# A Study of Applying the Use of Breathing Training to Palliative Care Patients, Based on the Bio-Psycho-Social Model

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**Abstract**—In clinical practices, it is common that while facing the unknown progress of their disease, palliative care patients may easily feel anxious and depressed. These types of reactions are a cause of psychosomatic diseases and may also influence treatment results. However, the purpose of palliative care is to provide relief from all kinds of pains. Therefore, how to make patients more comfortable is an issue worth studying. This study adopted the "bio-psycho-social model" proposed by Engel and applied spontaneous breathing training, in the hope of seeing patients' psychological state changes caused by their physiological state changes, improvements in their anxious conditions, corresponding adjustments of their cognitive functions, and further enhancement of their social functions and the social support system. This study will be a one-year study. Palliative care outpatients will be recruited and assigned to the experimental group or the control group for six outpatient visits (once a month), with 80 patients in each group. The patients of both groups agreed that this study can collect their physiological quantitative data using an HRV device before the first outpatient visit. They also agreed to answer the "Beck Anxiety Inventory (BAI)", the "Taiwanese version of the WHOQOL-BREF questionnaire" before the first outpatient visit, to fill a self-report questionnaire after each outpatient visit, and to answer the "Beck Anxiety Inventory (BAI)", the "Taiwanese version of the WHOQOL-BREF questionnaire" after the last outpatient visit. The patients of the experimental group agreed to receive the breathing training under HRV monitoring during the first outpatient visit of this study. Before each of the following three outpatient visits, they were required to fill a self-report questionnaire regarding their breathing practices after going home. After the outpatient visits, they were taught how to practice breathing through an HRV device and asked to practice it after going home. Later, based on the results from the HRV data analyses and the pre-tests and post-tests of the "Beck Anxiety Inventory (BAI)", the "Taiwanese version of the WHOQOL-BREF questionnaire", the influence of the breathing training in the bio, psycho, and social aspects were evaluated. The data collected through the self-report questionnaires of the patients of both groups were used to explore the possible interfering factors among the bio, psycho, and social changes. It is expected that this study will support the "bio-psycho-social model" proposed by Engel, meaning that bio, psycho, and social supports are closely related, and that breathing training helps to transform palliative care patients' psychological feelings of anxiety and depression, to facilitate their positive interactions with others, and to improve the quality medical care for them.

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## I. INTRODUCTION

PALLIATIVE care is an idea and a model of care that people around the world work hard to promote. According to WHO's 2002 definition, the targets of palliative care are patients who suffer from a malignant disease and their families. The purpose is to identify patients' biological, psychological, or social problems that are caused by the disease from which they are suffering from an early stage, make a thorough assessment, and determine appropriate treatment to prevent and ease their pain, improve their quality of life, and support and accompany their families while they are sick or after they have passed away through the cooperation of multi-disciplinary teams. Essentially, palliative care is about the whole team providing complete care services for patients suffering from a malignant disease (such as cancer) and their families throughout the whole process.

Palliative care patients are primarily cancer patients. Since 1982, cancer has been No. 1 on the "top 10 causes of death." In 2013, 44,791 people died of a malignant tumor in Taiwan. That is, cancer constituted 29.01% of all deaths that year. Cancer's spread and recurrence characteristics means that cancer patients often have to face multiple uncertainties after their diagnosis and their continued existence is threatened. Their development of emotions related to excessive fear significantly influences their daily functions and social activities; they might even develop depression or PTSD, and their quality of life will deteriorate. They could be sad and lost, and unable to make future plans, and their mind, body, and heart may be out of balance. Eventually, this can even affect their overall survival period; therefore, palliative care plays an important and active role in the course of cancer patient care. How to provide various caring services to reduce cancer patients' fears related to their perception of tumor progression, influences on their psychological and physical functions, and improving their psychological health and quality of life is an important issue.

In clinical practice work, the unknown course of their condition makes anxiety and depression common emotional disorders among cancer patients. The psychological effects of pain include anxiety, depression, fatigue, anorexia, insomnia, helplessness, disappointment, fear, and anger; these often affect the patient's willingness to receive treatment, and even their will to survive. It is common for cancer patients, because of the threat of their disease, to exhibit depression, worry, panic,

helplessness, and hopelessness alongside other emotions. Although most of their feelings are negative, these are normal responses; they usually improve as the disease comes under control, but as with other major physical diseases, the proportion of depression among cancer patients is high.

According to foreign scholars [1], who found that for many cancer patients, although their degree of emotional distress did not reach severe depression, it had a significant impact. Thus, it is recommended that general assessment include five vital signs (pulse, breathing, blood pressure, body temperature and pain), and psychological pain (distress) as a sixth sign of life to understand cancer patients' psychological situation. When a patient first learns that they are suffering from cancer, they experience shock, fear, anger, hopelessness, and other moods, and the formation of immense psychological pressure, often appearing simultaneously. The general understanding of cancer, whether diagnosed early or late, often points to the cultural taboo "death" phenomenon, which makes cancer patients prone to considerable fear of death, and may even create a self-confession or self-abandonment mood, so that cancer patients treat life after diagnosis as though it were the end of the world, they spend every day in extreme fear, with frustrating emotions. When a cancer patient focuses all their attention on their uncertain future and when death will arrive, it can be easy for them to ignore the positive aspects of their current circumstances, such as their quality of life and their intimate relationships with others, and thus, they have less chance to feel to positive emotions. One study has shown [2] that appropriate and efficient breathing methods can effectively regulate the autonomic nervous system so that the body can rest, improve body resilience, and repair the damage caused by stress. Meanwhile, cancer patients also face the impact to their self-conception, from being a healthy, productive person, to recognizing themselves as a patient with reduced productivity, and they may even need to rely on other people for assistance. Such an impact will often make patients feel inferior, retreating, and frustrated, thus affecting them and those with whom they have interpersonal relationships. Ill patients are also prone to feelings of helpless and the loss of self-control; therefore, they ignore that they can still control and complete many things in their lives.

Psychiatric symptoms in cancer patients include the following:
1. Biological factors
(1) Brain tumor or brain metastasis, and
(2) Other medical conditions.
2. Psychological factors
3. Social factors
(1) With regard to family and friends, and
(2) With regard to work and society.

When we face stress, the autonomic nervous system is dominated by the sympathetic nerve, while the HPA axis (hypothalamus–ventral gland–adrenal axis) is actively secreted by pressure-related hormones in the blood. However, if the stress factor disappears, we relax the physiological response when the autonomic nervous system is dominated by the parasympathetic nerve, while the HPA axis stops producing the pressure of hormones. Therefore, healthy people will self-regulate their physiological stress response. However, if the environment causes long-term stress, the body will lose the self-regulation function; that is, the pressure factor disappears, the body's pressure in the cortisol content remains high, while the sympathetic exuberant sympathetic and parasympathetic nervous system is unbalanced, resulting in autonomic nervous system disorders. This long-term abnormal physiological state can cause both physical and mental illnesses. Stress can lead to personal work or school performance deterioration, attention and memory loss, anxiety, depression, task avoidance, irritability, depression, insomnia, headache, abdominal pain, indigestion, and other issues that directly impact our lives. Such feelings affect health and interpersonal relationships and cause immune system problems.

Studies by Yale University Professors have shown that long-term high levels of pressure hormones prevent the formation of new nerve links in the brain, atrophying the brain, disrupting both mental function and mood-related neural circuits [3]. This results in worsening judgment, learning, memory, and emotional management.

The human heart does not beat at a fixed speed; every time the heartbeat interval alters, this change is called Heart Rate Variability (HRV). HRV is caused by activity in the autonomic nervous system, the sympathetic signal to make the heartbeat and parasympathetic deceleration; it reflects the balance between the sympathetic and parasympathetic nervous systems. Parasympathetic signals produce high frequency responses in the heartbeat and the sympathetic signal produces lower frequency changes. Therefore, the parasympathetic signal will increase as the heart rate changes and for people in a stressed state, the autonomic nervous system will alter according to the brain signal and the sympathetic nerve becomes more active, so HRV will be reduced compared to normal. Therefore, the physiological situation of the HRV can reflect a person's stress level. Thus, this study adopted respiratory modulation based on the RSA biofeedback mechanism as the intervention to explore whether respiratory modulation can help efficiently reduce patients' anxiety and depression. In addition, this study used a HRV measurement device to give subjects real-time feedback to increase their sense of self-control, which could help them when facing uncertainty related to the course of their cancer.

Simultaneously, this study's purpose is to reduce cancer patients' anxiety and depression through respiratory modulation with feedback based on data from a HRV measurement device to improve their social support system, while also exploring the influences of the intervention of respiratory modulation on cancer patients' anxiety, depression, and social support systems.

## II. RELEVANT STUDIES

This study explored the effects of two different breathing ratios based on the HRV data and the subjects' subjective perceptions. It was found that when the respiratory rate is low to a certain degree, it can immediately result in influences on HRV and modulating the autonomic nervous system [4]. Lower respiratory frequency can help with the activation of the

parasympathetic nerve through the RSA mechanism and further relax the body. Currently, the RSA biofeedback-based breathing technique has been applied in clinical practices to reduce the anxiety and physiological discomfort caused by the pressures in daily life [5]. When the parasympathetic nerve system is working, both the heart rate and the respiratory rate would reduce so that the body can rest, improving body resilience and repairing the damages caused by pressure [6]. Also, the study found that when a healthy adult breathes normally (12~18 breaths per min), his heart rate would not be influenced by his breathing. Only his slow and deep breathing can result in respiratory sinus arrhythmia (RSA) [7]. Heart rate variability (HRV), which represents a change in the time interval of continuous heartbeat, is a noninvasive measure of autonomic nervous system function. The observed HRV parameters are considered to be a dynamic interaction between the sympathetic and parasympathetic nervous systems [8].

At present, it is known that to inhale allows the sympathetic nerve to be more active; while to exhale allows the parasympathetic to be more active. So by breathing, it is possible to adjust the autonomic nervous system, so that unbalanced autonomic nerve recovers to the state of coordination. In addition, the measure of the current autonomic nerve from the HRV value can also determine the status of breathing training [7].

The pain caused by the comprehensive impact on patients, especially that resulting from emotional distress such as anxiety and depression, can affect a patients' life meaning; in particular, the pain that patients' experience, as an indicator of the progression of the disease, can significantly increase the level of depression and anxiety. These emotions may make the patient's coping strategy more negative, and thereby increasing the complexity of pain management; thus, to understand the patient's accompanying pain and the emotional impact of their illness, can help professionals understand the nature of cancer pain care [9]

When one develops emotions related to excessive fear, his daily functions and social activities would be influenced. He might even develop depression or PTSD, and his quality of life would be worse. He could be sad and lost, and unable to make future plans. His mind, body, and heart would be out of balance. Eventually, his overall survival period would be affected [10].

The study found that cancer diagnosis is a huge blow to patients, so that patients feel fear and uncertainty, accompanied by treatment leading to changes in the body caused by anxiety and depression [11].

## III. METHOD

1. Subjects: This study cooperated with doctors working in the Cathay General Hospital to select qualified palliative care patients.
2. Requirements: Subjects must be (1) aged 20~65 years; and (2) with a definite diagnosis of cancer (not including cancer in-situ) based on the pathological examination result.
3. Conditions of exclusion: Subjects are excluded if they (1)

present with a metastasis or have a medical history of cancer; (2) take anti-depression drugs; or (3) have untreated hyperthyroidism or hypothyroidism.
4. Data collection: Data collected include (1) demographic data (age, profession, education, activity level, etc.); (2) data from the Beck Anxiety Inventory; (3) data from the Taiwanese version of the WHOQOL-BREF questionnaire; (4) data from the self-report self-description questionnaire; (5) data related to cancer stages, treatment programs, and other clinical information from the case history; (6) and HRV measurement data.
5. Research Tools
(1) The Beck Anxiety Inventory,
(2) The WHOQOL-BREF questionnaire,
(3) A self-report self-description questionnaire,
(4) A comprehensive questionnaire used to collect patients' demographic information, and
(5) A HRV measurement device.

## IV. RESEARCH DESIGN

During a period of six months, participants were divided into two groups, each group with 80 patients. All of participants have agreed to wear the HRV measurement device to collect their physical data. After the outpatient appointment, they were asked to complete the "Beck Anxiety Inventory (BAI)", the "Taiwanese version of the WHOQOL-BREF questionnaire", and a self-report self-description questionnaire.

The patients from the control group practice to use the HRV measurement device after their first outpatient appointment. Then they return home and practice respiratory modulation on their own, and not to use the HRV measurement device. Every month after (including six times), each time they came back for another outpatient appointment, they check their pressure data by using the HRV measurement device. And after the sixth and final appointment, they were asked to complete the "Beck Anxiety Inventory (BAI)", the "Taiwanese version of the WHOQOL-BREF questionnaire", and a self-report self-description questionnaire. The patients from the experimental group learned to practice respiratory modulation with the portable HRV measurement device after their first outpatient appointment after agreeing to participate in this study. The mode of breathing training was as follows:
1. Breathing training, sitting upright in a chair with their feet flat to the floor, and with the upper body held in the most relaxed state.
2. Respiratory cycle is set between eight and 15 seconds. When the subject is retrospective, the counselor will assist in making a breathing training adjustment. Consult with the subject through the breathing training score. Find the most appropriate training cycle, and also, to help set the test for the mobile phone training conditions.
3. When the subject is able adapt to the breathing cycle (training scores reach 90 points or more each time), there is a gradual elongation of their breathing cycle.
4. Each breathing training session consists of five sections. Each section includes 3-5 minutes breathing training, and then 2-5 minutes of resting. Subjects are able to stand up

and move about during the rest period, so that the body is not held in the same position

5. Before and after breathing training, the pressure index should be measured to assess the effect of the cycle of breathing training.

Participants in the study were given a portable HRV measurement device to take home to practice for a period of six months. The experimental group of patients was expected to home to do there breathing practice and take notes, based on the following guidelines:

1. Respondents do at least two breathing training sessions at home daily, based on the previously described method. Such as time permits, they can also increase the practices times.

2. After completing each breathing training session, respondents are expected to use software (such as Line or Skype) to contact the consultant and record the notes.

During the first outpatient appointment, the results of the respiratory modulation and the related data were recorded. A month later, the participants in the study came back for another outpatient appointment, and at this appointment, the pressure indicator data were recorded again. After this appointment, they were asked to complete the "Beck Anxiety Inventory (BAI)" and the "Taiwanese version of the WHOQOL-BREF questionnaire". Statistical analyses: all the values are displayed in the form of "Mean ± Standard Deviation (SD)". The data were analyzed using Microsoft Office Excel and SPSS. "P <0.05" represents statistical significance.

## V. EXPECTED RESULTS

This study expected that the findings would support the "Bio-Psycho-Social Model" proposed by Engel. In other words, biological, psychological, and social supports are interlinked. And spontaneous respiratory modulation does help to efficiently reduce patients' anxiety and depression, while facilitating their positive interactions with others, and thus, medical treatment quality can be improved. Also, the portable HRV measurement device is useful to help patients to monitor their spontaneous respiratory modulation results on their own.

## REFERENCES

[1] Kim SD, Kim HS (2005). Effects of a relaxation breathing exercise on anxiety, depression, and leukocyte in hemopoietic stem cell transplantation patients. Cancer nursing 28:79.

[2] Lehrer PM, Vaschillo E, Vaschillo B, Lu SE, Scardella A, Siddique M, Habib RH (2004). Biofeedback Treatment for Asthma. Chest 126:352-361.

[3] Vanja Duric, Mounira Banasr, Pawel Licznerski, Heath D Schmidt, Craig A Stockmeier, Arthur A Simen, Samuel S Newton & Ronald S Duman. Nature Medicine. Advance online publication, Published online 17 October2010. DOI: doi:10.1038/nm.2219.

[4] C. J. Liu, G. Y. Tu, S. L. Lin, and C. C. Yeh, Comparisons of Different Breathing Ratios of Slow Breathing among Outpatients with Anxiety Disorders. Journal of Medicine and Health, 2014. 3(1): p. 57-66.

[5] W. D. Chang, C. T. Tsai, H. Y. Lin, J. C. Liu, and B. D. Li, Heart Rate Variability and Associated Factors of Women in Menopause. Journal of Disability Research, 2012. 10(3): p. 196-210.

[6] Kreibig, S. D., Autonomic nervous system activity in emotion: a review. BiolPsychol, 2010. 84(3): p. 394-421.

[7] Lehrer, P. M. and R. Gevirtz, Heart rate variability biofeedback: how and why does it work? Frontiers in Psychology, 2014. 5.

[8] Y.F. Hsiung, S. L. Tsai, Y. Y. Wang, and Y. F. Li, The Factors, Evaluation, and Care of the Fear of Disease Progression for Cancer Patients, the Journal of Oncology Nursing, 2016. 16: P.43-56.

[9] Laborde, S., Mosley, E., Thayer, J. F., Heart Rate Variability and Cardiac Vagal Tone in Psychophysiological Research-Recommendations for Experiment Planning, Data Analysis, and Data Reporting. Front Psychol, 2017. 8: p. 213.

[10] O'Connor, M., Wei r, J., Butcher, I., Kleiboer, A., Murray, G., Sharma, N., Sharpe, M. (2012). Pain in patients attending aspecialist cancer service: prevalence and association with emotional distress. Journal of Pain and Symptom Management, 43 (1), 29-38. doi:10.1016 /j.jpainsymman.2011.03.010.

[11] Zhao Huiling, Huang Huiru, Xie Biqing, Su Huifang, 2013; Fu Jen Medical Journal; 11, No. 3 (2013/09/01), P205 – 214.