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Heart Coherence: A New Tool in the Management of Stress on Professionals and Family Caregivers of Patients with Dementia

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Abstract We describe a stress management intervention intended to reduce the damage and stress impact on the heart physiology and function of a group of caregivers (professional and non-professional) who work with patients with dementia. The intervention consisted in applying heart coherence techniques in a population of 72 caregivers of patients with dementia (42 professional and 29 non-professional caregivers) who had high scores in heart stress and burden tests. Six months after the training they were able to generate appropriate patterns of heart coherence, with a statistically significant decrease in their heart overload. We conclude that training in techniques of heart coherence and positive psychology had effective results on the stress management of the participant caregivers. This was a simple, inexpensive technique with lasting results. To our knowledge this is the first research in Spain studying the application of heart coherence techniques to caregivers of people with dementia.

Keywords Caregivers · Nursing · Dementia · Stress · Biofeedback

Introduction

Our physical condition can be affected by our emotions and feelings, and by the manner in which we deal with daily events (Moscoso 2013). A positive mindset to face difficult situations can make people more resilient to disease and stress (Tugade 2011). Recent advances in neuroscience suggest the possibility of reprogramming and changing behavior patterns through thought modification techniques that extend beyond the paradigm of cognitive psychology (Montilla 2008). Thoughts, ideas, beliefs and emotions can be modified to develop healthy and productive thought patterns, in addition to solving health problems such as phobias and post-traumatic stress, smoking addiction or even abnormal blood-pressure levels (Köteles and Simor 2013).

Heart Coherence

One of the most successful techniques in health and disease pattern modification is heart coherence (Marquínez-Báscones 2006). Since the 1980s, the Institute of HeartMath (IHM) in the US has explored the physiological mechanisms by which the heart communicates with the brain, which are influenced by information processing, perceptions, emotions and health conditions. They have amply demonstrated that negative emotions lead to an increased incidence of disorders in heart rhythms and in the autonomic nervous system, which negatively affects the rest of the body (Groff et al. 2010; McCraty and Atkinson 2000). A positive mindset state, called heart coherence when it matches a particular heart pattern, is associated with high performance, stress reduction, greater emotional stability and numerous health benefits (Rozman et al. 1996). Heart coherence can be induced by the individual through biofeedback techniques (Del Pozo et al. 2004; Giardino et al. 2004; Karavidas et al. 2007; Lagos et al. 2008; Zohar et al. 2013), generating states of tranquility and emotional stability that influence health significantly.

The IHM identified a specific physiological state associated with optimal cognitive functioning and emotional stability, and introduced the psycho-physiological coherence model. This model is grounded in and consistent with

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research in the fields of neurocardiology, psychophysiology, and neuroscience (McCraty et al. 2009b). The model shows that changes in beat-to-beat heart rate, also called heart rate variability (HRV), reflect the emotional state of human beings (HeartMath 2011; McCraty et al. 2009b; Lacey and Lacey 1978). The time between beats is not as regular as normally perceived; for example, during states of anxiety, the time between beats is slightly variable and irregular. The analysis of this variability is recognized as an effective method for measuring the autonomic nervous system activity and function (Barrios-Choplin and Atkinson 2000; Reynard et al. 2011). Training in techniques of heart coherence foster stable physiological states, the prevalence of the parasympathetic state over the sympathetic (usually more activated in situations of stress and anxiety), and hormonal and chemical parameters, which play an important role in chronic stress and its consequences, are normalized (McCraty and Tomasino 2006). These states of physiological coherence through visualization techniques and inducing positive emotional states, together with a simple technique of cardiac biofeedback, improve cognitive function and overall fitness after 3 months of training (Childre and Martin 1999). Heart coherence induction techniques have proven to be effective not only in stress management in people with already developed anxiety problems, insomnia, hypertension, etc., but also as a preventive measure in high-risk situations (Alabdulgader 2012; Geisler et al. 2013; McCraty and Zayas 2014). The most resistant (or resilient) people under stress or difficult situations often have adequate heart coherence patterns (Mikels et al. 2008).

The training technique is simple, easy to apply and does not require specialized supervision other than the information given by a biofeedback device, although individuals who train extensively are able to apply the technique without the device. The biofeedback device utilized in the study was as a portable unit that monitors the heart rate and enables the participant to visualize and understand their heart patterns. By combining relaxation through breathing and feedback, the heart rate is induced to normal parameters for the participant. Further training enables the person to identify and then develop these parameters in future stressful situations. The highlight of this treatment is to induce physiological changes by means of positive emotional states, not through mental autosuggestion techniques, but by focusing directly on normalizing the heart rate and perceiving actual effects (Cohen-Katz et al. 2005; Zohar et al. 2013).

Caregivers of Patients with Dementia

In recent years, an increasing number of studies in stress have been focused on professionals (Knudsen et al. 2009). Affected professionals speak of burnout to define a state of emotional and physical exhaustion caused by the stressful demands of their daily work. The equivalent concept in caregivers is the Caregiver Burden (identified by the nursing diagnosis of "Fatigue in the caregiver role"). The study of these two conditions has been developed in areas of high demand for services such as care for people with dementia (Judkins 2003). As dementia is a progressive, disabling and long-term neurodegenerative disease, the risks of being exposed to chronic stress situations both professional and caregivers is very high (Scott et al. 2006; Salmond and Ropis 2005).

Many studies show the consequences of professional stress, both emotional and physical (Chandola et al. 2008), which can cause communication problems in the team and families (Mikels et al. 2008), and affect the general welfare of the person (Salmond and Ropis 2005).

Adopting effective techniques of stress management may require improving the emotional and physical state of the caregiver, and promoting a better working environment and a better relationship with others in both the institutional and home and family environments (Salmond and Ropis 2005).

Improving the ability of caregivers to effectively meet the challenges of the daily work is valuable not only for institutions (having less stressed and healthier workers) but also for people receiving care (Pipe and Bortz 2009).

This is why in recent years, the management of burnout and overload situations has been addressed in areas such as Positive Psychology (Seligman and Csikszentmihalyi 2000), which studies resilience and optimism as predictors of effective coping in difficult and demanding situations. In this context, resilience refers to the ability to adapt to changing situations, being able to effectively handle stress or potential stressors in the process (Tugade et al. 2004). Positive Psychology studies have begun to confirm that chronic stress or certain stressful situations lead to negative emotional states (anxiety, frustration, anger, sadness, etc.), which not only affect caregivers and other professionals themselves, but also have an impact in their performance at work. This suggests that emotional and mental factors play a key role in situations of stress, and maintains that the dimensions of resilience must begin to be taken into account in the study of these groups, as evidenced by recent investigations (Otake et al. 2006).

Training is possible for caregivers and other professionals to acquire the positive emotions and optimism that helps them deal with difficult situations at work, such as daily and long-term care. For this reason, heart coherence techniques are promising, not only because of their immediate results, but because their beneficial effects can be prevalent (Siepmann et al. 2008). The important aspect of this line of research is that positive emotional states can be learned, and these in turn may have a direct influence on the person's physiological state.

The main objective of this work is to describe a stress management intervention based on heart coherence, applied on a group of nursing professionals and family caregivers of elderly patients with dementia.

The conceptual nursing model that guided the implementation of this intervention project was Jean Watson's theory of Human Care (Watson 2009). Watson's theory emphasizes the importance of taking care of oneself, of colleagues or family, and others as a means of achieving a more healing environment.

Our hypothesis is that nursing professionals and family caregivers of patients with dementia have high scores on stress, and acquiring a technique of emotional self-control can directly affect their physiological state and reinforce their emotional and physical welfare, significantly reducing their ratings of stress and overload.

Methods

Design

A descriptive and multicenter trial with a quasi-experimental study of repeated measures.

Subjects

The study was conducted in three nursing homes for elderly people, all from the same religious order (all three are long-stay institutions, and two of them also have a day care center), and each located in a different city in Spain. Subject selection was made among professional Registered Nurses (RNs) and Certified Nursing Assistants (CNAs), as well as among non-professional family caregivers of the day care centers.

The sample size was calculated on GRANMO 7.11 (computer application) with a significance level of .05 and a power of .8, resulting in 42 professionals (n total = 101) and 32 (n total = 68) family caregivers, a proportional sample for each center.

All subjects agreed to participate in the study by signing an informed consent. Prior permission was obtained from the general direction of the entity from the three directors of the centers and the project was approved by the ethics committee at the general direction of the entity (Madrid).

The only exclusion criterion was to discard subjects with sensory or cognitive impairment that prevented them from performing the training.

Instruments

A number of sociodemographic variables of all participants were collected, including age, sex, occupation, education level, medical history, drug use, years of caregiving-professional or family as appropriate- and information about of the people under their care, such as their degree of dementia according to the Functional Assessment Staging scale (FAST), which evaluate the level of dementia in low (3/4 FAST), medium (5/6 FAST) and high (7/8 FAST) stages, and to the Barthel Index (in the case of nursing professionals, this record is taken per unit of work, as the three centers are organized by units depending on the degree of dependence and evolution of dementia).

To evaluate the degree of stress and burnout, two specific instruments were used:

- *Professional Caregivers* The Maslach Burnout Inventory (MBI) (Maslach and Jackson 1997) is a tool to assess the feelings and thoughts of a person with regard to their interaction at work. It is the most widely used for the detection of stress and burnout in health professionals, especially in the health area (Méndez et al. 2012). Three factors form the scale, resulting in three subscales: emotional exhaustion, depersonalization and personal accomplishment at work. The inventory takes into account the three scores independently. Scores for each subscale are compared for each percentile. Subjects above the 75th percentile are included in the "high" category; subjects between the 75th and the 25th are in the "medium" category; and subjects below the 25th percentile are in the "low" category. This measure presents reasonable validity and reliability for measuring burnout among nurses: cronbach alpha ratings of .90 for emotional exhaustion, .76 Depersonalization, and .76 for Personal accomplishment (Méndez et al. 2012).
- *Family Caregivers* The scale used to detect overload was the "cuestionario de Zarit" (Martín et al. 1996) which is a validated Spanish version of the Zarit Burden Inventory (Zarit et al. 1985). It consists of a list of 22 statements describing how the caregiver feels, with a Likert-type scale to indicate how often he or she feels that way (five alternatives range from 0, "never," to 4, "almost always"). Scores are summed to give a score between 0 and 88. The most accepted cutoff points are less than 46, "no overload," with 47–55 being "light overload" and items involving more than 56 points being a "greater burden." The measure has good internal consistency reliability, with a Cronbach's alpha coefficient of .92 (Martín et al. 1996).

For measurement of heart coherence training and portable recording units, we used heart coherence Personal Stress Reliever® (PSR) and a licensed Professional emWave® PC software that enables the management of recorded information in the PSR. Using the technique of quick consistency the changes in the heart rate can be

displayed. In essence, the software is a heart rhythm coherence coach designed to help the user prevent, control and reverse the effects of stress across three levels of heart coherence: high, medium and low. The aim is to increase the consistency of the coherence in each session while the software keeps track of the progress.

The assessment of emotional stress and its management is needed to maintain emotional and physiological stability requirements. Therefore, professionals and family caregivers, measured heart coherence at different times throughout the project. The HeartMath self-regulation techniques and assistive technologies provide a systematic process for self-regulating thoughts, emotions and behaviors, and increasing physiological coherence (Childre and Martin 1999; McCraty and Atkinson 2000). The basis of the applied self-regulation technique to induce a coherent state was the Heart-Focused Breathing (McCraty and Zayas 2014). It consists in putting one's attention in the center of the chest (area of the heart) and imagining how the breath is flowing in and out of that area while breathing slower and deeper than usual. Conscious regulation of one's respiration at a 10 s rhythm (.1 Hz) increases heart coherence and starts the process of shifting into a more coherent state. As we have conscious control over breathing and can easily slow the rate and increase the depth of the breathing rhythm, we can take advantage of this physiological mechanism to modulate the efferent vagal activity and thus the heart rhythm (McCraty et al. 2009b).

Procedure

Sociodemographic data collection and questionnaires were self-administered in the case of professionals and administered through personal interviews with family caregivers.

The heart coherence training was conducted in workshops for groups of ten people, without differentiating between professional and family caregivers, but maintaining their proportions in each sample.

The workshops were carried out in 1-h weekly sessions, in a period of 3 months from February to April 2013, led by the principal investigator. In the first session, the purpose, schedules and working group guidelines of the study were discussed, and two heart coherence measures were taken for each participant. One measure was the heart coherence of the participant in normal conditions, taken as a baseline for future sessions. Then, they were asked to attempt to relax as much as possible, and the second measure was taken.

The first three workshops were both theoretical and practical, with an explanation of what stress is, how it affects people, and the concepts of optimism, resilience and positive psychology were explained. Respiratory control and display exercises were introduced, as the procedures to check the pulse and achieve body self-consciousness.

The following workshops were focused on the heart coherence technique (Heart-Focused Breathing) using heart coherence devices (five per workshop), so that all participants could train with the devices. Further heart coherence measures were recorded for about 5 min per participant. The last three workshops were focused on inducing states of heart coherence without the use of the device.

At the end of the workshops, participants filled out questionnaires on stress and overload, and a measure of heart coherence was taken. Three months later, they returned to repeat these measures to assess the degree of monitoring and maintenance training. Only people who attended more than 80 % of the workshops were included in this study.

For statistical analysis, the IBM SPSS Statistics 20 software was used. A descriptive analysis of all sociodemographic variables collected for each group was performed. The mean was calculated for continuous variables and percentages were used for categorical variables. We performed a correlation study (Pearson r) between the scores on the questionnaires and the degree of care overload (assessed by the Barthel and FAST). A repeated measures ANOVA of one factor was also performed (score on the questionnaires as an independent variable) with three levels: baseline, 3 months after training and 6 months after training. All statistical tests were two-tailed and $p < .05$ was considered as statistical difference (95 % confidence interval) (application of Bonferroni correction was necessary).

Results

Set Baseline

Participants in the study included 42 professionals (67.9 % CNAs) and 32 caregivers whose families attend the day care center. Among these, three were discarded as they did not attend a minimum of 80 % of the workshops. Table 1 shows the demographic data collected. Also noteworthy among family caregivers was a high percentage of problems with hypertension (43.7 %), insomnia (28.7 %) and anxiety (31.8 %), requiring consumption of at least one drug on a daily basis. In professionals, the most prevalent issues were sleep problems (27.8 %) and muscular or mechanical (47.6 %) problems.

A Levene's test was carried out to assess the homogeneity of variance, which showed that homoscedasticity was met (16.27, $p = .09$).

Table 1 Socio-demographic variables and others

	Professionals (n = 42)	Family caregivers (n = 32)
Age (M)	42.7	59.2
Gender	83 % Females	86 % Females
Education level		
Illiterate	0 %	9 %
Primary education	12 %	47 %
Secondary education	75 %	24 %
Universitary education	13 %	20 %
Years of care performance (M)	11.7	9.8
Medical history	42 % Muscular problems	52 % Sleep problems
	27 % Sleep problems	42 % Anxiety
	21 % HTA	37 % Muscular p.
	12 % Anxiety	27 % HTA
	6 % DM	19 % DM
	3 % Depression	17 % Osteoarthritis
		13 % Depression
Drug use	59 % Analgesics	72 % Analgesics
	37 % Anxiolytics	64 % Hypnotics
		51 % Anxiolytics
	18 % Antihypertensive	24 % Antihypertensive
		11 % Antidepressants
FAST patients		
FAST 3/4	21 %	9 %
FAST 5/6	32 %	59 %
FAST 7/8	47 %	32 %
Years evolution dementia patients (M)		9.3

Professionals Caregivers

Results obtained from the MBI suggested that, on the Emotional Exhaustion subscale, 37.2 % had upper levels of burden and 47.6 % had average levels; on the Depersonalization subscale, 21.8 % had high levels and 59.4 % low; and on the Personal accomplishment at work subscale, 26.6 % had high levels, 38.6 % low and 34.8 % average. There were no significant differences between RNs and CNAs. Studying the correlation between the three subscales of the MBI and the characteristics of the unit of work, we observed significant results in the first two subscales but not in the third (Emotional Exhaustion, Pearson's $r = .489$, $p = .01$; Depersonalization, $r = .324$, $p = .00$; Performing at Work, $r = .458$, $p = .07$), which indicates that a higher degree of dependence of patients (with advanced stages of FAST and Barthel indices of close to zero), causes a greater the emotional exhaustion and feelings of depersonalization in professionals.

Family Caregivers

The Zarit results indicated that 69.8 % of family caregivers had high load versus 14.7 % presenting low load. There were no significant differences either in their sex or level of education. However, there were differences regarding the age of the caregiver ($t = .745$, $p = .01$), progress of the FAST ($t = .425$, $p = .02$) and years caring for the family ($t = .354$, $p = .00$). A correlational study was conducted between the burden score and the degree of FAST with significant results (Pearson $r = .865$, $p = .00$), such that the greater the degree of evolution, the extreme the Zarit scale score. Correlation was also found between burden and years providing care ($r = .654$, $p = .04$).

Heart Coherence

As for the baseline measurements of heart coherence taken in the first session, 58.7 % of all participants (n = 71) reported a pattern of low heart coherence, 32.3 % a pattern of medium coherence, and 9 % a pattern of high heart coherence. There were no significant differences between the baseline measure and the second measure took after they were asked to relax ($F = .236$, $p = .15$).

For the group of professionals (n = 42), a correlational study of heart coherence levels and scores on the three subscales of the Maslach was performed. The results indicated a significant correlation between a low level of

heart coherence on the Depletion subscale (r = .689, $p = .02$) and Depersonalization (r = .568, $p < .05$), but not on Development (r = .425, $p = .08$).

For the group of family caregivers (n = 29), the same correlational study found a positive correlation between low levels of heart coherence and high levels of burden (r = .654, $p = .01$).

After 3 Months of Training

Professionals Caregivers

As for the scores on the questionnaires, compared to the professionals in the Maslach, on the Emotional Exhaustion subscale, 19.2 % had high levels and 31.2 % average levels; on the Depersonalization subscale, 12.3 % had high levels and 72.3 % low levels; and on the Conduct at Work subscale, 42.8 % had high levels, 21 % low and 36.2 % average levels. A repeated measures ANOVA was performed for each subscale, and the baseline score was compared with the significantly statistical results for two subscales (Bonferroni correction $p < .025$) (Emotional Exhaustion F = .987, $p = .00$; Performance F = .745, $p = .01$) but not to Depersonalization F = .458, $p = .03$.

Family Caregivers

Zarit scale results indicated that 58.7 % had high overhead compared to 11.2 % with low overhead. In the repeated measures ANOVA, these differences were not statistically confirmed (Bonferroni correction $p < .025$), (F = .365, $p = .04$).

Heart Coherence

Regarding patterns of heart coherence, 86.4 % of participants had high heart coherence, with significant differences with regard to the baseline values (F = .847, $p = .00$). A Student's t test was performed to assess whether there were differences in groups (professionals and caregivers) as measures of consistency, but no significant differences were found (Bonferroni correction $p < .025$) (F = .365, $p = .03$).

After 6 Months of Training

The scores barely changed between the third and 6th month of training, as shown in Table 2. The ANOVA results showed statistical significance on the Maslach test, and on the Zarit test (in high and medium burden) and for low on HRV (Bonferroni correction, $p < .02$).

Discussion and Conclusions

The main objective of this work was to reduce the states of stress and overload through measures of psychological control of heart coherence in a group of professionals and caregivers of people with dementia. The results suggest that the intervention achieved the main objective.

Regarding the characteristics of the study sample, they are similar to those found in other studies. The average professional was a 42-year-old with vocational studies, with at least 11 years working in the field of dementia care, with muscle problems, analgesic consumption and serving people with advanced dementia (Miró et al. 2007). These results agree with other studies that link musculoskeletal problems to the physical stress that their job demands (Scott et al. 2006). Regarding the Maslach scale, almost 50 % had average scores for Emotional Exhaustion, which is also consistent with the literature, since working with people with dementia requires a high level of care, resilience and proper stress management. On the Depersonalization subscale, almost 60 % had low levels, indicating that professionals remain affable and cordial during their work. In the Development subscale, around 35 % had low scores, meaning that their perception of achievement at work was low, in contrast to the 26.6 % who indicated that they felt recognized for their work. These data not only depend on personal factors and the type of work, but also significantly depend on the institution, work environment and work organization (Tucker et al. 2010). Family caregivers' profiles are also found in the literature for these cases (Salmond and Ropis 2005). The average caregiver is a woman of almost 60 years, with primary education, who has been in the caregiver role nearly 10 years, experiences insomnia and anxiety, consumes analgesics, hypnotics and anxiolytics, and cares for a family member that suffer from an average degree of dementia. The percentage of caregivers with high overload was 70 % according to the Zarit scale, a high rate that was linked to the age of the caregiver, the continuous years of care and the degree of dementia, as indicated by the correlational studies. All this is an indication that this type of disease, slowly progressive and degenerative, is in most cases a major source of physical and emotional stress for caregivers (Molinuevo and Hernández 2011).

Regarding the levels of heart coherence, the first test showed that more than 50 % of participants presented low levels, compared to 9 % with a more desirable pattern of high consistency. The results are similar to those in other studies, in which the heart coherence pattern is often low in cases of stress and overload, and thus less healthy (McCraty et al. 2009a). In addition, significant correlations were found between low scores on burnout and overload

Table 2 Ratios and significance test in the questionnaires and heart coherence in the three stages

	Baseline	3 months	6 months	*p*
Proffesionals (n = 42)				
Maslach				
Emotional	37.2 % High	19.2 % High	21.3 % High	.00*
Exhaustion	21.8 % High	12.13 % High	11.7 % High	
Depersonalization	26.6 % High	42.8 % High	44.1 % High	
Performing				
Family caregivers (n = 29)				
Zarit				
High burden	69.8 %	58.7 %	54.7 %	.02*
Medium burden	15.5 %	30.1 %	26.4 %	.01*
Low burden	14.7 %	11.2 %	18.9 %	.03*
Heart coherence (n = 71)				
High	9 %	86.4 %	81.7 %	.03*
Medium	32.3 %	20.8 %	11.7 %	.03*
Low	58.7 %	7.2 %	7.4 %	.02*

* $p < .05$ significance

levels and consistency. This remarks the importance of heart coherence and emotional stability as promising means to reduce overload levels, as well as to measure stress (Uliaszek et al. 2012).

The results are in line with the existing literature on heart coherence as effective method for reducing stress and assisting in the handling and management of overload situations such as those frequently encountered in caregiving (Childre and Rozman 2005; Kim et al. 2013; O'Donnell 2007). Training people to develop positive emotions that affect their psychological well-being in situations of psychological and physical stress is critical for institutions. Healthier caregivers provide better care and also suffer fewer casualties related to work (Reineck and Furino 2005). Influencing the management of anxiety, fatigue and wear of caregiving through emotional control techniques has very positive consequences (Cloninger et al. 2012).

It has been shown that affecting emotional optimism based on search techniques and positive mental states has a significant effect on fatigue states, overload and stress (Cohn et al. 2009). Conducting training techniques in a group setting also reinforces the spread of the desired emotional state through the sensation of support, fellowship and identification with others who are in the same situation, which is consistent with Watson's conceptual framework of Human Caring (Schwerdtfeger and Friedrich-Mai 2009). According to this theory, by focusing on becoming self-aware, we are better able to recognize and change stress from a more balanced perspective, and this is transmitted and affects our environment. From a physical approach, inducing an emotional state that alters the physiological state of the body and reducing the physical response to chronic stress, it is an effective way to achieve quick and lasting changes (Yucha and Montgomery 2008).

One limitation of the study is the lack of a control group, to ensure that the measured differences are due to the application of the technique. It would be interesting to extend the study including a control group of similar characteristics to the experimental groups.

The results seem to suggest that heart coherence techniques have been proven easy to apply and an effective tool for health professionals and caregivers of people with dementia (Cloninger et al. 2012; Reineck and Furino 2005). Although the study has been restricted to this collective, the technique can be easily learned by and applied on any group of people exposed to stressful situations (Siepmann et al. 2008).

References

Alabdulgader, A. (2012). Coherence: A novel nonpharmacological modality for lowering blood pressure in hypertensive patients. *Global Advances in Health and Medicine, 1*, 54–62.

Barrios-Choplin, B., & Atkinson, M. (2000). *Personal and organizational quality assessment*. Boulder Creek, CA: HeartMath Research Center, Institute of HeartMath.

Chandola, T., Britton, A., Brunner, E., Hemingway, H., Malik, M., Kumari, M., et al. (2008). Work stress and coronary heart disease: What are the mechanisms? *European Heart Journal, 29*, 640–648.

Childre, D., & Martin, H. (1999). *The HeartMath solution*. San Francisco: HarperSanFrancisco.

Childre, D., & Rozman, D. (2005). *Transforming stress: The HeartMath solution to relieving worry, fatigue, and tension*. Oakland: New Harbinger Publications.

Cloninger, C. R., Zohar, A. H., Hirschmann, S., & Dahan, D. (2012). The psychological costs and benefits of being highly persistent: Personality profiles distinguish mood disorders from anxiety disorders. *Journal of Affective Disorders, 136*, 758–766.

Cohen-Katz, J., Wiley, S., Capuano, T., Baker, D., Kimmel, S., & Shapiro, S. (2005). The effects of mindfulness-based stress reduction on nurse stress and burnout. Part II: A qualitative and quantitative study. *Holistic Nursing Practice, 1*, 26–35.

Cohn, M. A., Fredrickson, B. L., Brown, S. L., Mikels, J. A., & Conway, A. M. (2009). Happiness unpacked: Positive emotions increase life satisfaction by building resilience. *Emotion, 9*, 361–368.

Del Pozo, J. M., Gevirtz, R. N., Scher, B., & Guarneri, E. (2004). Biofeedback treatment increases heart rate variability in patients with known coronary artery disease. *American Heart Journal, 147*(3), 545.

Geisler, F. C., Kubiak, T., Siewert, K., & Weber, H. (2013). Cardiac vagal tone is associated with social engagement and self-regulation. *Biological Psychology, 93*, 279–286. doi:10.1016/j.biopsycho.2013.02.013.

Giardino, N. D., Chan, L., & Borson, S. (2004). Combined heart rate variability and pulse oximetry biofeedback for chronic obstructive pulmonary disease: Preliminary findings. *Applied Psychophysiology and Biofeedback, 29*(2), 121–133.

Groff, D., Battaglini, C., Sipe, C., Peppercorn, J., Anderson, M., & Hackney, A. C. (2010). Finding a new normal: Using recreation therapy to improve the well-being of women with breast cancer. *Annual in Therapeutic Recreation, 18*, 40–52.

HeartMath. (2011). The science behind the emWave® desktop & emWave2 products. http://www.heartmathstore.com/cgi-bin/category.cgi?category=sciencebehind. Accessed October 11, 2014.

Judkins, S. (2003). Stress among nurse managers: Can anything help? *Nurse Researcher, 12*(2), 58–70.

Karavidas, M. K., Lehrer, P. M., Vaschillo, E., Vaschillo, B., Marin, H., Buyske, S., et al. (2007). Preliminary results of an open label study of heart rate variability biofeedback for the treatment of major depression. *Applied psychophysiology and biofeedback, 32*(1), 19–30.

Kim, S., Zemon, V., Cavallo, M. M., Rath, J. F., McCraty, R., & Foley, F. W. (2013). Heart rate variability biofeedback, executive functioning and chronic brain injury. *Brain Injury, 27*(2), 209–222.

Knudsen, H. K., Ducharme, L. J., & Roman, P. M. (2009). Turnover intention and emotional exhaustion "at the top": Adapting the job demands-resources model to leaders of addiction treatment organizations. *Journal of Occupational Health Psychology, 14*, 84–95.

Köteles, F., & Simor, P. (2013). Somatic symptoms and holistic thinking as major dimensions behind modern health worries. *International Journal of Behavioral Medicine, 21*(5), 869–876.

Lacey, B. C., & Lacey, J. I. (1978). Two-way communication between the heart and the brain. *American Psychologist, 2*, 99–113.

Lagos, L., Vaschillo, E., Vaschillo, B., Lehrer, P., Bates, M., & Pandina, R. (2008). Heart rate variability biofeedback as a strategy for dealing with competitive anxiety: A case study. *Biofeedback, 36*(3), 109.

Marquínez-Báscones, F. (2006). Cerebro y coherencia hearta. *Gaceta Médica de Bilbao, 103*(4), 157–161.

Martín, M., Salvadó, I., Nadal, S., Miji, L. C., Rico, J. M., Lanz, P., et al. (1996). Adaptación para nuestro medio de la Escala de Sobrecarga del Cuidador (Caregiver Burden Interview) de Zarit. *Rev Gerontol, 6*, 338–346.

Maslach, C., & Jackson, S. E. (1997). *Maslach burnout inventory*. Palo Alto, CA: Consulting Psychlogists Press. 1986. Seisdedos N. Manual MBl, Inventario Burnout de Maslach. Madrid: TEA.

McCraty, M., & Atkinson, L. (2000). *Emotional self-regulation program enhances psychological health and quality of life in patients with diabetes R*. LipsenthalHeartMath Research Center, Institute of HeartMath, Publication No. 00-006. Boulder Creek, CA.

McCraty, R., Atkinson, M., Lipsenthal, L., & Arguelles, L. (2009a). New hope for correctional officers: An innovative program for reducing stress and health risks. *Applied Psychophysiology and Biofeedback, 34*, 251–272.

McCraty, R., Atkinson, M., Tomasino, D., & Bradley, R. T. (2009b). The coherent heart: Heart-brain interactions, psychophysiological coherence, and the emergence of system-wide order. *Integral Review, 5*, 10–115.

McCraty, R., & Tomasino, D. (2006). Emotional stress, positive emotions, and psychophysiological coherence. In B. B. Arnetz & R. Ekman (Eds.), *Stress in health and disease* (pp. 342–365). Weinheim: Wiley-VCH.

McCraty, R., & Zayas, M. A. (2014). Heart coherence, self-regulation, autonomic stability, and psychosocial well-being. *Psychology for Clinical Settings, 5*, 1090.

Méndez, I., Secanilla, E., Martínez, J. P., & Navarro, J. (2012). Estudio comparativo de burnout en cuidadores profesionales de personas mayores institucionalizadas con demencias y otras enfermedades. *European Journal of Investigation in Health, Psychology And Education, 1*(2). https://scholar.google.es/scholar?cluster=16326944594588649068&hl=es&as_sdt=2005&sciodt=0,5.

Mikels, J., Reuter-Lorenz, P., Beyer, J., & Fredrickson, B. (2008). Emotion and working memory: Evidence for domain—Specific processes for affective maintenance. *Emotion, 8*(2), 256–266.

Miró, E., Solanes, A., Martínez, P., Sánchez, A. I., & Rodríguez, J. (2007). Relación entre el burnout o "síndrome de quemarse por el trabajo", la tensión laboral y las características del sueño. *Psicothema, 19*(3), 388–394.

Molinuevo, J. L., & Hernández, B. (2011). Perfil del cuidador informal asociado al manejo clínico del paciente con enfermedad de Alzheimer no respondedor al tratamiento sintomático de la enfermedad. *Neurología, 26*(9), 518–527.

Montilla, M. L. (2008). La neurocodificación de la experiencia como marco para la psicoterapia del siglo XXI. *Venezolanos de psiquiatría y neurología, 20*. http://svp.org.ve/images/revistasvp111.pdf#page=20.

Moscoso, M. (2013). La psicología de la salud: Un enfoque multidisciplinario acerca del estrés y cambio conductual. *Revista de Psicología, 12*(1), 47–72.

O'Donnell, M. (2007). The heart and the brain within the broader context of wellness. *Cleveland Clinic Journal of Medicine, 74*(Suppl 1), S56–S58.

Otake, K., Shimai, S., Tanaka-Matsumi, J., Otsui, K., & Fredrickson, B. L. (2006). Happy people become happier through kindness: A counting kindnesses intervention. *Journal of Happiness Studies, 7*, 361–375.

Pipe, T., & Bortz, J. (2009). Mindful leadership as healing practice: Nurturing self to serve others. *International Journal for Human Caring, 13*(2), 34–38.

Reineck, C., & Furino, A. (2005). Nursing career full fillment: Statistics and statements from registered nurses. *Nursing Economics, 23*(1), 25–30.

Reynard, A., Gevirtz, R., Berlow, R., Brown, M., & Boutelle, K. (2011). Heart rate variability as a marker of self-regulation. *Applied Psychophysiology and Biofeedback, 36*, 209–215. doi:10.1007/s10484-011-9162-1.

Rozman, R., Whitaker, T., & Beckman, D. (1996). A pilot intervention program which reduces psychological symptomatology in individuals with human immunodeficiency virus D. *JonesComplementary Therapies in Medicine, 4*(4), 226–232.

Salmond, S., & Ropis, P. (2005). Job stress and general well-being: A comparative study of medical-surgical and home care nurses. *Medsurg Nursing, 14*(5), 301–309.

Schwerdtfeger, A., & Friedrich-Mai, P. (2009). Social interaction moderates the relationship between depressive mood and heart rate variability: Evidence from an ambulatory monitoring study. *Health Psychology, 28*, 501–509.

Scott, L., Hwang, W., & Rogers, A. (2006). The impact of multiple care giving roles on fatigue, stress, and work performance among hospital staff nurses. *The Journal of Nursing Administration, 36*(2), 86–95.

Seligman, M. E., & Csikszentmihalyi, M. (2000). *Positive psychology: An introduction* (Vol. 55(1), p. 5). Washington, DC: American Psychological Association.

Siepmann, M., Aykac, V., Unterdorfer, J., Petrowski, K., & Mueck-Weymann, M. (2008). A pilot study on the effects of heart rate variability biofeedback in patients with depression and in healthy subjects. *Applied Psychophysiology and Biofeedback, 33*(4), 195–201.

Tucker, S., Harris, M., Pipe, T., & Stevens, S. (2010). Nurses' ratings of their health and professional work environment. *AAOHN Journal, 58*(6), 253–267.

Tugade, M., Fredrickson, B., & Barrett, L. (2004). Psychological resilience and positive emotional granularity: Examining the benefits of positive emotions on coping and health. *Journal of Personality and Social Psychology, 72*(6), 1161–1190.

Tugade, M. M. (2011). Positive emotions and coping: Examining dual-process models of resilience. In *The Oxford handbook of stress, health, and coping* (pp. 186–199). Oxford University Press.

Uliaszek, A. A., Zinbarg, R. E., Mineka, S., Craske, M. C., Griffith, J. W., Sutton, J. M., et al. (2012). A longitudinal examination of stress generation in depressive and anxiety disorders. *Journal of Abnormal Psychology, 121*, 4–15.

Watson, J. (2009). *Nursing: The philosophy and science of caring*. Boulder, CO: University Press of Colorado.

Yucha, C., & Montgomery, D. (2008). *Evidenced-based practice in biofeedback and neurofeedback*. Wheat Ridge, CO: Association for Applied Psychophysiology and Biofeedback.

Zarit, S., Orr, N., & Zarit, J. (1985). *The hidden victims of Alzheimer's disease: Families under stress*. New York: University Press.

Zohar, A., Cloninger, C., & McCraty, R. (2013). Personality and heart rate variability: Exploring pathways from personality to heart coherence and health. *Open Journal of Social Sciences, 1*(6), 32–39.