, and feeling better reinforces continued practice. Home tracking devices with device and program feedback for consistent encouragement could be integrated into future programs to facilitate ongoing practice.

The improvements in symptoms and medication and the continuing practice one month after the class sessions suggest the beginning of a habit. Habit development is noted as one of the lasting methods whereby people obtain and maintain self regulation (Kroese, 2019). Lally et al. (2010)

report an average of 66 days to develop a strong habit with a wide variation from 8 to 254 days. The context of this program encouraged habit development by a consistent focus on cues from their bodies (self-awareness aided by biofeedback), repeated opportunities of experiencing a relaxation state, and practicing brief skills to quickly recreate the awareness and relaxed state which could then transfer to practice in other independent environments. Wittrock et al. (1988) noted that it was the degree of the relaxed state that differentiated the successful from less successful patients. Additionally, the provision of temperature biofeedback and logging of progress possibly created expectations which, like Wittrock et al. (1988), may have accounted for the degree of success. Ford et al. (1983) noted that most patients can acquire the relaxation techniques in 8 weeks but long-term benefits are a matter of daily home practice with generalization of the effects enhanced through transfer skills such as the 6 second Quieting Response.

Technique Preference

Both females and males most preferred Autogenic Training. The second most popular choice for females was Alphagenics while for males it was Progressive Muscle Relaxation. This is similar to Bird et al. (1985) where the first choice was Autogenic Training and second choice was Progressive Muscle Relaxation. We do not know if this is due to an order effect, the instructors' ability to teach these techniques, or if these techniques were more effective at reducing their symptoms.

Early research (Lehrer & Woolfolk, 1983; Timmerman et al., 1998; Murphy, 1996) suggested that there is no single best relaxation technology, that not all techniques are equally efficacious, and that the most powerful stress management and behavioural medicine programs are multi component programs. In a later review of 64 studies on stress management of athletes, Rumbold et al. (2012) found multimodal programs were beneficial in achieving stress reduction while

Hoareau et al. (2021) noted that a stress management program with a variety of components significantly reduced perceived stress more effectively than HRV biofeedback training alone. Lehrer and Woolfolk (2021) also report that for various disorders, multimodal programs produce more powerful therapeutic effects than any individual technique alone and that the subtle differences between techniques may have clinical significance.

Benson et al. (1974) and Peper et al. (2019) believe that all relaxation techniques create a common integrated “relaxation response”. While components of programs differ, ie. Alphagenics, Autogenic, biofeedback, breathing, imagery, meditation, mindfulness, Progressive Muscle Relaxation, Quieting Response, etc., they may all decrease sympathetic arousal. Most techniques also include the practice of letting go of thoughts, and focusing on the present, which was also included in this program.

In this study, presenting a variety of techniques better addressed the individual preferences of a diverse group and likely enhanced group adoption/effectiveness. Clients who ruminate have been encouraged to practice ‘letting go’, which was purposedly incorporated into the teaching and practice of each technique (PMR, Autogenic, etc.) in the program.

Male Female Differences and Differences by Success in the Program

While the program was equally effective for males and females, there were some significant differences in their stress symptom intensity and responses to the program. It is important for future work to look separately at data from males and females and determine what parameters cause differences in those participants who feel the most and least successful.

One possible contributor to male female differences is the finding by Dolcos et al. (2020) that females have enhanced sensitivity to emotional stimuli, especially negative stimuli, and they show negative affective bias in attention and perception while also exhibiting enhanced

emotional competence in the processing of emotions. Additionally, Rattel et al. (2020) noted females have a higher/stronger concordance (response concordance is the integration of thinking, feeling and responding) than males on almost all physiological parameters, and that females are better than males at recognizing emotions, expressing emotions, and being more aware of emotions. Rattel et al. (2020) further postulates that these sex differences may be due to better awareness as women are more responsive and sensitive to the environment. These concur with Bekker and Mens-Verhulst's (2007) summary that although anxiety disorders are more prevalent among women than among men, "scant attention has been given to these differences in terms of treatment. Prevention and treatment of anxiety disorders might be more effective if the available knowledge about gender specificity was implemented. Concomitantly, treatment effect studies could be improved by greater consideration of gender throughout the research process".

The differences of participants by sex and success suggests that researchers should further evaluate this relationship with a larger sample size to determine what components of the program are most associated with compliance, failure and success. Additionally, a longer time period for follow up evaluation is recommended (Ford et al., 1983).

SUMMARY

The group stress management program was significantly effective for females and males with decreases in anxiety, neuroticism, symptoms, medication, and increases in self-confidence, extraversion, and feelings of well-being. Physiological differences were found with both males and females having higher skin temperature post-program, but they had different patterns of stress profile reactivity and recovery. The amount and consistency of home practice was impressive with continued reductions in symptoms and medication one month after the program.

Males and females differed in their patterns of home practice and changes in symptoms and medication use over time. The most successful males and females were older, practiced more, reported greater increases in self confidence, and attributed more of their success to the group/instructor. Further study should focus on the needs of those who did not achieve as much success.

One component of success may be commitment and motivation that was generated through a program structured with a variety of techniques, provision of their scientific rationale, experiential awareness during class training, classroom opportunities to learn/share experiences with ‘similar’ others, and group reinforcement. A second component of success may have been the ongoing home practice with journaling, feedback, and reward for compliance. Future studies should include the nature of the group (culture, environment, race, sex, etc.), mind and body measures, and reporting of the components of the course content as all play a factor in unique responses to a stress management program.

The findings of this study suggest that in the face of increasing stress, mental health issues, Covid19, and financial strains, a group stress management program is a cost efficient and effective method for increasing self-regulation, reducing anxiety, and enhancing well-being.

Dr. Evelyn I. Bird (1928-2020)

This article is a tribute to Evelyn, a professor in Human Kinetics at the University of Guelph in Ontario, Canada, who created the Stress Management and High Performance Clinic in 1978.

Her 12-session program amalgamated information and research she learned at early meetings and workshops of BSA (now AAPB) along with research and training in stress management and sport psychology. Later she returned and taught self-regulation skills at these associations. Her university teaching was impactful and included novel experiences such as taking students up in a glider airplane while monitoring their physiology. Her group and individualized stress management programs greatly benefited from the respect and referrals from the University and local medical practitioners, and were utilized by students, musicians, athletes, national teams, businesses, health agencies, and the community at large.

Evelyn's legacy continues with the multifaceted program now expanding to on-line offerings for national and international groups seeking practical methods to self-regulate. She was a pioneer in biofeedback assisted stress management with a wide range of interests and service to the field.

References

Aritzeta, A., Soroa, G., Balluerka, N., Muela, A., Gorostiaga, A., & Aliri, J. (2017). Reducing anxiety and improving academic performance through a biofeedback relaxation training program. *Applied Psychophysiology and Biofeedback*, *42*, 193–202. DOI: 10.1007/s10484-017-9367-z

Austin, E. J., Saklofske, D. H., & Mastoras, S. M. (2010). Emotional intelligence, coping and exam-related stress in Canadian undergraduate students. *Australian Journal of Psychology, 62*, 42–50.

Baum, A., & Grunberg, N. E. (1991). Gender, stress, and health. *Health Psychology*, *70*(2), 80–85.

Bekker, M. H. J., & Mens-Verhulst, J. V. (2007). Anxiety disorders: sex differences in prevalence, degree, and background, but gender-natural treatment. *Gender Medicine*, *4*,178–93.

Benson, H., Beary, J. R., & Carol, M. K. (1974). The relaxation response. *Psychiatry*, *37*, 37–46.

Benson, H. E. (1976). *The Relaxation Response.* Morrow and Company.

Bird, E. I., Wilson, V. E., & Blanchard, E. B. (1985). Characteristics of stress clinic attendees. *Biofeedback and Self-regulation*, *10*, 343–348.

Bird, E. I., & Wilson, V. E. (1988). Personality and relaxation therapy: changes among clinical and normal subjects. *Perceptual and Motor Skills*, *66*, 283–289.

Biron. C. (2012). *Improving organization interventions for stress and well-being: Addressing process and context* (C. Biron, M. Karanika-Murray, C. Cooper, Eds.). Routledge. https://doi.org/10.4324/9780203723494

Brown, J. S. L., Cochrane, R., Mack, C. F., Leung, N., & Hancox, T. (1998). Comparison of effectiveness of large scale stress workshops with small stress/anxiety management training groups. *Behavioural and Cognitive Psychotherapy*, *26*, 219–235.

Carmody, J., & Baer, R. A. (2008). Relationships between mindfulness practice and levels of

mindfulness, medical and psychological symptoms and well-being in a mindfulness-based stress reduction program. *Journal of Behavioral Medicine*, *31*(1), 23–33. https://doi.org/10.1007/s10865-007-9130-7.

De Anda, D. (1998). The evaluation of a stress management program for middle school adolescents. *Child and Adolescent Social Work Journal, 15*(1), 73–85.

DeGood, D. E., Buckelew, S. P., & Tait, R. C. (1985). Cognitive-somatic anxiety response patterning in chronic pain patients and nonpatients. *Journal of Consulting and Clinical Psychology*, *53*, 137–138.

De Witte, N. A. J., Buyck, I., & Van Daele, T. (2019). Combining biofeedback with stress management interventions: A systematic review of physiological and psychological effects. *Applied Psychophysiology and Biofeedback*, *44*, 71–82. https://doi.org/10.1007/s10484-018-09427-7

Diener, E. (2000). Subjective well-being—the science of happiness and a proposal for a national index. *American Psychologist*, *55*(1), 34–43. doi:10.1037/0003-066x.55.1.34

Ditzen, B., & Heinrichs, M. (2014). Psychobiology of social support: The social dimension of stress buffering. *Restorative Neurology and Neuroscience*, *32*, 149–162. DOI 10.3233/RNN-139008

Dolcos, F., Katsumi, Y., Moore, M., Berggren, N., de Gelder, B., Derakshan, N., Hamm, A. O., Koster, E. H. W., Ladouceur, C.D., Okon-Singer, H., Pegna, A. J., Richter, T., Schweizer, S., Van den Stock, J., Ventura-Bort, C., Weymar, M., & Dolcos, S. (2020). Neural correlates of emotion-attention interactions: From perception, learning, and memory to social cognition, individual differences, and training interventions. *Neuroscience & Biobehavioral Reviews, 108*, 559–601. https://doi.org/10.1016/j.neubiorev.2019.08.017

Duckro, P. N., & Cantwell-Simmons, E. (1989). A review of studies evaluating biofeedback and relaxation training in the management of pediatric headache. *Headache, 29,* 428–433.

Eisen, K. P. (2005). *Stress management in the workplace: A comparison of a computer-based*

and a group-based stress management intervention. [Doctoral dissertation, University of Connecticut]. Doctoral Dissertations.

Eppley, K. R., Abrams, A. I., & Shear, J. (1989). Differential effects of relaxation techniques on trait anxiety: A meta-analysis. *Journal of Clinical Psychology*, *45*(6), 957–974.

Eysenck, H. J., & Eysenck, S. B. G. (1968). *Eysenck Personality Inventory Manual*. San Diego, CA: Educational and Industrial Testing Service.

Fehmi, L. G., & Fritz, G. (1980). Open focus: The attentional foundation of health and well being. *Somatics*, *2*(4), 24–30.

Ford, M. R., Stroebel, C. F., Strong, P., & Szarek, B. L. (1983). Quieting response training: long-term evaluation of a clinical biofeedback practice. *Biofeedback and Self-regulation*, *8*, 265–278.

Ford, M. R., Stroebel, C. F., Strong, P., & Szarek, B. L. (1983). Quieting response training: predictors of long-term outcome. *Biofeedback and Self-regulation*, *8*, 393–408.

Glass, C. R. & Levy, L. H. (1982). Perceived psychophysiological control: The effects of power versus powerlessness. *Cognitive Therapy and Research*, *6*(1), 91–103.

Hillenberg, J. B., & Collins, F. L. (1983). The importance of home practice for Progressive Relaxation Training. *Behaviour Research and Therapy*, *21*(6), 633–642.

Hoareau, V., Godin, C., Dutheil, F., & Trousselard, M. (2021). The Effect of Stress Management Programs on Physiological and Psychological Components of Stress: The Influence of Baseline Physiological State. *Applied psychophysiology and biofeedback*, *46*(3), 243–250. https://doi.org/10.1007/s10484-021-09508-0

Huppert, F. A., & Johnson, D. M. (2010). A controlled trial of mindfulness training in schools: the importance of practice for an impact on well-being. *The Journal of Positive Psychology*, *5*(4), 264–274. https://doi.org/10.1080/17439761003794148.

Jacobson, E. (1978). *You Must Relax*. McGraw Hill.

Jin, X., Cao, X., Zhong, M., Chen, L., Zhu, X., Yao, S., & Yi, J. (2014). The psychometric

properties of the Cognitive-Somatic Anxiety Questionnaire in Chinese undergraduate students and clinical patients. *Comprehensive Psychiatry*, *55*(7), 1751–1756. https://doi.org/10.1016/j.comppsych.2014.07.005

King, N. J. (1980). The therapeutic utility of abbreviated Progressive Relaxation: A critical review with implications for clinical practice. In Hersen, M., Eisler, R. M., Miller, P. M. (Eds.), *Progress in Behavior Modification, 10*. Academic Press: New York.

Kiselica, M. S., Baker, S. B., Thomas, R. N., & Reedy, S. (1994). Effects of Stress Inoculation Training on anxiety, stress, and academic performance among adolescents. *Journal of Counselling Psychology*, *41*(3), 335–342.

Knowlton, G. E., & Larkin, K. T. (2006). The influence of voice volume, pitch, and speech rate on progressive relaxation training: application of methods from speech pathology and audiology. *Applied psychophysiology and biofeedback*, *31*(2), 173–185. https://doi.org/10.1007/s10484-006-9014-6

Krantz, G., Forsman, M., & Lundberg. U. (2004). Consistency in physiological stress responses and electromyographic activity during induced stress exposure in women and men. *Integrative Physiological and Behavioral Science*, *39*, 105–118.

Kroese, F. M. (2019). Why self-regulation success is not the opposite of failure. *Social and Personality Psychology Compass, 13*(4), p.e12446-n/a. https://doi.org/10.1111/spc3.12446

Lally, P., Van Jaarsveld, C., Potts, H., & Wardle, J. (2010). How are habits formed: modelling habit formation in the real world. *European Journal of Social Psychology*, *40,* 998–1009.

Lashley, J. K., Gamble, E. H., Grenier, C. E., Roundtree, G. A., & Elder, S. T. (1987). An empirical account of temperature biofeedback applied in groups. *Psychological Reports*, *60*, 379–388.

Lehrer, P. M., & Woolfolk, R. L. (1983). Are stress-reduction techniques interchangeable, or do

they have specific effects. In R.L. Woolfolk & P.M. Lehrer (Eds.), *Handbook of Relaxation and Stress Reduction Techniques.* Guilford Press.

Lehrer, P. M., & Woolfolk, R. L. (2021). Wearing the clinical hat. In P.M. Lehrer & R.L. Woolfolk (Eds.), *Principles and Practice of Stress Management,* (4th ed*.,* 649–656). Guilford Press.

Luthe, W., & Schultz, J. H. (1969). *Autogenic Therapy*. Grune and Stratton.

Matthews, G., & Zeidner, M. (2000). Emotional intelligence, adaptation to stressful encounters, and health outcomes. In R. Bar-On & J.M. Parker (Eds.), *Handbook of emotional intelligence*, 459–489. NY: Jossey-Bass.

Moser, J. S., Moran, T. P., Kneip, C., Schroder, H. S., & Larson, M. J. (2016). Sex moderates the association between symptoms of anxiety, but not obsessive compulsive disorder, and error-monitoring brain activity: A meta-analytic review. *Psychophysiology*, *53*, 21–29. DOI: 10.1111/psyp.12509

Murphy, L. R. (1996). Stress management in work settings: A critical review of the health effects. *American Journal of Health Promotion*, *11*(2), 112–135.

Nakagawa Kogan, H., Betrus, P., Beaton, R., Burr, R., Larson, L., Mitchell, P., & Wolf-Wilets, V. (1984). Management of Stress Response Clinic: Perspective of 5 years of biofeedback and self-management treatment of stress-related disorders by nurses. *Biofeedback and Self-Regulation*, *9*(1), 121–122.

Pekrun, R. (2006). The control-value theory of achievement emotions: Assumptions, corollaries, and implications for educational research and practice. *Educational Psychology Review, 18*, 315–341.

Peper, E., Harvey, R., & Lin, I. (2019). Mindfulness training as elements common to other techniques. *Biofeedback*, *47*, 50–57. DOI: 10.5298\1081-5937-47.3.02

Pillette, L., Roc, A., N'Kaoua, B., & Lotte, F. (2021). Experimenters' influence on mental-imagery based brain-computer interface user training. *International Journal of Human-Computer Studies*, *149*, 102603.

Rattel, J. A., Mauss, I. B., Liedlgruber, M., & Wilhelm, F. H. (2020). Sex differences in emotional concordance. *Biological Psychology*, *151*, 107845–107845.

Rumbold, J. L., Fletcher, D., & Daniels, K. (2012). A systematic review of stress management interventions with sport performers. *Sport, Exercise, and Performance Psychology, 1*(3), 173–193. https://doi.org/10.1037/a0026628

Schwartz, G. E., Davidson, R. J., & Goleman, D. J. (1978). Patterning of cognitive and somatic responses in the self-regulation of anxiety: effects of meditation versus exercise. *Psychosomatic Medicine*, *40*, 321–328.

Shaghaghi, A., Asadi, M., & Allahverdipour, H. (2014). Predictors of Self-Medication Behavior: A Systematic Review. *Iranian journal of public health*, *43*(2), 136–146.

Skinner, N. F., & Peters, P. L. (1984). National personality characteristics: Comparison of Canadian, American and British samples. *Psychological Reports*, *54*, 121–122.

Spielberger, C. D., Gorsuch, R. L., & Luschene, R. L. (1970). *STAI: Manual for the State-Trait Anxiety Inventory*. Palo Alto, CA: Consulting Psychologists Press.

Stangle, A. M., & Lowinger, D. A. (1998). A clinical review of a stress management and biofeedback program with a student client base. *Applied Psychophysiology and Biofeedback*, *23*(2), 131.

Steptoe, A., & Kearsley, N. (1990). Cognitive and somatic anxiety. *Behaviour Research and Therapy*, *28*(1), 75–81.

Stroebel, C. F. (1982). *QR: The Quieting Reflex.* G.P. Putnam's Sons.

Taub, E., & School, P. J. (1978). Some methodological considerations in thermal biofeedback training. *Behavior Research Methods & Instrumentation*, *10*(5), 617–622.

Terp, U., Bisholt, B., & Hjarthag, F. (2019). Not just tools to handle it: A qualitative study of nursing students' experiences from participating in a cognitive behavioral stress management intervention. *Health Education & Behavior*, *46*(6), 922–929.

Timmerman, I. G. H., Emmelkamp, P. M. G., & Sanderman, R. (1998). The effects of a stress-

management training program in individuals at risk in the community at large. *Behavior Research and Therapy, 36,* 863–875.

Wittrock, D. A., Blanchard, E. B., & McCoy, G. C. (1988). Three studies on the relation of process to outcome in the treatment of essential hypertension with relaxation and thermal biofeedback. *Behaviour Research and Therapy, 26*(1), 53–66. https://doi.org/10.1016/0005-7967(88)90033-2

Yamasue, H., Abe, O., Suga, M., Yamada, H., Inoue, H., Tochigi, M., Rogers, M., Aok, S., Kato, N., & Kasai, K. (2008). Gender-common and -specific neuroanatomical basis of human anxiety-related personality traits. *Cerebral Cortex, 18*, 46–52. doi:10.1093/cercor/bhm030

Zaffuto, A., & Zaffuto, M. (1974). *Alphagenics. How to use your brain waves to improve your life.* Warner Paperback.