



6-1989

The Use of Musical Wind Instruments as an Expiratory Therapy with Chronic Obstructive Pulmonary Disease Patients

Ellen R. Griggs Drane

Follow this and additional works at: https://scholarworks.wmich.edu/masters_theses



Part of the Music Education Commons, and the Public Health Commons

Recommended Citation

Griggs Drane, Ellen R., "The Use of Musical Wind Instruments as an Expiratory Therapy with Chronic Obstructive Pulmonary Disease Patients" (1989). *Master's Theses*. 1104.

https://scholarworks.wmich.edu/masters_theses/1104

This Masters Thesis-Open Access is brought to you for free and open access by the Graduate College at ScholarWorks at WMU. It has been accepted for inclusion in Master's Theses by an authorized administrator of ScholarWorks at WMU. For more information, please contact wmu-scholarworks@wmich.edu.



THE USE OF MUSICAL WIND INSTRUMENTS AS AN EXPIRATORY
THERAPY WITH CHRONIC OBSTRUCTIVE
PULMONARY DISEASE PATIENTS

by

Ellen R. Griggs Drane

A Thesis
Submitted to the
Faculty of The Graduate College
in partial fulfillment of the
requirements for the Degree of Master of Music
School of Music

Western Michigan University
Kalamazoo, Michigan
June 1989

ACKNOWLEDGEMENTS

This paper is dedicated to the memory of Lorraine Gilliland Griggs, my grandmother. Her love for life and her constant battles against emphysema and bronchitis motivated me to conduct this research.

My appreciation is extended to my thesis committee: Mel Ivey, Brian Wilson, Mary Scovel, and Dennis Simpson. A special thanks to Mary Scovel for stepping in at the last minute, and also to Dennis Simpson who filled in upon the death of William Burian and provided guidance throughout this project. My special thanks to Dr. Geoffrey Grambeau for serving as a catalyst in setting up the research at Bronson Methodist Hospital, and also to Viki Bilyk, A New Breath Director for her constant support.

Thank you, Peg Bernhard for all of your time, and the use of your computer. Most important, thank you to my husband, Cary, for everything. Ditto.

Ellen R. Griggs Drane

INFORMATION TO USERS

The most advanced technology has been used to photograph and reproduce this manuscript from the microfilm master. UMI films the text directly from the original or copy submitted. Thus, some thesis and dissertation copies are in typewriter face, while others may be from any type of computer printer.

The quality of this reproduction is dependent upon the quality of the copy submitted. Broken or indistinct print, colored or poor quality illustrations and photographs, print bleedthrough, substandard margins, and improper alignment can adversely affect reproduction.

In the unlikely event that the author did not send UMI a complete manuscript and there are missing pages, these will be noted. Also, if unauthorized copyright material had to be removed, a note will indicate the deletion.

Oversize materials (e.g., maps, drawings, charts) are reproduced by sectioning the original, beginning at the upper left-hand corner and continuing from left to right in equal sections with small overlaps. Each original is also photographed in one exposure and is included in reduced form at the back of the book. These are also available as one exposure on a standard 35mm slide or as a 17" x 23" black and white photographic print for an additional charge.

Photographs included in the original manuscript have been reproduced xerographically in this copy. Higher quality 6" x 9" black and white photographic prints are available for any photographs or illustrations appearing in this copy for an additional charge. Contact UMI directly to order.



University Microfilms International
A Bell & Howell Information Company
300 North Zeeb Road, Ann Arbor, MI 48106-1346 USA
313/761-4700 800/521-0600

Order Number 1337498

**The use of musical wind instruments as an expiratory therapy
with Chronic Obstructive Pulmonary Disease patients**

Griggs Drane, Ellen R., M.M.

Western Michigan University, 1989

Copyright ©1989 by Griggs Drane, Ellen R. All rights reserved.

U·M·I

**300 N. Zeeb Rd.
Ann Arbor, MI 48106**

Copyright by
Ellen R. Griggs Drane
1989

TABLE OF CONTENTS

ACKNOWLEDGEMENTS	ii
LIST OF TABLES	v
I. INTRODUCTION	1
Statement of the Problem	3
Definition of Terms.....	3
II. REVIEW OF THE SELECTED LITERATURE	6
Traditional Methods of Treatment.....	9
Inspiratory Treatment Methods.....	10
Expiratory Resistive Training	13
The Use of Music for Increased Respiration	14
Hypotheses.....	18
III. DESIGN AND METHODOLOGY.....	21
Subjects	21
Instruments.....	22
Materials	24
Design	24
Procedures.....	27
Analysis of Data.....	28
IV. FINDINGS	30
Hypotheses for the Study.....	30
V. CONCLUSIONS AND RECOMMENDATIONS	39
Discussion	40

Table of Contents--Continued

Delimitation.....	45
Limitations.....	45
Conclusions	46
Recommendations	48
APPENDICES	
A. Daily Participation Logs	50
B. Prescribed Treatment Evaluation	52
C. Informed Consent.....	54
D. Informed Consent Approval Western Michigan University Human Subjects Institutional Review Board.....	59
E. Informed Consent Approval Bronson Methodist Hospital Human Use Committee.....	61
BIBLIOGRAPHY.....	63

LIST OF TABLES

1. Pretest and Posttest Means and Standard Deviations for Forced Expiratory Volume.....	30
2. Pretest and Posttest Means and Standard Deviations for Forced Vital Capacity.....	31
3. Pretest and Posttest Means and Standard Deviations for Twelve Minute Walk Endurance Test.....	32
4. Means and Standard Deviations for Treatment Compliance	33
5. Means and Standard Deviations for Enjoyment of Treatment as Measured by the Prescribed Treatment Evaluation	34
6. Means and Standard Deviations for Self Motivational Levels as Measured by the Prescribed Treatment Evaluation	35
7. Means and Standard Deviations for Focused Attention During At-Home Practice as Measured by the Prescribed Treatment Evaluation.....	35
8. Means and Standard Deviations for Subject Awareness of Correct Posture and Breathing Techniques as Measured by the Prescribed Treatment Evaluation.....	36
9. Means and Standard Deviations of the Subjects' Awareness of the Utilization of Maximum Effort Used During the At-Home Practice as Measured by the Prescribed Treatment Evaluation.....	36
10. Means and Standard Deviations Assessing The Ability To Apply The Prescribed Treatment Easily Into The Subjects' Lifestyle as Measured by the Prescribed Treatment Evaluation	37
11. Means and Standard Deviations for Subjects' Satisfaction of Personal Achievements as Measured by the Prescribed Treatment Evaluation.....	38
12. Means and Standard Deviations of Additional Benefits of a New Breath Clinic as Measured by the Prescribed Treatment Evaluation	38

CHAPTER I

INTRODUCTION

Chronic Obstructive Pulmonary Disease (COPD) is a major health problem ranking second only to coronary disease as a cause of permanent disability for individuals above forty years of age (Lertzman & Cherniack, 1976). For men and women who suffer from COPD, even the smallest physical tasks seem insurmountable. In addition to the physical limitations presented by COPD, many individuals suffer increased anxiety, depression, and fear as a result of a limited social role in the community. The prevalence of depression is higher in COPD than in most other medical patients (Light, Merrill, Despars, Gordon, & Mutalipassi, 1985).

Respiratory therapy for the COPD patient has traditionally used inspiratory treatment methods (personal communication, G. Grambau, January 7, 1988). These methods are part of an eclectic approach including: physical exercise; diet; medication; oxygen therapy; and breathing training including diaphragmatic breathing and pursed lip breathing. Studies have shown that inspiratory treatment provides no significant increase on maximum inspiratory pressure (Chen, Dukes, & Martin, 1985; Madsen, Secher, Kay, Kok-Jensen, & Rube, 1985; McKeon, Turner, Kely, Dent, & Zimmerman, 1986; Pardy, Rivington, Despas, & Macklem, 1981), but is effective in improving physical endurance (Anderson & Falk, 1984; Pardy et al., 1981; Sonne & Davis, 1982).

Inspiratory muscle trainers provide a resistive force on the patient's inspiratory efforts. In the past, inspiratory treatment methods have taken on a variety of forms

(Anderson, Dragsted, Kann, Johansen, Nielsen, Karbo, & Bentzen, 1979; Belman & Mittman, 1980; Bjerre-Jepsen, Secher, & Kok-Jensen, 1981; Jederlinic, 1984; Madsen, et al., 1985). Presently, a Pflex Inspiratory Muscle Trainer is the most widely used inspiratory treatment. The use of the inspiratory muscle trainers are to promote increased respiratory exercise; however, no significant conclusions have been made to the effectiveness of this treatment (personal communication, V. Bilyk, January 5, 1988).

Since COPD is identified as an expiratory obstruction (Moser, Archibald, Hansen, Ellis, & Whelan, 1980), exhalation therapy benefits the COPD patient. This is accomplished by providing a resistive load during exhalation mimicking pursed lip breathing which aids in hyperinflation of the lungs and also relieves expectoration (Anderson, et al., 1979).

Presently inspiratory treatment is more commonly being used with patients suffering from COPD to strengthen muscles used in inspiration (personal communication, G. Grambau, January 7, 1988). In addition, pursed lips breathing and diaphragmatic breathing techniques are used as training techniques to facilitate maximum exhalation. The previously mentioned research supports towards a conclusion that music therapy intervention, using wind instruments, incorporates diaphragmatic breathing with increased resistance levels as an elementary technique in instrumental training. Also, the use of wind instruments provides varying exhalation resistances to the patients depending on the selected instrument. In addition, it is suggested the combination of these two concepts can enhance the benefits of pursed lip breathing.

Statement of the Problem

The purpose of this study was to compare the effectiveness of musical wind instruments (expiratory therapy) and inspiratory muscle trainers (inspiratory therapy) as a treatment technique for COPD patients. Subjects were evaluated on respiration gains as determined by a Pulmonary Function Test (PFT), physical endurance determined by a Twelve Minute Endurance Walk Test, treatment compliance as assessed by a Daily Participation Log, and treatment satisfaction as determined by the Prescribed Treatment Evaluation.

Definition of Terms

The following terms were defined for operation in this research.

Atelectasis: Collapse of an expanded lung (Mash, 1986).

Diaphragm: The diaphragm is an airtight sheet of muscle and tendon between the chest and abdominal cavities and is the principal muscle of respiration (Wynngarden & Smith, 1985).

Diaphragmatic Breathing: A method of respiration involving a conscious attempt to use the diaphragm as opposed to the accessory muscles in which air is inhaled using the diaphragm (Hodgkin, Zorn, & Conners, 1984). When air is inhaled through the nose or mouth, the diaphragm should expand to allow for a thorough inhalation. Likewise, during exhalation, the diaphragm contracts serving to aid in a thorough exhalation to aid in the removal of carbon dioxide.

Expiratory Therapy: Therapeutic intervention related to expiration.

Forced Expiratory Volume (FEV1): The amount of expired forced air in one second.

Functional Residual Capacity (FRC): Volume of gas in lungs at resting expiratory volume (Altman & Dittner, 1971).

Hyperinflation: Increased functional residual capacity during quiet breathing (Forster, Dubois, Briscoe, & Fisher, 1986). This results in expanded lungs which requires the COPD patient to force air out during expiration.

Hypoventilation: Decreased ventilation (Forster et al., 1986).

Inspiratory Therapy: Therapeutic intervention related to inspiration.

Intermittent Positive Pressure Breathing (IPPB): Technique where a patient holds a hand held IPPB device (Hand-E-Vent, Ohio Medical Products, Madison, Wisconsin) and selects his or her own breathing rate. This is utilized to lower PCO₂ (Petty & Guthrie, 1971).

Maximal Sustained Ventilatory Capacity (MSVC): Objective measures of respiratory muscle work capacity (Hodgkin, Zorn, & Connors, 1984).

Mechanical Compression: The use of a compressing device applied by a physiotherapist to promote thorough pulmonary expiration (Petty & Guthrie, 1971).

Obstructive: A blockage or disease which blocks the airways from proper respiration. COPD is the opposite from a restrictive disease, in that a restrictive disease actually inhibits the functioning of the lungs and muscles used during respiration.

Pursed Lips Breathing: A method of breathing whereas air is inhaled through the nostrils which serve as both a filter for impurities and a warmer for cold air, and exhaled through lips that are tightly pursed together providing a resistance. This type of breathing is effective with the COPD patient, in that it forces the patient to work to maximize exhalation. The appearance of pursed lip breathing resembles whistling.

Residual Volume: Volume of gas in lungs at end of maximal expiration (Altman & Dittmer, 1971).

Respiration: The exchange of gases in which oxygen is taken up and carbon dioxide released. This gas exchange occurs with respect to the atmosphere and the

blood circulation in the lungs as a result of pulmonary ventilation (sometimes called external respiration), and similarly between blood and tissue in the peripheral circulation (tissue or internal respiration) (Walton, Beeson, & Scott, 1986).

Total Lung Capacity: Volume of gas in lungs at end of maximal inspiration (Altman & Dittmer, 1971).

CHAPTER II

REVIEW OF THE SELECTED LITERATURE

COPD refers to a condition where the patient has difficulty expelling air from the lungs. There are three diseases that cause COPD: chronic bronchitis, emphysema, and asthma (Moser et al., 1980). Bass, Whitcomb, and Forman (1970) provide a definition of the COPD diseases:

Chronic bronchitis is a clinical disorder characterized by excessive mucous secretion in the bronchial tree and manifested by chronic or recurrent productive cough. Emphysema is an anatomic alteration of the lung characterized by an abnormal enlargement of air spaces distal to the terminal nonrespiratory bronchiole and accompanied by destructive changes of alveolar walls. Asthma is both an acute and chronic disease characterized clinically by episodes of shortness of breath and wheezing with symptom-free intervals of varying lengths. Bronchial asthma should be differentiated from bronchospasm, a loose term which is used to describe a 'wheezy chest,' a sign which can be present in all forms of COPD. (p. 118)

The most common symptom of COPD patients is dyspnea or breathlessness. Altose (1985) states there are presently no effective methods of treating dyspnea, however, overall conditioning and respiratory muscle performance may be helpful.

The amount of breathlessness during exercise is related to the amount of inspiratory pressure and the amount of muscle strength (El-Manshawi, Killian, Summers, & Jones, 1984). A significant number of patients with COPD show abnormalities in their thoracoabdominal motion which indicate either a lack of coordination in producing a pattern for healthy respiration or decreased abdominal volume during inspiration (Sharp, Goldberg, Druz, Fishman, & Danon, 1977).

Abnormal breathing patterns are perpetuated due to a low, flattened diaphragm with greatly diminished movement thus resulting in a near functionless inspiratory

muscle (Sharp et al., 1977). Diaphragmatic fatigue, like any muscle fatigue, is defined as "when the energy consumption of the respiratory muscles exceeds a critical level" (Roussos & Macklem, 1977, p.189). When the diaphragmatic muscles fatigue and are no longer able to aid in respiration, a laborious breathing pattern begins. To compensate for the lack of strong diaphragm muscles, many COPD patients rely on accessory and rib cage muscles.

The sensation of dyspnea was studied by Cropp, Zuti, Kendis, and Altose (1984) and Mazza, Zuti, Smith, and Altose (1983). These researchers found that the sensation of difficulty in breathing is a function of the level of external respiratory activity. In addition, Crop, et al. (1984) found that the intensity of the dyspnea is the same in normal individuals and COPD individuals with the exception of decreased ventilatory capacity found in the COPD patient. A second similarity the COPD patient has with the healthy individual is the phenomena of the second wind. Once dyspnea is experienced by the COPD patient, it is possible for the individual to experience the second wind. When an individual experiences a second wind, diaphragmatic fatigue diminishes and results in decreased dyspnea (Scharf, Bye, Pardy, & Macklem, 1984).

The differences between dyspnea felt by the COPD patient and dyspnea felt by the normal individual are based on two things: the frequency of the breathlessness occurrence creating regular fear; and the intensity of the dyspnea as it occurs leaving the COPD patient physically fatigued. Healthy individuals recover from dyspnea on their own in a relatively short amount of time depending upon the physical condition of the individual. The COPD patient, however, is treated for dyspnea with medication including bronchodilators and oxygen administered as needed. Recent treatment of dyspnea has included relaxation therapy in an effort to reduce the stress and fear that accompanies breathlessness.

Breathlessness is not only caused by the physical condition of COPD, but it is also related and frequently set off due to the fear, anxiety, and frustration that accompanies this condition. COPD patients often share feelings of social isolation, loneliness, lack of knowledge and understanding of their condition, and are often fearful to commit themselves to vocational or recreational activities (Lustig, Haas, & Castillo, 1972). Dyspnea can often be disproportionately severe in relation to the severity of the pulmonary disease (Burns & Howell, 1969). In other words, the COPD patient may create or exacerbate an existing condition due to emotional symptoms of the disease.

Rutter (1977) assessed the depression of bronchitic patients and also determined if they were more psychiatrically disturbed and more neurotic in personality than their matched controls. The controls were matched on the basis of sex, living alone, social class, and occupation. The researcher found the chronic bronchitic was significantly more psychiatrically disturbed and significantly more neurotic. These results reflect behavior patterns of the chronically ill.

There is a significant prevalence of depression in patients with moderate or severe COPD, but not a significant incidence of anxiety (Light et al., 1985). The depression is attributed to the limitation of lifestyle and changes in home management due to lung disease, early retirements or vocational changes and the inability to physically compete with peers (Light et al, 1985; McSweeney, Grant, Heaton, Adams, & Timms, 1982). The general psychodynamic explanation of depression for the COPD patient is the experience of loss. The loss increases as the disease progresses (Dudley, Glaser, Jorgenson, & Logan, 1980).

Traditional Methods of Treatment

Diaphragmatic breathing retraining is an essential and primary technique used in respiratory rehabilitation. It is directed at obtaining the following goals: teach the patient to decrease the speed of respiration using expiratory muscles to reduce the FRC; to promote greater use of the diaphragmatic muscles and less use of the rib cage muscles resulting in increased breathing efficiency, to improve effective alveolar ventilation; and improve activity tolerance and relieve dyspnea (Sharp et al., 1974). Sharp et al. (1974) continues to identify the reason behind expecting diaphragmatic breathing to accomplish these goals. As a result of slow, deep breathing diaphragmatic muscles may be increased and the use of accessory muscles reduced. Casciari, Fairshter, Morrison, and Wilson (1981) found the use of breath retraining to be significantly more effective in increasing exercise tolerance.

Pursed lips breathing is a technique taught to patients with COPD in an attempt to provide the patients with the knowledge to form a continuous resistance level during exhalation through pursed lips. Pursed lips breathing was found to provide decreased hyperinflation of the lungs, decreased CO₂ levels, and provide subjective benefits to patients (Mueller, Petty, & Filley, 1970; Petty & Guthrie, 1971; Tiep, Burns, Kao, Madison, & Herrera, 1986). The physiological benefits from pursed lips breathing provides an increased airway pressure, which appears to provide relief from airway collapse (Campbell, Freedman, Smith, & Taylor, 1961; Ingram & Schilder, 1967).

Physical exercise is a method of intervention with COPD patients. The standard methods of physical intervention include: stair climbing, bicycle riding, and walking or using a tread mill (Madsen et al., 1985; Nicholas, Gilbert, Gabe, Auchincloss, & 1970; Sonne & Davis, 1982). Nicholas, Gilbert, Gabe, and Auchincloss (1970) found exercise therapy to be physically beneficial based on decreased CO₂ retention. In addition, increased resistance towards acute illnesses was also found (Mertens,

Shephard, & Kavanagh, 1978; Nicholas et al., 1970). Even the most severe patient showed subjective improvements of well being during a physical rehabilitation program even if objective improvements of lung volumes and ventilation are not indicated (Brundin, 1974). A sense of accomplishment and confidence was achieved where previous tasks were impossible to complete.

Subjective benefits are a goal with this population. Once the individual is confident, and has increased self confidence, other tasks will be achieved. Bass et al. (1970) found subjective improvements as evidenced by patient's daily logs and objective improvements indicating decreased heart rate and increased work load, as a result of physical exercise. The researchers acknowledged that much of the success was attributed to the fact that the patients kept daily exercise journals which served as an incentive to perform additional exercise and encourage at-home activities.

Inspiratory Treatment Methods

The purpose of inspiratory treatment methods is to enhance the respiratory fitness of the COPD patient. This is done by providing levels of resistance during the inhalation process. The behavior of the normal diaphragm "reflects that of other respiratory muscles; it appears that quite high inspiratory loads can be tolerated indefinitely" (Roussos & Macklem, 1977, p. 189). This indicates that exercise of the inspiratory muscles is better tolerated by the COPD patient while still providing a challenge and thus increasing both objective and subjective gains.

Inspiratory treatment methods have used a variety of devices in the past. A face mask has been used, providing consistent resistive forces during expiration, yet increasing resistive forces during inspiration. Inspiratory pressure was increased until it was no longer tolerated by the patient (Anderson, et al., 1979). Other inspiratory devices have included the Hans-Rudolf valve with plexiglas alovear

resistance connected to the inspiratory port with no resistance during expiration (Asher et al., 1982).

The maximal Sustained Ventilatory Capacity Rebreathing Circuit System was developed by Belman and Mittman (1980). This construction used a vacuum cleaner which generated air flow. The patient rebreathed through a tube 1 cm long and 3.5 cm. in diameter. The resistance level was set and remained constant until the patient was able to increase the level. This technique was used to increase the maximum sustained ventilatory capacity. McKeon et al. (1986) and Madsen et al. (1985) used a training device that consisted of a face mask attached to a Y connector with a one-way valve on the expiratory limb and a variable aperture on the inspiratory side. The problem with a face mask was that it was not convenient for the patient to use at his or her home. Therefore, a trip to the physician was necessary for rehabilitation to occur.

The PFLEX Inspiratory Muscle Trainer; Healthscan, Inc. (Aldrich & Karpel, 1985; Jederlinic, 1984; Jederlinic, Muspratt & Miller, 1986) is a popular inspiratory treatment due to its easy accessibility by the patient. It provides an inspiratory resistance by inhaling through the small structure resembling a musical kazoo. The patient is able to monitor this resistance by manipulating a dial selector on the training instrument which will alter the resistance level. A setting of 1 is the least resistive and a setting of 6 is the most resistive. A nose clip is used during inspiration for maximum effort by the patient.

Jederlinic, Muspratt, and Miller (1986) conducted a study on inspiratory muscle training using the PFLEX Inspiratory Muscle Trainer. The data from this research indicated there was no significant improvement in performance but the results were attributed to the limited length of the study (three weeks). In addition, the researchers found that as a result of muscle training, there was a tendency for hypoventilation even at the lowest resistive loads.

The use of inspiratory muscle training in patients with cystic fibrosis, assessing inspiratory muscle strength and endurance and exercise performance, showed an improvement in inspiratory muscle strength and endurance by inspiratory muscle training. Improvement in exercise endurance time was seen in 2 of the 11 patients, but as a group, there was no change in exercise performance (Asher, Pardy, Coates, Thomas, & Macklem, 1982).

Bjerre-Jepsen, Secher, and Kok-Jensen (1981) found that both inspiratory load tolerance and work ability as evidenced through stair climbing can be improved in COPD patients, but that inspiratory resistance training does not contribute to these improvements. Inspiratory resistance was administered by a face mask set with a constant expiratory resistance and the inspiratory resistance was gradually increased. As a result of the constant expiratory pressure used in the inspiratory face mask during the Bjerre-Jepsen, et al. (1981) study, the patients experienced a subjective improvement of expectoration.

Inspiratory muscle fatigue may be an important factor limiting exercise. Training of the respiratory muscles should improve respiratory tolerance. A study using quadriplegics found that inspiratory treatment methods using a Hans-Rudolph valve for 15 minutes twice daily resulted in increased inspiratory muscle performance resulting in increased strength, endurance, and exercise tolerance (Grassino, Gross, Macklem, Roussos, & Zagelbaum, 1979).

Petty and Guthrie (1971) found that augmented expiration may aid in elimination of CO₂ and provide relief of dyspnea. These researchers studied and compared four different methods of augmented breathing maneuvers: intermittent positive pressure breathing, mechanical compression, voluntary deep breathing, and manual compression of diaphragmatic breathing against pursed lips. Manual compression of

diaphragmatic breathing against pursed lips was found to be the most beneficial in carbon dioxide elimination and thus decreased dyspnea.

The PFLEX Inspiratory Muscle Trainer (IMT) was successfully used to wean patients off of a mechanical ventilation system which could be used only at the hospital (Aldrich & Karpel, 1985). The utilization of the PFLEX IMT also provided increased inspiratory strength and increased respiratory muscle endurance.

Expiratory Resistive Training

Expiratory Resistive Training was provided primarily to post operative patients to treat atelectasis. This procedure used a commercially available blow bottle, Clinical Products, that used two 2 liter bottles. One bottle was filled with water, the other bottle was empty. The two bottles were connected with rubber tubing. The patients were asked to inspire deeply and blow into the rubber tubing forcing the water to go from the full bottle into the empty bottle. This technique was found to significantly increase FRC (Colgan, Mahoney, Fanning, 1970).

O'Conner (1975) compared the blow bottle technique to a dead space expiratory pressure device on postoperative patients suffering from atelectasis. This new expiratory pressure device consisted of a tube with a 1 liter volume of dead space, a one-way valve that allows free inspiration, and a one-way valve for expiration that opens and closes at a pressure of 20 centimeters of water. As with the blow bottle, there is a resistive component. The comparisons between the two treatments found the dead space respiratory device to be significantly more effective on vital capacity than the blow bottle technique (O'Conner, 1975).

The Use of Music for Increased Respiration

The use of music utilizing correct breathing techniques with pulmonary patients has been found to be an effective, non-traditional intervention. Music therapy is defined as a "systematic application of music as directed by the music therapist in a therapeutic environment to bring about desirable changes in behavior to strive for his/her fullest potential" (personal communication, M. Scovel, September 11, 1986). Historically music therapy has contributed to health promotion in the areas of psychological behavior, physiological behavior, social behavior, developmental behavior, and academic behaviors. Sears, a pioneer in music therapy, proposed basic classifications that underlie the processes in music therapy: (1) music is structure; (2) music demands time ordered behavior; (3) music is self organization; and (4) music provides for social intervention (Peters, 1987). These qualities enable the music therapist to develop and implement personalized goals and objectives for the client.

Music therapy intervention provides emotional and social benefits such as: immediate reinforcement, promotion of socialization, encouragement of intervention on a regular basis by individual practice and ensemble rehearsal, and the ability to lower stress and promote relaxation (Stratton & Zalanowski, 1984), and decrease anxiety (Peretti & Swenson, 1974; Stoudenmire, 1975). Music therapy is an effective tool in health promotion since it not only addresses the client's mental, emotional, and physical needs but it also provides both the client and the therapist with an aesthetically pleasing form of intervention that allows for spontaneity, creativity, and self expression (Corey, 1986).

The use of music to improve respiration has resulted in emotional, physiological and physical benefits. Several studies have been done that determine the respiratory benefits of singing. "Singing is a complex biomechanical process. This process is

unitary, but often is conceptualized as involving respiratory, laryngeal, velopharyngeal-nasal, and oral components of function" (Watson & Hixon, 1985, p. 201).

Phillips (1985) studied the effects of group breath-control training on singing ability of elementary students by incorporating a ten to twelve minute long breath control exercise unit into the daily lesson of one of his elementary classes he used as the experimental group. Phillips found that breath control training had significant effects on the singing ability of students. Gould and Okamura (1976) stated that there is a definite correlation between ventilatory capacity and voice training and found not only was ventilatory capacity improved, but through the use of correct breathing, voice production was increased by providing energy and vocal efficiency.

Students who have been through formal training are found to have a greater vital capacity than non-singers (Proctor, 1968). Bouhuys, Proctor, and Mead (1966) noted that this vital capacity is directly related to the volume produced in the airflow of the trained singer. This airflow then becomes greater as the sound level is increased whereas the untrained singer has a comparatively high air flow rate used in singing softly. This is because the trained singer is able to use his or her full vital capacity (Bouhuys et al., 1966).

Heller, Hicks, and Root (1960) found no difference between trained singers and non-singers in their performance on pulmonary function tests; however, no treatment was given. In other assessments of pulmonary function between musicians, it was found that there is no greater pulmonary benefits among wind instrumentalists and singers than that among string players (Claussen, 1988; Navaratil & Rejsek, 1968; Schorr-Lesnick, Teirstein, Brown, & Miller, 1985). However, significantly fewer wind players than string players had complaints of cough and sputum even though wind players had the highest percentage of smokers (Schorr-Lesnick et al., 1985).

This appears to support that expectorant benefits may result from the further expiratory resistance provided by wind instruments.

Bouhuys (1964) studied 452 male professional wind instrument players and compared the data of their pulmonary function studies with results obtained from individuals who did not play wind instruments. Vital capacity, total lung capacity, and forced expiration were greater in the wind instrumentalists than in the control group. Bouhuys (1964) identifies wind instruments and singing as requiring a regulation of exhaled air flow. This is developed as a result of music instruction teaching the performer to use lung volume or vital capacity to the fullest possible extent thus exhaling to the maximum degree (Bouhuys, 1964).

Musicians use diaphragmatic breathing as a technique while playing an instrument or singing. Diaphragmatic breathing is used because more air is put through the instrument, thus resulting in a fuller more appealing sound. The incorporation of diaphragmatic breathing also provides exercise of the respiratory muscles, as well as coordinates the movement between the rib cage and the abdomen. When skilled musicians were compared to one novice musician, all were found to have smooth and coordinated movements between the rib cage and abdominal muscles, thus allowing expiratory airflow to be maintained at a constant value (Cugell, 1986). This consistent expiratory airflow is the desired response for COPD patients providing for a thorough and complete exhalation.

Asthma music was developed in an effort to provide diaphragmatic respiratory training using singing and whistling (Tatino & Suzuki, 1982). This form of music intervention was developed as a supplement to Asthma Gymnastics, a technique used for the purpose of relieving distress in an asthma attack.

The use of instrumental music was shown to be an effective rehabilitation technique in the treatment of children with asthma (Marks, 1974). Breathing

exercises were a necessary part of the respiratory process for asthmatic children and can be performed through wind instrumental performance. Constant practice on a wind instrument often improved pulmonary function, thus reducing progression of the disease (Marks, 1974). "It is believed that training the abdominal muscles to assist the diaphragm in some of the work of breathing helps many children to moderate and even control attacks of bronchospasm" (Marks 1974, p. 314).

In 1963 and 1964, Marks (1974) conducted a study on 30 of his asthmatic patients, 15 who played a wind instrument and 15 who did not. After 24 months, significant changes were noted in 11 patients who continued playing. The benefit of the experiment was physical as shown in increased vital capacity, timed vital capacity, and total lung capacity.

Playing a woodwind instrument involves blowing against a resistive force as demonstrated when blowing into the mouthpiece. The similarities to the Proflexive Muscle Trainer include contrasting bore sizes for each instrument thus allowing for various resistive levels. The larger bore size instruments (e.g. tuba, euphonium, baritone horn, trombone, baritone saxophone, tenor saxophone, and bass clarinet) provide less expiratory resistance. Instruments with narrowing bore sizes (e.g. cornet, trumpet, french horn, alto saxophone, alto clarinet, Bb clarinet, Eb clarinet, bassoon, English horn, and oboe) provide a greater resistance.

Instrumental music may promote self monitoring behavior allowing the client to effectively exercise the lung and diaphragm muscles with daily consistent practicing. Successful respiratory therapy is related to the amount of time involved in patient intervention and the amount of time the patient takes in following through with the prescribed exercises (Nicherson & Keens, 1982; personal communication, J. Taylor, January, 13, 1988). Music is conducive to increasing the amount of time spent on the treatment because it provides an interesting form of therapy which will stimulate

motivation and thus provide for further health benefits. Grambea (personal communication, January 7, 1988) states that when working with the COPD patient, it is essential to stress the importance of consistent maximum exerted effort while involved in any form of respiratory treatment so as to fully exercise the pulmonary muscles.

Expiratory treatment provides the client with techniques to aid in controlling exhalation. The most common expiratory treatment method is pursed lip breathing which aids the patient in removing trapped air from the lungs. "Pursed lip breathing provides a resistance to exhaled air at the mouth level and maintains a higher pressure in the airways. This keeps the airways open so that more air can get out" (Moser, et al, 1980, p. 35). Playing a wind instrument follows the same principle of pursed lip breathing: providing an increased resistance to aid in decreasing hyperinflation of the lungs.

Based on existing research, it is possible to infer that the numerous problems that accompany the COPD patient: decreased socialization, decreased physical activity, and increased dyspnea, will improve with the use of instrumental music intervention. This technique may be effective because it allows the COPD patient to take a part in active therapy and renew control over their disabling conditions.

Hypotheses

Hypothesis HO₁: There is no difference in mean change between pre and post pulmonary function in control and experimental groups as measured by the Forced Expiratory Volume in one second Test (FEV₁).

Hypothesis HO₂: There is no difference in mean change between pre and post pulmonary function in control and experimental groups as measured by the Forced Vital Capacity Test (FVC).

Hypothesis HO3: There is no difference in physical endurance between the control group and the experimental group as measured by the Twelve Minute Endurance Walk Test.

Hypothesis HO4: There is no difference in treatment compliance between the control group and the experimental group as measured by Daily Participation Logs.

Hypothesis HO5: There is no difference in enjoyment of the prescribed treatment between the control group and the experimental group as measured by the Prescribed Treatment Evaluation.

Hypothesis HO6: There is no difference between motivation between the control group and the experimental group as measured by the Prescribed Treatment Evaluation.

Hypothesis HO7: There is no difference in focused concentration between the control group and the experimental group as measured by the Prescribed Treatment Evaluation.

Hypothesis HO8: There is no difference in the awareness and utilization of learned techniques between the control group and the experimental group as measured by the Prescribed Treatment Evaluation.

Hypothesis HO9: There is no difference in the maximum effort used between the control group and the experimental group as measured by the Prescribed Treatment Evaluation.

Hypothesis HO10: There is no difference in the applicability of the prescribed treatment into daily lifestyles between the control group and the experimental group as measured by the Prescribed Treatment Evaluation.

Hypothesis HO11: There is no difference in personal achievement between the control group and the experimental group as measured by the Prescribed Treatment Evaluation.

Hypothesis HO₁₂: There is no difference in awareness of treatment benefits between the control group and the experimental group as measured by the Prescribed Treatment Evaluation.

CHAPTER III

DESIGN AND METHODOLOGY

The research study took place as a part of Bronson Methodist Hospital's A New Breath Outpatient Pulmonary Rehabilitation Clinic. A New Breath Outpatient Pulmonary Rehabilitation Clinics were held at Bronson Methodist Hospital's Crosstown location, Kalamazoo, Michigan and also at Bronson Methodist Hospital's Vicksburg location, Vicksburg, Michigan. A New Breath was a six week training seminar to help individuals with COPD use and develop their respiratory capabilities.

Subjects

Eight male and eight female subjects ($N = 16$) suffering from (COPD) were either assigned to attend Bronson Hospital's Pulmonary Outpatient Clinic by their physician or came voluntarily. All subjects had a physical examination and pulmonary function test prior to attending the clinic. The age of the subjects ranged from 54 to 78 years; mean age was 70.

The subjects were randomly assigned, using matched random sampling, to 2 groups: experimental and control. Matching was based on pulmonary function as determined by the pre Pulmonary Function Test. The experimental group received expiratory treatment (wind instruments), and the control group received inspiratory treatment (PFLEX inspiratory muscle trainer).

Inclusive in A New Breath Clinic were: training in diaphragmatic breathing, training in pursed lip breathing, posture training, occupational therapy, a dietary

lecture, and weekly physical fitness training. All subjects visited the Program Director during the weekly physical fitness training.

Instruments

The Pulmonary Function Test (Ambrosino, Paggiaro, Roselli, 1984; Britten, Davies, Colley, 1987; Chen, et al., 1985; Degree, Sergysels, Messin, Vandermoten, Salhadin, Denolin, & De Coster, 1974; Jederlinic, et al., 1986) assesses respiration gains of the experimental and control group. The PFT, a ratio scale of measurement was the standard assessment of respiration. Review of the literature did not reveal the existence of validity or reliability measures for the PFT. The PFT measures forced vital capacity, the longitudinal aspect of expiration, forced expiratory volume, the amount of forced expired air in one second, and the forced expiratory flow over the mid-50% of the vital capacity (Hodgkin et al., 1984). Forced vital capacity and forced expiratory volume were the only two areas of the PFT that were used in this study.

When PFTs were performed, the patient provided the following information: age, sex, height, and weight. This information was used to determine the predicated score or the score the patient should receive given these variables. This predicated score was compared to the actual score the patient received. When PFT scores were reported, they were given in a percentage of the predicated score obtained.

Measurement of physical endurance for the COPD patient was assessed through level of exercise. "It is important to recognize that the maximum level of exercise that a patient can achieve is not related to the level of ventilatory function or gas exchange and cannot be predicted from pulmonary function tests" (Chermack, 1985, p. 96S). The use of the Twelve Minute Walk Endurance Test (Anderson & Falk, 1984; Belman & Mittman, 1980) used the individual as his or her own control from pre to

post measurements. This test assessed any physical endurance gains of the experimental and control group. The test was administered by asking the patients to walk within a 12 minute time limit. The distance each patient walked within the 12 minutes was recorded, and monitored, for any endurance increases. Through documentation of each subject's baseline score, progress was monitored. The Twelve Minute Endurance Walk Test was a ratio measurement scale.

The daily participation logs for both the experimental and control groups assessed each subject's compliance to treatment. Participation logs/diaries were used during Bass, Whitcomb, and Forman's study (1970) of Exercise Training for patients with COPD. For this study, patients stated that this type of self documentation was helpful in that it served as an incentive to perform increased amounts of exercise.

Compliance was increasingly regarded as an important issue because of the effect it has had on the patient's health (DiMatteo & DiNicola, 1982). The experimental and control groups used different daily participation logs throughout the experiment (see Appendix A). The Daily Participation Logs were an interval scale of measurement.

In order to assess treatment satisfaction of both the experimental and control groups, a Prescribed Treatment Evaluation was used (see Appendix B). The objectives of the questions used in this Likert Scale evaluation were aimed towards assessing areas of treatment compliance, enjoyment of the prescribed treatment, motivation, concentration, awareness and utilization of learned techniques, maximum effort, applicability of the prescribed treatment into daily lifestyles, personal achievement, and awareness of treatment benefits. The Prescribed Treatment Evaluation was an interval scale of measurement.

Materials

Those subjects assigned to the control group used the PFLEX Inspiratory Muscle Trainer. This was provided as part of the usual services rendered during A New Breath Clinic.

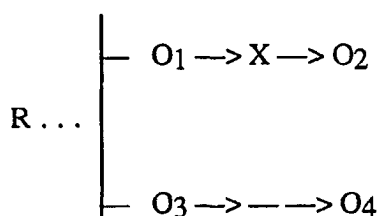
Subjects assigned to the experimental group selected the musical wind instrument of their choice from a selection of four instruments: Bb clarinet, alto saxophone, Bb trumpet, and trombone. These instruments were provided by Western Michigan University. All method books and instrumental needs (reeds, valve oil, etc.) were provided by the researcher.

Subjects assigned to the experimental group were instructed on the PFLEX Inspiratory Muscle Trainer. Follow-up instruction on the PFLEX Inspiratory Muscle Trainer was required due to its inclusion in the cost of A New Breath Clinic.

Design

As the research used multiple measures, multiple designs were used for a goodness of fit for the measures. For the Twelve Minute Endurance Walk Measure, The Pretest-Posttest Control Group Design was chosen (Leedy, 1974; Campbell & Stanley, 1963; Kerlinger, 1973; Kirk, 1968).

This design was:



R = Randomization

X = Exposure to experimental variable

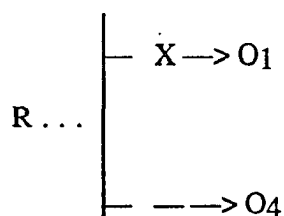
O₁ & O₂ = Observation of experimental group

O₃ & O₄ = Observations of control group

In this design, experimental and control groups were chosen through randomization procedures. The experimental group was evaluated, subjected to the experimental variable, and re-evaluated. The control group was isolated from all experimental variable influences and was merely evaluated at the beginning and the end of the experiment. The experimental and control groups were matched against each other. For the PFT, the Pretest-Posttest Control Group Design was also employed (Campbell & Stanley, 1963; Kerlinger, 1973; Kirk, 1968 Leedy, 1974).

For the Prescribed Treatment Evaluation variable, the Posttest Only Control Group Design was used. This design assumed randomization and matching of experimental and control groups, but does not involve pre-observations on either group.

This design was:



R = Randomization

X = Experimental variable

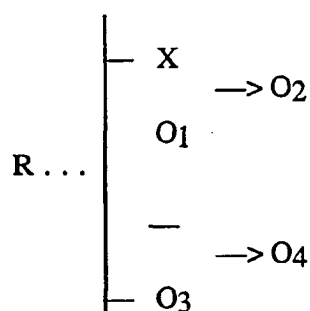
O₁ = Post observation of experimental group

O₂ = Post observation of control group

This design was chosen for the Prescribed Treatment Evaluation measure so as to exclude pretest sensitization by instrumentation in both the experimental and control groups (Campbell & Stanley, 1963; Kerlinger, 1973; Kirk, 1968 Leedy, 1974).

For the Daily Participation Log variable, the Concurrent Treatment-Observation Posttest Control Group Design was used. This design was a variant of a Time Series Experiment and a Posttest Only Control Group Design. In this design, observations were made during treatment and at set time frames following cessation to the experimental variable.

This design was:



R = Randomization

X = Experimental Value

O1 & O2= Observations of experimental group

O3 & O4= Observations of control group

This design was chosen for the Daily Participation Log Variable as weekly average time on treatment task measures were the observations. Those observations were made throughout the twelve week research period (Campbell & Stanley, 1963; Kerlinger, 1973; Kirk, 1968; Leedy, 1974).

Procedures

Upon qualifying for A New Breath Clinic, all patients were told of the study by the researcher, and asked to participate in the study by the Program Director. This was a result of a request by Bronson Methodist Hospital's Human Use Committee. This procedure was used to eliminate any chance of direct or indirect pressure that might have been applied by the researcher on the subjects to participate in the study.

Those patients who decided to participate were given the Informed Consent (see Appendix C), read the informed consent, and were provided with the opportunity to ask questions to both the researcher and the Program Director. The informed consent was approved by both Western Michigan University Human Subjects Institutional Review Board (see Appendix D) and Bronson Methodist Hospital Human Use Committee (see Appendix E). The patient was asked to sign the informed consent as well as given a copy.

Each subject was randomly assigned to one of two groups: experimental, receiving expiratory training on a musical wind instrument; or control, receiving inspiratory training on a PFLEX Inspiratory Muscle Trainer (IMT). The experimental group was given the choice of a musical wind instrument from four selections: Bb clarinet, alto saxophone, trumpet, or trombone. Appropriate physical characteristics of the subjects influenced the instrument selection process based on hand size, lips, presence of teeth, and present pulmonary function. Private instrumental instruction was provided by the researcher for each experimental subject 45 minutes weekly. Instrumental instruction included: deep breathing exercises, embouchure instruction, warm-ups including long tones and arpeggios, performance of musical selections, and listening activities to improve imitating skills as related to a well produced tone.

Rhythms were used in that long tones and slurred arpeggios were taught initially, and then increased to articulated rhythmic patterns. The use of tonguing on a wind instrument, in addition to providing the client with more musical selections, also required more breath support and facilitated a more thorough exhalation. Tempos of musical selections were flexible and up to the performer which encouraged creativity and independence.

All subjects met for A New Breath Clinic twice weekly for six weeks. The first session of the week was presented in a lecture format for two hours in which both experimental and control subjects were together. The second session of the week was devoted to individual thirty minute physical fitness training for all subjects. During this second session of the week, each experimental subject received music therapy treatment either before or after his or her scheduled physical training.

At the conclusion of the six week clinical session, each subject was reassessed on the Twelve Minute Walk Endurance Test. For the remaining six weeks, all subjects were monitored on at-home practice without intervention. At the end of the second six week period, all subjects were given a follow-up Pulmonary Function Test and also administered the Prescribed Treatment Evaluation.

Analysis of Data

Data Organization

Data of Pulmonary Function Tests, Twelve Minute Endurance Walk Tests, Daily At-Home Participation Logs, and Prescribed Treatment Evaluations were presented in a table identifying the means and standard deviations.

Statistical Procedures

Only descriptive statistics were used in this research as the sample size for both the experimental group and the control group were insufficient for standard statistical analysis of significance (Leedy, 1974). The limitation of these descriptive statistics precluded the generalization of results and conclusions to other populations (Kerlinger, 1973).

CHAPTER IV

FINDINGS

The findings section report the results of the data analysis performed to investigate the twelve hypotheses stated in Chapter III. The results related to each hypothesis are reported by mean, standard deviation, and percentage in each. As previously stated, only descriptive statistics were used due to the small sample size.

Hypotheses for the Study

Hypothesis HQ1

The following hypothesis was investigated: There is no difference in pulmonary function in control and experimental groups as measured by the Forced Expiratory Volume in one second Test (FEV1). Relative to forced vital capacity, means and standard deviations were computed both for the pretests and the posttests. Means and standard deviations are contained in Table 1.

Table 1
Pretest and Posttest Means and Standard Deviations
for Forced Expiratory Volume

	<u>Pre-Test</u>		<u>Post-Test</u>	
	<u>Mean</u>	<u>S.D.</u>	<u>Mean</u>	<u>S.D.</u>
Experimental	49	5.09	74	1.80
Control Group	55	6.46	62	7.10

On average the experimental group produced a fifty-one percent increase from pretest to posttest. The control group, on average, produced a thirteen percent increase from pretest to posttest. Concurrently, the experimental group decreased its variance by sixty-five percent from pretest to posttest while the control group increased its variance by ten percent from pretest to posttest.

Hypothesis HO2

The following hypothesis was investigated: There is no difference in pulmonary function in control and experimental groups as measured by the Forced Vital Capacity (FVC). Relative to forced expiratory volume, means and standard deviations were computed both for the pretests and the posttests. Means and standard deviations are contained in Table 2.

Table 2
Pretest and Posttest Means and
Standard Deviations for Forced Vital Capacity

	<u>Pre-Test</u>		<u>Post-Test</u>	
	<u>Mean</u>	<u>S.D.</u>	<u>Mean</u>	<u>S.D.</u>
Experimental	74	1.8	35	7.73
Control Group	62	7.1	36	5.42

On average the experimental group produced a fifty-three percent decrease from pretest to posttest. The control group, on average, produced a forty-two percent decrease from pretest to posttest. Concurrently, the experimental group increased its variance by three hundred twenty-nine percent while the control group decreased its variance by twenty-three percent from pretest to posttest.

Hypothesis HO3

The following hypothesis was investigated: There is no difference in physical endurance between the control group and the experimental group as measured by the Twelve Minute Endurance Walk Test. Relative to the Twelve Minute Endurance Walk Test, means and standard deviations were computed both for the pretests and the posttests. Means and standard deviations are contained in Table 3.

Table 3

Pretest and Posttest Means and Standard Deviations
for Twelve Minute Walk Endurance Test

	<u>Pre-Test</u>		<u>Post-Test</u>	
	<u>Mean</u>	<u>S.D.</u>	<u>Mean</u>	<u>S.D.</u>
Experimental	1698.4	28.58	2025.2	23.00
Control Group	1678	48.40	1893	39.06

On average the experimental group produced a nineteen percent increase from pretest to posttest. The control group, on average, produced a thirteen percent increase from pretest to posttest. The experimental and control groups both decreased variance by nineteen percent from pretest to posttest.

Hypothesis HQ4

The following hypothesis was investigated: There is no difference in treatment compliance between the control group and the experimental group as measured by Daily Participation Logs. Relative to daily participation logs, means and standard deviations were computed both for the first six weeks of observations, and the second six weeks of observation. Means and standard deviations are contained in Table 4.

Table 4
Means and Standard Deviations for
Treatment Compliance

	<u>1 - 6 Weeks</u>		<u>7 - 12 Weeks</u>	
	<u>Mean</u>	<u>S.D.</u>	<u>Mean</u>	<u>S.D.</u>
Experimental	118	10.96	60	20.28
Control Group	45	16.32	16	15.72

On average, the experimental group spent two hundred sixty-two percent more time than the control group practicing their prescribed treatment during the first assessment period. The experimental group spent three hundred seventy-five percent more time than the control group during the second assessment period. The experimental group, on average, produced a forty-eight percent decrease between the two assessment periods. The control group, on average, produced a sixty-four percent decrease in time practicing between the two assessment periods.

Hypotheses 5 - 12 are based on the results from the Prescribed Treatment Evaluation. The mean scores that are listed are given as indicated from the Likert Scale.

Hypothesis HQ5

The following hypothesis was investigated: There is no difference in enjoyment of the prescribed treatment between the control group and the experimental group as measured by the Prescribed Treatment Evaluation. Relative to enjoyment of treatment as measured by the Prescribed Treatment Evaluation, means and standard deviations were computed as a comparison between the control and experimental groups. Means and standard deviations are contained in Table 5.

Table 5
Means and Standard Deviations for Enjoyment of Treatment
as Measured by the Prescribed Treatment Evaluation

	<u>Mean</u>	<u>S.D.</u>
Experimental	4	1
Control	3	1

Hypothesis HQ6

The following hypothesis was investigated: There is no difference between motivation between the control group and the experimental group as measured by the Prescribed Treatment Evaluation. Relative to self motivational levels as measured by The Prescribed Treatment Evaluation, means and standard deviations were computed. Means and standard deviations are contained in Table 6.

Table 6
Means and Standard Deviations for Self Motivational Levels
as Measured by the Prescribed Treatment Evaluation

	<u>Mean</u>	<u>S.D.</u>
Experimental	4	1.65
Control	3	1.82

Hypothesis HQ7

The following hypothesis was investigated: There is no difference in focused concentration between the control group and the experimental group as measured by the Prescribed Treatment Evaluation. Relative to comparing focused attention during at-home practice, means and standard deviations were computed. Means and standard deviations are contained in Table 7.

Table 7
Means and Standard Deviations for Focused Attention During At-Home Practice
as Measured by the Prescribed Treatment Evaluation

	<u>Mean</u>	<u>S.D.</u>
Experimental	4	1
Control	4	1.22

Hypothesis HQ8

The following hypothesis was investigated: There is no difference in the awareness and utilization of learned techniques between the control group and the experimental group as measured by the Prescribed Treatment Evaluation. Relative to

subjects awareness of correct posture and breathing techniques, means and standard deviations were computed. Means and standard deviations are contained in Table 8.

Table 8

Means and Standard Deviations for Subject Awareness of Correct Posture and Breathing Techniques as Measured by the Prescribed Treatment Evaluation

	<u>Mean</u>	<u>S.D.</u>
Experimental	5	.89
Control	4.5	1.05

Hypothesis HQ9

The following hypothesis was investigated: There is no difference in the maximum effort used between the control group and the experimental group as measured by the Prescribed Treatment Evaluation. Relative to awareness of the utilization of maximum effort used during the at-home practice, means and standard deviations were computed. Means and standard deviations are contained in Table 9.

Table 9

Means and Standard Deviations of the Subjects' Awareness of the Utilization of Maximum Effort Used During the At-Home Practice as Measured by the Prescribed Treatment Evaluation

	<u>Mean</u>	<u>S.D.</u>
Experimental	5	.77
Control	4	1.22

Hypothesis HQ10

The following hypothesis was investigated: There is no difference in the applicability of the prescribed treatment into daily lifestyles between the control group and the experimental group as measured by the Prescribed Treatment Evaluation. Relative to the ability to apply the prescribed treatment easily into the subjects lifestyle, means and standard deviations were computed. Means and standard deviations are contained in Table 10.

Table 10

Means and Standard Deviations Assessing the Ability to Apply the Prescribed Treatment Easily Into the Subjects' Lifestyle as Measured by the Prescribed Treatment Evaluation

	<u>Mean</u>	<u>S.D.</u>
Experimental	4.16	.65
Control	2.3	1.26

Hypothesis HQ11

The following hypothesis was investigated: There is no difference in personal achievement between the control group and the experimental group as measured by the Prescribed Treatment Evaluation. Relative to each subject's satisfaction of personal achievements as a result of A New Breath Clinic, means and standard deviations were computed. Means and standard deviations are contained in Table 11.

Table 11

Means and Standard Deviations for Subjects' Satisfaction of Personal Achievements
as Measured by the Prescribed Treatment Evaluation

	<u>Mean</u>	<u>S.D.</u>
Experimental	4.83	.38
Control	3.7	1.69

Hypothesis HQ12

The following hypothesis was investigated: There is no difference in awareness of treatment benefits between the control group and the experimental group as measured by the Prescribed Treatment Evaluation. Relative to the subjects' findings of any additional benefits that were not expected, means and standard deviations were computed and compared between the two groups. Means and standard deviations are contained in Table 12.

Table 12

Means and Standard Deviations of Additional Benefits of a New Breath Clinic as
Measured by the Prescribed Treatment Evaluation

	<u>Mean</u>	<u>S.D.</u>
Experimental	4.5	.87
Control	2.75	1.56

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

The main purpose of this investigation was to compare the differences of inspiratory and expiratory treatments for COPD patients, and determine the effectiveness of musical wind instruments as an expiratory therapy. Effectiveness was measured for physical gains, treatment compliance, and personal satisfaction of the prescribed treatment.

In order to achieve the purposes of this investigation, sixteen COPD patients, who were all a part of A New Breath Clinic, were randomly assigned to two groups: experimental and control. Four subjects did not continue the study for the duration. One subject died during the study from a heart attack. Three other subjects dropped out of the study before the end of the study. The experimental group received musical wind instrument training, and the control group received inspiratory training on a PFLEX IMT.

Prior to the initiation of the treatment, both groups received specific pretests. Pretest and Posttest were the FEV1 and FVC given as part of the PFT, as well as the Twelve Minute Walk Endurance Test. Additional posttest assessments were done to assess treatment compliance, enjoyment of the prescribed treatment, motivation, concentration, awareness and utilization of learned techniques, maximum effort, applicability of the prescribed treatment into daily lifestyles, personal achievement, and awareness of treatment benefits. A fourth continuing assessment, the Daily Participation Log was used to compare the actual amount of time spent utilizing the

two treatments. Treatment was given once weekly for forty-five minutes. The data were analyzed for trends by producing means and standard deviations.

Discussion

The major findings of this investigation were shown in Tables I through XII. Therefore, this discussion only examined some of the more interesting results.

Discussion of the Results of Hypotheses HQ1 and HQ2

Hypotheses one and two were assessments of pulmonary function. There was no strong evidence that either group showed changes that were attributable to the treatment. The researcher did not expect to see any changes in the pulmonary function assessment. This expectation was a result of two factors: the age of the patients, and the length of the study. Due to the nature of COPD, these subjects were in a chronic state and had been for many years. Pulmonary function was tested to determine if any trends could be found between pulmonary function and treatment compliance. No trends were indicated.

Discussion of the Results of Hypothesis HO3

Both groups showed improvements on the Twelve Minute Endurance Walk Test. The experimental group showed slightly more of an improvement between pre and post testing. This suggested support for hypothesis HO3. An explanation of the increased physical gains of the experimental group was through the addition of the experimental treatment which enhanced diaphragmatic and pursed lips breathing. Through personal contact all subjects reported that the use of physical exercise improved their physical well being.

Discussion of the Results of Hypothesis HQ4

Results showed an extreme difference between the two groups on the basis of treatment compliance as determined by the Daily Participation Logs. The experimental group showed a greater participation level during both assessment periods than the control group. Both groups had a decrease between pre and post measures and the control group had a greater decrease than the experimental group. While reviewing the Daily Participation Logs, it was discovered that there was a difference between the two groups on two additional aspects of at-home practice. The experimental group, in addition to practicing longer, also practiced more frequently throughout any given day than did the control group. By example, the experimental group practiced their musical wind instruments on average from zero to three times daily, and the control group used their PFLEX IMT from zero to one times daily. This suggested the reinforcing qualities music had for the COPD patient. The second area showing differences between the two groups was the number of days practiced throughout the week. The experimental group averaged four to five days weekly of practice time, while the control group averaged one to three days weekly of using the PFLEX IMT. This also suggested the capabilities of music as a reinforcer. In addition, the experimental group had a musical tune to master. The sound of the tune provided reinforcement, because the patient knew that he or she had to play this tune for the researcher at the end of the week. The control group had no noticeable and immediate reinforcement that was useable for self- monitoring.

The drop of at-home participation between both groups during the second assessment period was attributed to the fact that neither group had to attend a treatment session. However, the experimental group was still greater on the level of at-home practice time. The researcher suggests that the experimental subjects had

enough knowledge to continue developing their musical skills, as well as working on diaphragmatic breathing and thorough exhalation. The control group had the same opportunity to continue work, but were provided no immediate reinforcers.

Discussion of the Results of Hypothesis HO5

The area of enjoyment was included in the Prescribed Treatment Evaluation because the research supported that there would be a difference between the two groups on this variable due to the positive reinforcing qualities of music. The experimental group had a greater mean than the control group and both groups had the same standard deviation. During the treatment sessions for the experimental group, stories were shared regarding how peers or significant others were surprised to hear of this form of treatment. The experimental subjects appeared to enjoy the added reinforcement and were even invited to participate in office and other social events to demonstrate their newly developed skills. Even though the experimental subjects found humor in their music participation, they made statements such as, "it was nice to have fun again while receiving treatment".

Discussion of the Results of Hypothesis HO6

Self motivational levels were addressed in this hypothesis. The experimental group had a greater mean and a lesser standard deviation on this variable. This suggests the experimental group found the use of music to be more reinforcing and motivating than the use of the PFLEX IMT used in the control group. As previously stated, the amount of time the patient takes in following through with the prescribed treatment, the more successful the treatment (personal communication, J. Taylor, January, 13, 1988; Nicherson & Keens, 1982). Once the patient was released from in-patient or out-patient intervention, it was up to the individual to continue treatment

at home. Therefore, it is important to recognize the motivating and reinforcing factors for each treatment.

Discussion of the Results of Hypothesis HO7

The levels of focused concentration between the experimental and control groups were assessed in this hypothesis. Focused concentration was assessed in relation to the amount of quality time spent on the prescribed treatment. Through interview and discussions with the patients of a previous study, the researcher found that individuals using the PFLEX IMT practiced in front of the television in a soft back chair or on a sofa. As a result of sitting in poor support furniture and watching television while attempting to work on the treatment, concentration levels were lower, resulting in poor utilization of diaphragmatic breathing. The experimental group was not able to practice in front of the television and had to use a straight back chair, thus encouraging proper posture and correct breathing.

In this study, the experimental and the control groups shared the same mean, but the experimental group had a lesser standard deviation. Based on the results and input from the previous study, the researcher expected to find a greater difference on this variable.

Discussion of the Results of Hypothesis HO8

Awareness of correct posture and breathing techniques between the control and experimental groups was addressed in this hypothesis. This treatment aspect is important due to the music's ability for encouragement of posture and appropriate breathing. Both groups had means above the Likert Midpoint, with the experimental group having the greatest mean. The experimental group had a lesser standard

deviation than the control group. This hypothesis was included as a complement to hypothesis HO7.

Discussion of the Results of Hypothesis HO9

The assessment of maximum effort used on the prescribed treatment was the basis for this hypothesis. The utilization of maximum is important to encourage the greatest treatment gains. The experimental group had a greater mean and a lesser standard deviation than the control group. This difference suggests the experimental group used more diaphragmatic breathing than the control group. This reinforces HO8.

Discussion of the Results of Hypothesis HO10

The ability of both groups to implement the prescribed treatments into daily lifestyles was the focus of this hypothesis. The experimental group indicated musical wind instruments were easier to incorporate into daily lifestyles than the control group. The experimental group also had a lesser standard deviation than the control group. This information suggests if a treatment was more easily implemented into a patient's lifestyle, there was an increased use of the treatment. Two experimental subjects stated they were able to use their instruments to practice with their grandchildren who were also learning musical wind instruments at school. This provided reinforcement and encouragement to the patient who was previously unable to share in active social roles with significant others or peers.

Discussion of the Results of Hypothesis HO11

This hypothesis was used to assess the personal achievements as a result of A New Breath Clinic. The differences between the experimental and control groups

was the application of the musical wind instrument. The experimental group had a greater mean and a lesser standard deviation. This data indicates the experimental group was more pleased with experimental treatment and felt they had achieved more as a result of A New Breath Clinic, and also the experimental treatment.

Discussion of the Result of Hypothesis HQ12

This hypothesis was used to assess the awareness of treatment benefits between the experimental and control groups. The experimental group had a greater mean awareness and lesser standard deviation than the control group. This suggested that as a result of the treatment provided by the experimental variable, and the increased amount of time spent by the experimental group on the prescribed treatment, the experimental group was more aware of the benefits of this particular pulmonary rehabilitation program.

Delimitation

This study was not delimited. Due to the preliminary nature of this study into a new area of research, it was intentionally constrained to demonstrate results only relative to the population of research subjects. As such, this was conceived as a base study to enhance future research.

Limitations

A major limitation was the number of subjects in the study. A New Breath Clinic was cancelled by Bronson Methodist Hospital during this study due to the small size of each clinic, thereby reducing the sample size for both experimental and control groups.

Another limitation was the inability to conduct data analysis regarding levels of significance which provide statistical support to this study. These two limitations produced a further limitation: the inability to generalize the results. This was produced by the number of the subjects as well as the lack of statistical analysis of significance.

The final two limitations were in relation to the condition of the COPD subjects. The first was the chronicity of the disease state which produced limitations in the areas of maturation, history, and mortality. The second of these was the intervening factor of physical debilitation due to the high rate of opportunistic diseases.

Conclusions

The use of music as a treatment technique with COPD patients was suggested to be effective by this study. The experimental group demonstrated gains over the control group for all measures except for FEV1. Even though this was not statistically documented, trends are evident.

The most suggestive results of this study were the increased at-home practice time of the experimental group as evidenced by the Daily Participation Log, as well as the increased levels of enjoyment, self motivational level, application of the prescribed treatment into daily lifestyle, satisfaction of personal achievement, and the awareness of additional benefits as a result of A New Breath Clinic.

The use of instrumental music provided the COPD patient with an active role of therapy which allowed for increased self disclosure, increased socialization, increased self esteem, and also served as an avenue for further discussion between the therapist and the patient. Music therapy produced a useable skill which in itself was reinforcing to the therapeutic regime. In addition, musical instrument intervention

facilitated the patient's desire to follow the prescribed therapy because of improved respiration and an increased desire to succeed in a performance medium. The music appeared to be a secondary reinforcement to the primary reinforcement of improved respiratory health.

There were many beneficial qualities that music therapy brought to the COPD patient: independence for musical interpretation, self monitoring behaviors which encourage improved self esteem, leisure time activities, respiratory fitness, and socialization. The continuity of wind instrument instruction enabled rehabilitation and provided motivation. Diaphragmatic breathing and proper posture were habitual because the patient was able to hear a supportive sound versus a non-supportive sound while practicing a musical instrument. The use of a musical wind instrument also appeared to increase expectoration, especially when treatment followed the use of a prescribed inhaler 20 minutes prior to treatment.

The unique benefit of this form of music therapy was that both the instrument and the music was adapted to meet the needs of the patient. As clients who have COPD needed to learn complete exhalation, phrasing encouraged this and was altered for gradual extending exhalation exercises. By example, when therapy began the client exhaled one complete measure (time signature 4/4). The goal was to encourage and train the client to reach an extended exhalation period thus permitting thorough emptying of the lungs. Once the patient developed confidence and musical maturity, instructional guidance gradually declined. This form of music therapy allowed the patient to continue his/her therapy without the aid of a therapist during the second six week period.

This study suggests the intervention proved effective because of expiratory therapy and music's aesthetic qualities motivated the client to continue practice. Treatment was found to be effective since the condition improved or was stabilized,

thus reducing the degeneration process. The subject population was an important target group, since effective outcomes were obtained with older subjects; treatment techniques may also be used on younger populations.

Results suggested music therapy provides a cost effective intervention for the COPD patient as traditional treatment due to its promotion of treatment compliance. Results suggested the experimental treatment was used more by the patients and was easier to implement into the patient's lifestyle. As such the patient was more compliant to treatment, thereby increasing respiratory gains and decreasing long-term treatment cost.

Recommendations

Based upon the results of the research, music therapy treatment may be as effective as traditional treatment toward desired outcomes. Further research should focus on developing measures of statistical significance between true control groups (no treatment) and traditional treatment groups (PFLEX Treatment) versus music therapy treatment.

Variables to be addressed in future research are those contained in this study as well as variables as to the efficacy of use of music therapy, both from a view of implementation as well as cost. Populations for future research should consist of individuals from multiple clinics as well as be representative of the entire national population by demographic variables.

It is also recommended that behavioral research address the power of reinforcement of self-produced music versus the power of PFLEX feedback as a motivational variable in the treatment of COPD. This type of research should extend into longitudinal periods beyond formal treatment to assess the effect of compliance with aftercare plans on functioning.

A final recommendation is to conduct research to assess the acceptance level by physicians of the music therapy treatment, an alternative to traditional PFLEX treatment. Unless physician acceptance is gained, positive research results are only of an academic importance.

In summary, recommendations are of two types. The first type is to statistically determine if music therapy treatment is, unto itself, a significant variable in producing COPD treatment outcomes in the desired direction as well as comparing music therapy treatment with traditional PFLEX treatment. The second type is to determine if the use of music therapy with COPD patients is acceptable to the medical profession, and to assess the cost-effective nature of music therapy in treating COPD.

Appendix A
Daily Participation Logs

MUSICAL WIND INSTRUMENT/AT - HOME PRACTICE RECORD

Week 1 ()

Length of	Mon	Tue	Wed	Thu	Fri	Sat	Sun
Practice Time (in minutes)	_____	_____	_____	_____	_____	_____	_____

Comments: _____

INSPIRATORY MUSCLE TRAINER/AT - HOME PRACTICE RECORD

Length of	Mon	Tue	Wed	Thu	Fri	Sat	Sun
Practice Time (in minutes)	_____	_____	_____	_____	_____	_____	_____

Dial Setting	Mon	Tue	Wed	Thu	Fri	Sat	Sun
	_____	_____	_____	_____	_____	_____	_____

Comments: _____

Appendix B

Prescribed Treatment Evaluation

PREScribed TREATMENT EVALUATION

5 = strongly agree 4 = agree 3 = undecided 2 = disagree 1 = strongly disagree

1. The treatment I received was found to be enjoyable

5 4 3 2 1

2. I was self-motivated to practice. the prescribed treatment

5 4 3 2 1

3. I enjoyed spending time at home on the prescribed treatment

5 4 3 2 1

4. During at-home practice, my attention was focused only on the prescribed treatment and I was not distracted

5 4 3 2 1

5. The prescribed treatment made me aware of posture and correct breathing techniques

5 4 3 2 1

6. I utilized maximum effort while using the prescribed treatment during at-home practice

5 4 3 2 1

7. I was able to apply the prescribed treatment easily into my daily lifestyle

5 4 3 2 1

8. I am satisfied with my personal achievements as a result of A New Breath Clinic

5 4 3 2 1

9. The prescribed treatment provided me with additional benefits than what I expected

5 4 3 2 1

10. The prescribed treatment was enjoyable and I plan to continue with it and incorporate it into my lifestyle

5 4 3 2 1

Appendix C

Informed Consent

Informed Consent

I. Purpose:

The purpose of this study is to assess the effectiveness of the use of musical wind instruments as an additional respiratory treatment in the New Breath Clinic. Subjects who participate in this study will be randomly assigned to one of two groups: those receiving traditional treatment of A New Breath Clinic, and those receiving traditional treatment of A New Breath Clinic plus musical wind instrument training. Traditional treatment includes occupational therapy, dietary training, physical fitness training, lecture series on diaphragmatic breathing, pursed lip breathing, and using an Inspiratory Muscle Trainer.

A comparison will be made between the two groups on physical improvements, treatment compliance, personal satisfaction of the patient, and self motivational levels of patients.

II. General Information

The study is being conducted on patients with Chronic Obstructive Pulmonary Disease (COPD). Characteristics of this disease include: asthma, emphysema, and bronchitis. The study is being conducted to assess the treatment effectiveness of the musical wind instruments. A comparison between the two groups may provide useful information pertaining to the most effective treatment for the COPD patient.

III. Qualifications

The criteria for acceptance into this study is based on the patient having Chronic Obstructive Pulmonary Disease. Only those patients who have completed the required physical exam and Pulmonary Function Test will be permitted to participate in the study.

IV. Study Course

The time commitment involved in the study basically adheres to the requirements of A New Breath Clinic. Additional time required as a result of participating in this study will involve 1 hour individual instrumental music instruction for patients assigned to the musical wind instrument group. This 1 hour of music instruction will be scheduled on Thursdays during A New Breath Clinic each week. At home practice on either the Inspiratory Muscle Trainer or a musical wind instrument will be expected from both groups.

A return to Bronson Hospital for a follow-up Pulmonary Function Test and a follow-up 12 Minute Endurance Walk Test is required. These follow-up tests will be administered at the subject's convenience at 6 weeks following the last clinic session and at no cost to the patient. The exact date will be given to each subject prior to participating in the study.

Patients will be expected to continue with their usual medications unless otherwise prescribed by their physician.

V. Test Articles Used

All tests used to assess physical progress, Pulmonary Function Test and 12 Minute Endurance Walk Test, are standard procedures already implemented at A New Breath Clinic. Assessment techniques used exclusively to this research study include: the Daily Participation Record used to monitor both groups at-home participation, the Prescribed Treatment Evaluation used to evaluate the subject's perception of the treatment received relating to one of the two groups, and musical wind instruments (e.g. saxophone, clarinet, trumpet, etc.). These musical wind instruments will be furnished by Western Michigan University for the duration of the study at no cost to the patient.

VI. Risk/Benefit Statement:

Risks: Theoretical risks indicate musical wind instruments may constrict airways, however these risks will be no greater than expected while using the Inspiratory Muscle Trainer. There may also be a slight risk of blood vessel capillary breakage if excessive expiratory force is used.

Benefits: These include the improvement in lung function for the Chronic Obstructive Pulmonary Disease patient. The present research literature indicates that musical wind instruments provide additional exercise to the diaphragm which coincides with the goal of the Inspiratory Muscle Trainer. Therefore, as a treatment technique, it is felt that musical wind instruments will provide comparable benefits.

VII. Alternative Treatments Section

I understand that I am not required to participate in this study. If I decide not to participate in this study, appropriate treatment will be provided for me.

VIII. Volunteer Statement/Patient Acknowledgement:

"I have been given an opportunity to ask questions regarding this research study, and these questions have been answered to my satisfaction. I understand that if I have any additional questions I can contact Ellen R. Griggs at 345-9482 and Geoffrey R. Grambau, MD at 388-LUNG."

"In giving my consent, I understand that my participation in this research project is voluntary, and that I may withdraw at any time without affecting my future medical care. I also understand that the investigator in charge of this study, with my welfare as a basis, may decide at any time that I should no longer participate in this study."

"I hereby authorize the investigator, Ellen R. Griggs, to release the information obtained in this study to the medical science literature. I understand that I will not be identified by name."

"Because no medication or invasive procedures are involved in collection of this information, no physical injury is anticipated due to this study. In the event of unanticipated physical injury resulting from the research procedures, Bronson Methodist Hospital and /or the investigator, Ellen R. Griggs will provide or arrange to provide for all necessary medical care to help me recover, but they do not commit themselves to pay for such care, or to provide any additional compensation. I also understand that neither Bronson Methodist Hospital nor the

investigator Ellen R. Griggs agree to bear the expense of medical care for any new illness or complications which may develop during my participation in this study, but are not a result of the research procedures. If I have further questions or concerns regarding my participation in this study, I may direct them to the investigator in charge."

"I acknowledge that I have read and understand the above information, and that I agree to participate in this study. I have received a copy of this document for my own records. "

Patient

Date

Witness

Date

Appendix D

**Informed Consent Approval Western Michigan University
Human Subjects Institutional
Review Board**



Western Michigan University
Kalamazoo, Michigan 49008-3899

*Human Subjects
Institutional Review Board*

TO: Ellen Griggs *E-P-R*
FROM: Ellen Page-Robin, Chair
RE: Research Protocol
DATE: August 22, 1988

This letter will serve as confirmation that your research protocol, "The Use of Musical Wind Instruments as an Expiratory Therapy with Chronic Obstructive Lung Disease Patients" is now complete and has been signed off by the HSIRB.

If you have any further questions, please contact me at 387-2647.

Appendix E

**Informed Consent Approval
Bronson Methodist Hospital
Human Use Committee**

BMH561 The Use of Musical Wind Instruments as an Expiratory
Therapy with Chronic Obstructive Pulmonary Disease Patients
(ERGriggs/GGGrambau)

At the July 14, 1988 Meeting of the Bronson Methodist Hospital Human Use Committee, BMH561 and the informed consent were approved with the following changes:

1. Throughout the protocol "verses" should be spelled "versus."
2. In the protocol and informed consent include "petechiae" and "subconjunctival hemorrhages" as possible side effects in lay terms.
3. In the informed consent include that the musical instruments will be supplied by Western Michigan University at no additional cost.
4. In the informed consent include that the subjects are to practice with their instruments separate from the music lessons.
5. In the informed consent include an Alternative Treatments Section describing other treatment modalities available to the study subjects.
6. In the informed consent under V. Test Articles Used. List which wind instruments will be available (e.g., trumpet, alto saxophone, etc.).
7. In the informed consent under VI. Risk/Benefit Statement, second paragraph. Explain "longitudinal respiration benefits" in lay language.
8. In the informed consent under VII. Volunteer Statment/Patient Acknowledgement. Include Dr. Geoffrey Grambau as co-investigator in the first paragraph.

Robert H. Hume M.D.
Robert H. Hume, M.D., Chairman
Bronson Methodist Hospital
Human Use Committee
252 East Lovell Street
Kalamazoo, MI 49007
(616) 393-7988

15 July 88
Date

cc: ERGriggs, GGGrambau

BIBLIOGRAPHY

- Aldrich, T., & Karpel, J. (1985). Inspiratory muscle resistive training in respiratory failure. American Review of Respiratory Disease, 131(3), 461-462.
- Altman, P., & Dittmer, D. (Eds.). (1971). Respiration & Circulation. Bethesda, MD: Federation of American Societies for Experimental Biology.
- Altose, M. D. (1985). Assessment and management of breathlessness. Chest, 88(2), 77s-83s.
- Ambrosino, N., Paggiaro, P., Roselli, M., & Contini, V. (1984). Failure of resistive breathing training to improve pulmonary function tests in patients with chronic obstructive pulmonary disease. Respiration, 45, 455-459.
- Andersen, J., Dragsted, L., Kann, T., Johansen, S. H., Nielsen, K., Karbo, E., & Bentzen, L. (1979). Resistive breathing training in severe chronic obstructive pulmonary disease. Scandinavian Journal of Respiratory Disease, 60, 151-156.
- Andersen, J., & Falk, P. (1984). Clinical experience with inspiratory resistive breathing training. International Rehabilitative Medicine, 6, 183-185.
- Ary, D., Jacobs, L., & Razavieh, A. (1985). Introduction to Research in Education (3rd ed.). New York: CBS College Publishing.
- Asher, M., Pardy, R., Coates, A., Thomas, E., & Macklem, P. (1982). The effects of inspiratory muscle training in patients with cystic fibrosis. American Review of Respiratory Disease, 126, 855-859.
- Bass, H., Whitcomb, J., & Forman, R. (1970). Exercise training therapy for patients with chronic obstructive pulmonary disease. Chest, 79(4), 393-397.
- Belman, M., & Mittman, C. (1980). Ventilatory muscle training improves exercise capacity in chronic obstructive pulmonary disease patients. American Review of Respiratory Disease, 121, 273-280.
- Bilyk, V. (1988). Personal communication.
- Bjerre-Jepsen, K., Secher, N., & Kok-Jensen, A. (1981). Inspiratory resistance training in severe chronic obstructive pulmonary disease. European Journal of Respiratory Diseases, 62, 404-411.
- Bouhuys, A. (1964). Lung volumes and breathing patterns in wind instrument players. Journal of Applied Physiology, 19(6), 967-975.

- Bouhuys, A., Proctor, D. F., & Mead, J. (1966). Kinetic aspects of singing. Journal of Applied Physiology, 21, 483-496.
- Britten, N., Davies, J., & Colley, J. (1987). Early respiratory experience and subsequent cough and peak expiratory flow rate in 36 year old men and women. British Medical Journal, 294, 1317-1320.
- Browning, R. (1983). Exercise for the lungs: The case for breathing retraining. Practical Cardiology, 19(2), 119-126.
- Brundin, A. (1974). Physical training in severe chronic obstructive lung disease. Scandinavian Journal of Respiratory Disease, 55, 25-26.
- Burns, B., & Howell, J. ((1969). Disproportionately severe breathlessness in chronic bronchitis. Quarterly Journal of Medicine, 38, 277-293.
- Campbell, D., & Stanley, J. (1963). Experimental Designs and Quasi-Experimental Designs for Research. Skokie, IL: Rand McNally.
- Campbell, E., Freedman, S., Smith, D., & Taylor, M. (1961). The ability of man to detect added elastic loads to breathing. Clinical Science, 20, 223-231.
- Casciari, R., Fairshter, R., Morrison, J., & Wilson, A. (1981). Effects of breathing retraining in patients with chronic obstructive pulmonary disease. Chest, 79(4), 393-398.
- Chen, H., Dukes, R., & Martin, B. J. (1985). Inspiratory muscle training in patients with chronic obstructive pulmonary disease. American Review Respiratory Disability, 131, 251-255.
- Chermack, R. (1985). A comprehensive approach to asthma. Chest, 87(1), 94S-97S.
- Clausen, J. (1985). Of wind and song. Chest, 88(2), 165-166.
- Colgan, F., Mahoney, P., & Fanning, G. (1970). Resistance breathing (blow bottles) and sustained hyperinflations in the treatment of atelectasis. Anesthesiology, 32(6), 543-550.
- Comroe, J., Forster, R., Dubois, A., Briscoe, W., & Carlsen, E. (1972). The lung. Clinical physiology and pulmonary function tests (2nd ed.). Chicago: Year Book Medical Publishers.
- Corey, G. (1986). Theory and Practice of Counseling and Psychotherapy (3rd ed.). Belmont, CA.: Brooks/Cole.
- Cropp, A., Zuti, R., Kendis, C., & Altose, M. (1984). Determinants of the sensation of breathlessness in patients with chronic obstructive pulmonary disease. American Review of Respiratory Disease, 129, A240.
- Cugell, D. (1986). Interaction of chest wall and abdominal muscles in wind instrument players. Cleveland Clinic Quarterly, 53(1), 15-20.

- Degre, S., Sergysels, R., Messin, R., Vandermoten, P., Salhadin, P., Denolin, H., & De Coster, A. (1974). Hemodynamic responses to physical training in patients with chronic lung disease. American Review of Respiratory Disease, 110, 395-402.
- DiMatteo, M., DiNicola, D. Goldstein, A. P., & Krasner, L. (1982). Achieving Patient Compliance. Elmsford, N.Y.: Pergamon.
- Dudley, D., Glaser, E., Jorgenson, B., & Logan, D. (1980). Psychosocial concomitants to rehabilitation in chronic obstructive pulmonary disease. Chest, 77(4), 544-551.
- El-Manshawi, A., Killian, K., Summers, E., & Jones, N. (1984). Breathlessness and exercise capacity with and without respiratory loading. American Review of Respiratory Disease, 129, 239A.
- Forster, R., Dubois, A., Briscoe, W., & Fisher, A. (1986). The Lung (3rd ed.). Chicago: Year Book Medical Publishers, Inc.
- Gould, W. J., & Okamura, H. (1974). Respiratory training of the singer. Folia Phoniatica, 26, 275-286.
- Grambeau, G. (1988). Personal communication.
- Grassino, A., Gross, D., Macklem, P., Roussos, C., & Zagelbaum, G. (1979). Inspiratory muscle fatigue as a factor limiting exercise. Bulletin European de Physiopathologie Respiratoire, 15, 105-111.
- Heller, S., Hicks, W., & Root, W. (1960). Lung volumes of singers. Journal of Applied Physiology, 15, 40-42.
- Hodgkin, J., Zorn, E., & Connors, G. (Eds.). (1984). Pulmonary Rehabilitation. Guidelines To Success. Boston: Butterworth.
- Ingram, R., & Schilder, D. (1967). The effect of pursed lips expiration on the pulmonary pressure-flow relationships in obstructive lung disease. American Review of Respiratory Disease, 96, 380-387.
- Jederlinic, P. Muspratt, J. A., & Miller, M. J. (1986). Inspiratory muscle training in clinical practice. Chest, 86(6), 870-873.
- Kerlinger, F. N. (1973). Foundations of Behavioral Research (2nd Ed.). New York: Holt, Rinehard, and Winston.
- Kirk, R. E. (1968). Experimental Design Procedures for the Behavioral Sciences. Belmont, California: Brooks/Cole.
- Leedy, P. D. (1974). Practical Research: Planning and Design. New York: Macmillan.

- Lertzman, M., & Cherniack, R. (1976). Rehabilitation in patients with chronic obstructive pulmonary disease. American Review of Respiratory Disease, 114, 1145-1165.
- Light, R., Merrill, E., Despars, J., Gordon, G., & Mutalipassi, L. (1985). Chest, 87(1), 35-38.
- Lustig, F., Haas, A., & Castillo, R. (1972). Clinical and rehabilitation regime in patients with chronic obstructive pulmonary diseases. Archives of Physical Medicine and Rehabilitation, 53, 315-322.
- Madsen, F., Secher, N.H., Kay, L., Kok-Jensen, A., & Rube, N. (1985). Inspiratory resistance versus general physical training in patients with chronic obstructive pulmonary disease. European Journal of Respiratory Diseases, 67, 167-176.
- Marks, M. B. (1974). Musical wind instruments in rehabilitation of asthmatic children. Annals of Allergy, 33(6), 313-319.
- Mash, F. (Ed.). (1986). Webster's Ninth New Collegiate Dictionary (rev. ed). Springfield: Merriam-Webster.
- Mazza, F., Zuti, R., Smith, R., & Altose, M. (1983). Determinants of the sensation of breathlessness. American Review of Respiratory Disease, 127, 234.
- McKeon, J. L., Turner, J., Kelly, C., Dent, A., & Zimmerman, P. V. (1986). The effect of inspiratory resistive training on exercise capacity in optimally treated patients with severe chronic airflow limitation. Australian and New Zealand Journal of Medicine, 16, 648-652.
- McSweeney, A., Grant, I., Heaton, R., Adams, K., & Timms, R. (1982). Life quality of patients with chronic obstructive pulmonary disease. Archives of Internal Medicine, 142, 473-478.
- Mertens, D., Shephard, R., & Kavanagh, T. (1978). Long-term exercise therapy for chronic obstructive lung disease. Respiration, 35, 96-107.
- Moser, M. M., Archibald, C., Hansen, P., Ellis, B., & Whelan, D. (1980). COPD - what does that mean? Better Living and Breathing A Manual for Patients (pp. 9-15). St. Louis, MO: The C.V. Mosby Company.
- Mueller, R., Petty, T., & Filley, G. (1970). Ventilation and arterial blood gas changes induced by pursed lips breathing. Journal of Applied Physiology, 28, 784-789.
- Navratil, M., & Rejsek, K. (1968). Lung function in wind instrument players and glassblowers. Annals of the New York Academy of Science, 155, 276-283.
- Nicholas, J., Gilbert, R., Gabe, R., & Auchincloss, J. (1970). Evaluation of an exercise therapy program for patients with chronic obstructive pulmonary disease. American Review of Respiratory Disease, 102, 1-9.

- Nickerson, B., & Keens, T. (1982). Measuring ventilatory muscle endurance in humans as sustainable inspiratory pressure. Journal of Applied Physiology, 52, 768-72.
- O'Conner, M. (1975). Comparison of two methods of postoperative pulmonary care. Surgery, Gynecology, and Obstetrics, 140(4), 615-617.
- Pardy, R., Rivington, R., Despas, P., & Macklem, P. (1981). Inspiratory muscle training compared with physiotherapy in patients with chronic airflow limitation. American Review of Respiratory Disease, 123, 421-425.
- Peretti, P., & Swenson, K. (1974). Effects of music on anxiety as determined by physiological skin responses. Journal of Research in Music Education, 22(4), 278-283.
- Peters, J.S. (1987). Music therapy: an introduction. Springfield, IL: Thomas.
- Petty, T. (1975). Pulmonary rehabilitation. Basics of RD, American Thoracic Society, 4(1), 1-6.
- Petty, T., & Guthrie, A. (1971). The effects of augmented breathing maneuvers on ventilation in severe chronic airway obstruction. Respiratory Care, 16, 104-111.
- Phillips, K. H. (1985). The effects of group breath control training on the singing ability of elementary students. Journal of Research in Music Education, 33(3), 179-191.
- Proctor, D. F. (1968). The physiologic basis of voice training. Annals of the New York Academy of Science, 155, 208-228.
- Roussos, C., & Macklem, P. (1977). Diaphragmatic fatigue in man. Journal of Applied Physiology, 43, 189-197.
- Rutter, B. (1977). Some psychological concomitants of chronic bronchitis. Psychological Medicine, 7, 459-464.
- Scharf, S., Bye, P., Pardy, R., & MacKlem, P. (1984). Dyspnea, fatigue, and second wind. American Review of Respiratory Disease, 129, 88-89.
- Schorr-Lesnick, B., Teirstein, A., Brown, L., & Miller, A. (1985). Pulmonary function in singers and wind-instrument players. Chest, 88(2), 201-205.
- Scovel, M. (1986). Personal communication.
- Sharp, J., Danon, J., Druz, W., Goldberg, N., Fishman, H., & Machnach, W. (1974). Respiratory muscle function in patients with copd: Its relationship to disability and to respiratory therapy. American Review of Respiratory Diseases, 110, 154-167.
- Sharp, J., Goldberg, N., Druz, W., Fishman, H., & Danon, J. (1977). Thoracoabdominal motion in chronic obstructive pulmonary disease. American Review of Respiratory Disease, 115, 47-56.

- Sonne, L., & Davis, J. (1982). Increased exercise performance in patients with severe COPD following inspiratory resistive training. Chest, 81(4), 436-438.
- Stoudenmire, J. (1975). A comparison of muscle relaxation training and music in the reduction of state and trait anxiety. Journal of Clinical Psychology, 31(3), 490-492.
- Straton, V. N., & Zalanowski, A. H. (1984). The relationship between music, degree of liking, and self reported relaxation. Journal of Music Therapy, 21(4), 184-192.
- Tateno, K., & Suzuki, I. (1982). Asthma music. British Journal of Music Therapy, 13(3), 2-10.
- Taylor, J. (1988). Personal communication.
- Tiep, B., Burns, M., Kao, D., Madison, R., & Herrera, J. (1986). Pursed lips breathing training using ear oximetry. Chest, 90(2), 218-221.
- Watson, P. J., & Hixon, T. J. (1985). Respiratory kinematic in classical (opera) singers. Journal of Speech and Hearing Research, 28, 104-122.
- Walton, J., Beeson, P., & Scott, R. (Eds.). (1986). The Oxford Companion to Medicine. Oxford, NY: Oxford University Press.
- Wynngarden, J., & Smith, L. (1985). Respiratory diseases: Diaphragm. In J. Wynngarden & L. Smith (Eds.). The Testbook of Medicine (pp. 452-457). Philadelphia: W. B. Saunders Company.