THE EFFECTS OF A BREATHING EXERCISE PROGRAM
ON THE
OBSERVED BEHAVIOR OF ASTHMATIC CHILDREN
by
CHARLES PARKS SCEARCE, B.S., IN PHYSICAL THERAPY
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LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table 1</td>
<td>Raw scores of pre- and post-study parent questionnaires</td>
<td>22</td>
</tr>
<tr>
<td>Table 2</td>
<td>Raw scores of pre- and post-study teacher questionnaires</td>
<td>23</td>
</tr>
<tr>
<td>Table 3</td>
<td>Significance of changes in parent and teacher questionnaires</td>
<td>24</td>
</tr>
</tbody>
</table>
CHAPTER I
INTRODUCTION

Figures from the United States Department of Health, Education and Welfare (1971) indicate that among individuals under 17 years of age who have some degree of limitation of activity and mobility due to chronic conditions, there are as many who suffer from asthma and hay fever as from all other conditions combined. In Texas alone, in 1973, Bronchitis, Emphysema, and Asthma, as a group condition, ranked tenth in cause of death at 14 per 100,000 estimated population according to the Dallas Morning News.

The American Academy of Pediatrics' Committee on Children with Handicaps says Bronchial Asthma is a chronic pulmonary disorder, frequently allergic in nature, and is characterized by paroxysms of dyspnea, wheezing, tightness in the chest, and bronchospasm. Asthmatic attacks may be minor and short in duration with little discomfort, or they may be very severe and of long duration, producing the characteristic picture of intractability. During symptomatic periods it is usually possible to demonstrate changes in certain aspects of pulmonary function. With mild symptoms, or between the episodes of severe asthma, the individual may be at little or no disadvantage in any or all activities. However, when the symptoms of pulmonary distress become severe or prolonged, these may lead to interruption of the child's daily routine, including school attendance.

From a school health director's point of view, Hill (1966) pointed out that asthma can and should be prevented because it is a crippling disease; it slows growth in infancy and early childhood,
causes many days lost from school, and retards learning in many instances. Occasionally, such children may become home- or hospital-bound for long periods of time.

Statement of the Problem

It is recognized (Dunn, 1973) that some asthmatic conditions may require a child to spend some time in a hospital or clinic or to attend a special class where the contributing factors to an asthma attack can be controlled. Otherwise the child with asthma should be able to attend regular school.

According to the American Academy of Pediatrics (1970) asthma is the leading medical cause for school absenteeism and probably contributes to inefficient school work due to chronic fatigue, irritability, decreased attention span, and secondary emotional disorders.

Studies and experimental programs have been conducted under close medical and psychological supervision to determine what factors influence the asthmatic child's lifestyle. Specific studies of physical conditioning, self-concept, cardiovascular efficiency, and pulmonary function have shown varied results on the improvement of symptoms. Sly (1972) stated that the effects of such programs in pulmonary physiology in asthmatic children have failed to detail objective benefit, but improvement in behavior and general psychological adjustments have generally been sufficient to convince many of the value of such programs.

Since most asthmatic children attend regular schools in competition with non-asthmatic peers, the general psychological adjustments derived from such a program would be of utmost importance.
This is a reasonable assumption, but to do date it has not been documented by the literature. Therefore, the basic problem undertaken in this study is to determine the impact of a physical conditioning program on the observed behavior of asthmatic children.
CHAPTER II
REVIEW OF THE LITERATURE

For more than four decades medical professionals and educators have been aware of the desirability of adapted physical activity patterns for exceptional children among whom would be asthmatic children. These asthmatic children need help in combating the effects of chronic bronchial asthma and in making an adequate adjustment (McElhenney, 1963).

Exercise programs, presumably of specific value for the asthmatic have appeared in the literature since 1935 (Livingstone, 1935). On the basis of the breathing program described by the Asthma Research Council (1962), there have been numerous reports of primarily subjective benefits (Baker, 1951), (Dorinson, 1954), (Fein, 1953; 1955; 1965), (Miller, 1954; 1958), (Schutz, 1955), (Wood, et al, 1970). The physical and psychological benefits of a general conditioning program to improve the level of overall physical fitness in the chronically ill asthmatic child were generally accepted, but it was not until the description by Scherr and Frankel (1958) that a physical conditioning program was recommended specifically for asthmatic children. Numerous reports since then (Strick, 1969), (Sly, et al, 1972), (Hirt, 1964; 1965), (Itkin, 1964; 1966), (McElhenney, 1963), (Millman, et al, 1965); (Peterson, 1965), (Sheer, 1968) have described various physical conditioning programs applicable to asthmatic children and adults. Yet, to date, little has been shown in the literature of the response of such programs on the asthmatic child's activities in school.

Common to most programs mentioned above that ascribe to breathing exercises as an adjunct to treatment in asthma, is the theory...
that these exercises are designed to improve ventilation by enhancing expiration. Wood and colleagues (1970) state this is accomplished by increasing intra-abdominal pressure and, thereby, elevating the diaphragm. Normally, according to Otis (1950), expiration is a passive act caused by the elastic recoil of the lungs and the thoracic cage. The asthmatic compensates for expiratory obstruction by hyperinflating the lung and thereby increasing its elastic recoil. This also depresses the diaphragm and makes it less efficient during inspiration. Increased abdominal pressure is achieved by voluntary contraction of the abdominal muscles. Campbell (1958) has shown that involuntary contraction of the abdominal muscles occurs only during vigorous hyperventilation. The asthmatic who does not employ abdominal expiration must be taught this maneuver. Several authors (Wood, et al, 1970), (Strick, 1969), (Scheer and Frankel, 1958) report that some children are able to abort, or reduce the severity of symptoms of an asthma attack by using the abdominal assisted diaphragmatic breathing exercises.

Miller (1954) states the net result of diaphragmatic breathing is an increased diaphragmatic excursion, therefore, more effective alveolar ventilation.

Effective alveolar ventilation during abdominal assisted diaphragmatic breathing is complimented by pursed lips during the expiratory phase. Pursed lips provide a resistance to the escaping air, higher than the ambient pressure, therefore, putting a positive pressure back onto the alveoli which are often partially collapsed by bronchospasm of adjacent bronchi.

Clinically, Miller goes on to say that it is apparent that
effective diaphragmatic training usually results not only in simple improvement of ventilation but also in a more effective cough mechanism with improved evacuation of bronchial secretions.

Improved evacuation of bronchial secretions according to Wood (1970) can be accomplished by postural drainage and percussion. This techniques consists of positioning the child so that the segment of the lung to be drained is uppermost and then clapping the thorax rhythmically with cupped hands to mobilize the secretions so that they may subsequently be expelled by coughing. To mobilize mucus during an attack or following an episode of status asthmaticus, the head-down position prone, right lateral, and left lateral is sufficient and less fatiguing than a more elaborate program of positioning.

Specific posture exercises described by Strick (1969) and also by Scherr and Frankel (1958) emphasized trunk and shoulder mobility. In the asthmatic child, the sternum is prominent, the shoulders are usually elevated, and there is often an associated exaggeration of the kyphosis of the thoracic spine. The abnormal configuration, according to Campbell (1958), is partly a result of the bony thorax assuming a "barrel" shape to accommodate the hyperinflated lungs, but it is also caused by increased tonus of the muscles of inspiration on a reflex basis. In addition, a frequently-associated round-shouldered appearance is the result of poor postural habits.

The American Academy of Pediatrics Section on Allergy, in their publication on exercises for asthmatic children, uses elbow circling, and windmill exercises to stretch the pectoral muscles and strengthen the intrascapular musculature, therefore reducing the kyphotic tendencies
occuring from habitual use of asessory muscles of respiration, and hyperinflation of the lungs. This, accompanied with lateral and forward bending of the trunk, tends to restore flexibility and mobility needed in the thorax for unrestricted diaphragmatic excursion.

Fein and Cox (1963) demonstrated the use of quiet-pursed lip breathing to re-educate asthmatic patients to use their lower chest for more efficient breathing. By use of hemithorax measurements, objective findings of equal expansion as well as increased mobility and expansion of the lower chest were obtained.

Relaxation techniques have been applied to some extent in the treatment of asthmatic patients. One of these techniques, desensitization, is employed when it is desired to train a patient to substitute an adaptive response, such as relaxation, to a stimulus that has evoked an unadaptive one (Tal, 1973). The relative simplicity of this technique and the brief time required to produce behavioral changes have led to experimentation employing this technique with a broad variety of patients. In treating asthma, Moore (1965) suggested that taking a patient through successive steps of relaxation and, more especially, reciprocal inhibition, i.e., teaching the patient to respond with relaxation to stimuli associated with an asthmatic attack, can subsequently alleviate bronchial obstructions. Alexander, Miklich, and Hershkoff (1972) experimentally demonstrated that systemic relaxation had an immediate beneficial effect upon the pulmonary functioning of asthmatic subjects. These investigators found that by training asthmatic children to relax using a modified form of Jacobsen's systematic relaxation technique, they were able to increase significantly the subjects' peak expiratory
flow rate. Alexander (1972), who replicated this study, similarly found immediate improvements in pulmonary functioning of asthmatic children following relaxation.

Pulmonary function testing has resulted in varying degrees of success when used as an evaluation of the efficacy of a physical conditioning or breathing program for asthmatic children.

Studies by McElhenney and Petersen (1963), Brundin (1973), Millman, et al (1965) resulted in significant increases in vital capacity, while Sly, et al (1972) showed no significant change in vital capacity after similar exercise programs. The same authors showed no significant changes in FEV₁, related to exercise. Heimlich (1975) showed improvement in pulmonary function values as compared to percentages of predicted values for 130 out of 15 subjects involved in a ten week program of breathing exercises.

The results of various studies with asthmatic children involved in breathing programs have often been subjective. In Heimlich's study (1975) parents subjectively evaluated their children as to improved exercise tolerance and attitude and severity and frequency of attacks. Sly, et al. (1972) reported that even though no significant changes in response to treadmill exercise was shown, parents of all but one child in his study reported improved exercise tolerance. Also, Brundin (1974) experienced subjective improvement with increased activities of daily living and increased exercise tolerance, but without significant changes in lung volumes and ventilation.

Further observations by parents of asthmatic children who have participated in fitness programs, as reported by Petersen and
McElhenney (1965) mentioned marked reduction in the number and severity of asthma attacks and a definite increase in exercise tolerance. Fifteen out of 16 mothers stated that emotional upsets had decreased and half of the mothers in the study stated that the overall improvement in their asthmatic child had been excellent.

Millman, et al (1965) in an attempt to evaluate adjustments by asthmatic children during a controlled exercise study, obtained information from the children's school teachers. Each subject's teacher was supplied with a questionnaire to obtain information regarding the subject's ability to (1) demonstrate leadership, (2) demonstrate self-composure, (3) play or work by himself, (4) get along with others, (6) feel accepted by others, (7) demonstrate enthusiasm, and (8) demonstrate the capability to be a follower. These questions were asked regarding the student's behavior in the classroom and the same questions were also asked regarding the student's ability in physical activity. Questions were graded on a scale of Very Poor, Poor, Good and Very Good. The teachers were requested to evaluate the child prior to the exercise program and at its conclusion. The most significant improvement in the classroom, according to Millman's findings, was in the area of ability to demonstrate self-composure. Here the group mean moved from Poor to Good. The teachers also reported improvement in the areas of getting along with others, feeling accepted by others, demonstrating enthusiasm, and demonstrating capability to be a follower. There was no change in the areas of demonstrating leadership, playing or working by themselves, or having respect for other students. In physical activity, improvement was reported by the teachers in all areas with the exception of the
ability to be a follower. In that category there was no change reported.

Petersen and McElhenney (1965) reported 185 school days missed because of asthma as compared with 69 school days missed because of asthma for the same subjects after a fitness program was initiated. The resultant marked decrease of school days missed because of asthma by participants in such programs has implications for all concerned with asthmatic children's physical well-being, academic progress, and social adjustment.

Mascia, et al (1971) summarizes well when he says,

The goal in the education of our asthmatic children is to provide them with a maximum feeling of control over their own care and a greater sense of independence in terms of handling their physical crises.
CHAPTER III

METHODS AND PROCEDURES

The study was originally intended to accommodate 20 boys and girls between the ages of 8 and 12, who suffered from moderate to severe bronchial asthma, or with a history of recurrent episodes of generalized airway obstruction. The number of subjects in this study was low due to the limitations placed upon the researcher by space for activity sessions. Twenty-two applications were received by the West Texas Chapter of the American Lung Association, the co-sponsors of this project, by way of written referral from their family physicians or pediatric allergists. Twelve boys and ten girls, mean age 10.4 years, were allowed to participate, since the applications numbered 20 and above were received on the deadline day. A registration fee of $10.00 was charged to help defray the cost of the program and to obligate participants to attend regularly. In cases where the individual was unable to pay, the American Lung Association absorbed the cost.

The program was made up of ten, one and one-half to two-hour sessions occurring on consecutive Saturday mornings. The title of the ten-week program was the "Buckin' Bronchos Asthma Clinic," named after Scheer and Frankel's (1958) pilot program. All of the sessions took place in the physical therapy gym of Texas Tech University School of Medicine's Department of Physical Medicine and Rehabilitation. Medical direction and assistance, by a Physiatrist and Pediatric Allergist, was available at all times, although they did not actively participate every Saturday morning.

The atmosphere surrounding the program was casual during each
session, rather than one of medical treatment. Sheer and Frankel (1958) stressed the fact that the child's interest must be kept active for such a program to be beneficial. Music was utilized during several of the sessions while the children were performing exercises. Scheer (1958) found that this created more interest and lessened fatigue compared to the exercises being performed as a "gym" activity.

The first of the ten sessions in the "Buckin' Broncho Asthma Clinic" was an orientation session at which time the parents as well as the students attended. During this session, a brief overview by the medical director gave the participants and parents the medical implications of such a program, including etiology, treatment theory, and program goals.

The goals of the program included (1) improvement of respiratory function, (2) improvement of exercise tolerance, and (3) the improvement in self-concept.

Patient diary forms (Crisp, 1974) were also introduced to the group by the medical director. These forms (Appendix A) were used to keep a daily home record of the symptoms of asthma displayed by the child both during the day and at night. Day symptoms consisted of wheezing, breathlessness, tightness, cough, and number of asthma attacks. Night symptoms consisted of wheezing, breathlessness, tightness, cough and times awakened by asthma. Scoring of chest symptoms was on a 0 - 6 scale as shown below:

0 = none
1 = trivial or doubtful
2 = mild, clearly present, but causing little or no discomfort
3 = annoying, but not causing marked discomfort
4 = moderately severe, causing marked discomfort, but not interference with routine
5 = severe, some interference with sleep activity, but not incapacitating
6 - very severe - intolerable

The second part (Appendix B) or the reverse side of the patient diary form gives a record of the medications the student was taking as prescribed by his family physician. This information was not considered for research in this study, but proved helpful in evaluating symptomology.

A third portion of the form was included to show the days the child performed his breathing, posture and fitness exercises that were to be taught during the study.

The diary form was started on the day of the first session, although actual sessions specifically dealing with breathing and conditioning exercises would not start for 14 days. This allowed for a baseline behavior to be established.

Also, during the first session, a questionnaire (Appendix C) was given the parents regarding interpretations of their child's symptomology, peer relationships, and several characteristics of his school interaction. This questionnaire was filed until the end of the 10-week study when the parents then responded to a similar post-clinic questionnaire.

During the first week of the clinic, a questionnaire was also sent to the classroom teacher of each of the program participants.
Return envelopes were enclosed as was a cover letter explaining the purpose of such a questionnaire. Seventeen out of 22 pre-clinic questionnaires were returned.

The teacher questionnaire (Appendix D) chiefly looked for the teacher's interpretation of the way the student managed his asthma at school. In both the areas of peer interaction and individual performance the child should have shown changes if the goal of improvement of self-concept was to be attained. As with the pre-clinic parent questionnaire, the pre-clinic teacher questionnaires were filed in order to avoid influencing the interim sessions.

The second session of the "Buckin' Bronchos Asthma Clinic" went into the pulmonary function testing as well as the psychological self-concept studies. Because of the age range of the participants in the study, self-concept or personality studies could not be used. In an attempt to determine the improvement in self-concept as a result of the improved physical fitness, the CLOE-C Scale (Miller) was administered. This test proved to be targeted for a more cognitively mature population than those of the younger limits of this study; therefore, it was abandoned for purposes of this study.

Pulmonary function studies were to be performed on each of the participants in the program before and after the exercise sessions of the study. These tests were done in order to assess the functional conditions of the lungs of each child to see if the exercise program produced any significant effect. (Appendix E.)

The tests done included spirometry, dynamic volumes, and functional residual capacity. These were calculated and subsequently gave information as to total lung capacity, volumetric distribution,
and flow rates. All values obtained were plotted against normal values according to age, height and weight for each child.

The spirometry and dynamic volumes measurements were determined with the use of a Collins 9 liter spirometer. Vital capacity and forced vital capacity were both determined in duplicate and the better of the two efforts taken for reporting. Corrections for temperature and barometric pressure were made on all results. Vital capacity is the amount of air a person can expel from his lungs after having taken the deepest possible breath. Forced vital capacity is the same except that a forceful effort is made on expiration. How fast the air flows out of the lung is another prime consideration, especially in asthmatic children.

The physical activities which included breathing, posture and conditioning exercises started during the third and fourth sessions. Breathing exercises were modeled after those published by the American Academy of Pediatrics, Section on Allergy, and those described by Strick (1969). These exercises as well as relaxation techniques and additional abdominal and posture exercises were bound into a booklet which each parent and child received as a reference workbook for the program (Appendix F).

Exercises during the third and fourth sessions concentrated on specific breathing techniques which would help to restore normal breathing mechanisms in these asthmatic children. Parents were excluded from the first few sessions until the children were able to master each of the techniques presented to them. Only at this time were the parents allowed to attend the classes. This was done because it was
observed early in previous programs conducted by this researcher, that the presence of the parents would distract the child from performing to the best of his ability. This decision was made after observations of negative nodding of the parent's head or a cross look at the child that would completely demoralize him and actually prevent him from even attempting to perform the activities. This is a partial, temporary form of what Sheer (1958) compares to the practice of "parentectomy" as advocated by the Jewish National Home for Asthmatic Children in Denver.

The basic breathing techniques taught during these sessions were designed to improve ventilation, correct postural deformity and increase the mobility of the thorax. The first maneuver the participants were shown was that of abdominal breathing. (Appendix F3.) This exercise, or breathing technique, is done laying on their backs with their knees bent, feet on the surface, or with legs straight and completely relaxed. Hands are on the abdomen. While breathing in through the nose, the child feels the abdomen pop out; then, when he breathes out slowly, through partially-closed lips, making a hissing noise, the abdomen is felt to go down. This gives the child an idea of how the abdominal muscles help expel air from the lungs.

Breathing out through partially-closed lips or pursed-lip breathing (Appendix F3) is a method used to provide a positive pressure against the lungs. This positive pressure, i.e., higher than ambient pressure, will help keep open the alveoli which are often closed due to bronchospasm or increased mucus secretions that are associated with bronchial asthma. Allowing the students to make a hissing sound reinforced the technique of positive pressure expiration.
For the technique of abdominal breathing to become an exercise, a book was placed on the abdomen rather than the hands. (Appendix F4) Upon inspiration, as the abdomen expanded, the child tried to forcefully inspire so that the book fell off the abdomen. Then this is immediately followed with expiration using pursed-lip expiration and contraction of the abdominal muscles.

The entire portion of these first two activity sessions were not devoted entirely to exercise and breathing techniques, but were paced by intermittent periods of organized play. Games organized by physical educators working with the study provided the necessary break from the learning sessions. The games also served as a stressful activity which was useful in later sessions to force the children to use the techniques they had learned to control dyspnea. All games were done without emphasis on competition, even in the team form. Because of the age differential in this study group, this point became even more important.

Also, in the fourth session, lateral costal breathing and relaxation techniques were taught. Lateral costal breathing (Appendix F5) was done in two exercises, finger-tip breathing and towel pull (named so as to appeal to the child). During finger-tip breathing, the tip of the fingers touched with the hands flat on the abdomen, at the lower edge of the ribs. As the child inspires, the lateral ribs expand, therefore spreading the distance between the finger tips. Towel breathing was done by wrapping a bath towel around the lower chest and holding it firm against the chest. When the child breathed in with emphasis on abdominal and lateral costal action, the towel became tighter; then on expiration, it slackened.
Relaxation of the accessory muscles of respiration, that are so often recruited during an asthma attack, was especially important. The sternocleidomastoid, platysma, and scalines of the cervical area were brought to the child's attention with caution as to the lack of benefit and energy consumption that breathing required with this musculature.

Other relaxation techniques (Appendix F6) were taught the children in the form of rest positions. When the child would feel short of breath after play activity, exercise, running, or at the start of an asthma attack, he was instructed to sit or lay in a rest position, to relax, and to begin doing the breathing exercises he had already learned. As the program progressed, it became the responsibility of the student to drop out of an activity when dyspnea became pronounced, to assume a rest position, and to start breathing properly in order to help abort an episode of asthma. He then could return to the activity as soon as possible without interrupting the flow of the game. The rest positions used in this study were devised and taught to the children with the idea that no matter where the child was when an episode of labored breathing occurred, he would always inconspicuously start precise breathing techniques while in any type of environment.

Midway through the ten-week study, the parents as well as the children attended a session on postural bronchial drainage (Appendix G inclusive). The purpose of bronchial drainage is to facilitate removal of secretions with the aid of gravity from a peripheral portion of the lungs into the larger bronchi (Young, 1976). With asthma, increased secretions in the bronchial tress must be removed if proper breathing
is to occur. Therefore, both the children and parents were taught the positions which would aid in drainage. They were also instructed in coughing techniques to project mucus plugs from the proximal bronchi.

The first patient diary form was exchanged during this session for a second diary form to be tallied over the next thirty-day period. Collection and initiation of a new diary form during a session when parents were in attendance reassured adequate followup.

Posture exercises (Appendix F7-9) were incorporated into the study along with the exercises already learned during the sixth session. Many asthmatic children exhibit characteristic changes of the thorax consisting of marked increase of the anteroposterior and traverse diameters of the upper chest with some drawing in of the lower ribs and rib cartileges at the lower end of the sternum (Strick, 1969). With the correction of the underlying pathology, i.e., improper breathing techniques, the chest deformity should not be permanent. Hence, exercises designed to produce musculature relaxation, increased mobility of the thorax, increased flexibility of the shoulder girdle, and improved posture are important adjuncts to the comprehensive treatment of the asthmatic child.

The seventh and eighth sessions were used to put all of the techniques into practice by taxing the subjects during strenuous games and allowing them to independently assume rest positions, begin breathing properly, and then return to the activity.

The ninth session was devoted to post-clinic pulmonary function studies. Due to the length of time for each study, students from out of town were given priority to testing on that day and other students were
allowed to make appointments for post-clinic testing.

Graduation ceremonies for the "Buckin' Bronchos Asthma Clinic"
took place on the tenth and final session. Certificates (Appendix H)
of completion of the course were awarded to each child by an acclaimed
football coach from the local university team. The students were also
complimented on their performance and reassured that they must now put
into practice the things that they had learned during the clinic.

The parents also in attendance during the graduation ceremonies
completed a post-clinic questionnaire as mentioned earlier.

During that same week, the classroom teachers who responded to
pre-clinic questionnaires were asked to respond to a second questionnaire
as before, with regard to the student's present behavior.
CHAPTER IV

RESULTS

Both the parent and teacher questionnaires, pre- and post-study, had response choices of Excellent, Good, Fair, and Poor. For purposes of statistical examination, these alternative responses were given numerical values of 4, 3, 2, and 1 respectively. Raw scores were obtained by multiplying the number of responses for each alternative times its numerical representation. These values were then used in the form of a t test based on the assumption the two (i.e., pre- and post-) compared groups have the same deviation since they are, under the null hypothesis, samples of the same distribution (Ipsen and Feigl, 1970). Table 1 shows the raw scores for the pre- and post-study parent questionnaires calculated as mentioned above. Table 2 shows the raw scores for the pre- and post-teacher questionnaires computed under the same principle. Only ten subjects' questionnaires were complete for pre- and post-parent and teacher.

As shown in Table 3, the t value for the parent's questionnaires was significant at the .05 level. While the t value for the teacher's questionnaire was significant at the .01 level.

The mean change and standard deviations for both variables were calculated in the standard manner.

Percentile changes in the children's behavior, as calculated by changes reported in pre- versus post-parent and teacher questionnaires, were computed by recording only changes and not the magnitude of changes between the responses of excellent, good, fair, or poor.
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Table 2
RAW SCORES FOR PRE- AND POST-STUDY TEACHER QUESTIONNAIRES

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Table 3
SIGNIFICANCE OF CHANGES IN PARENT AND TEACHER QUESTIONNAIRES

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*All change scores were calculated by subtracting the pre-study questionnaire raw score from post-study questionnaire raw scores.

**For 18 degrees of freedom a t value of 2.10 is significant at the 0.05 level and a t value of 2.10 is significant at the 0.01 level (Ipsen and Feigl, 1970).
CHAPTER V
DISCUSSION

Although there is now considerable evidence that breathing exercise classes, emphasizing the child's independence in the management of the disease process, have definite implications for behavior in the home and school, there is little agreement on the extent to which this behavior occurs and the precise role of such a program in the school in expediting behavioral change.

According to Puthoff (1972) children with chronic respiratory conditions were severely restricted in their physical activities between attacks. The majority of these children were excused totally from physical education regardless of the severity of their condition. This has occurred for a number of reasons.

Fear and anxiety often accompany the attack unless the child has had training in coping with the attack. This study reports a 50% improvement in the child's ability to manage his asthma at school as measured by teacher questionnaires. Furthermore, 70% of the children improved in the degree of independence they exhibited during a severe asthma attack, as reported by parent questionnaires.

As did Brundin (1973), Sly, et al (1972) and others, even though measurable data was not obtainable in certain areas or it was not consistent with the outcome, parents in this study still reported increased activities of daily life, posture, and breathing.

Reports from parent questionnaires boasted improvements in the posture of 60% of the children who went through the study. The
breathing ability, as evaluated by parents, improved 60% during the same time period.

Participation by the children involved in the program during recess or play activity at school improved 60%, and the most dramatic improvement, with possible implications for the child's academic performance, was a 70% improvement in the child's ability to stand before the class.

Patient daily diary forms were used to compare symptomatology subjectively with the results of the questionnaires. Again, subjective evaluation of symptoms reflected no impressive gains; yet, parents and teachers reported benefit.

This information compared with the results of the pulmonary function studies showed only very slight improvement in vital capacity and one second forced expiratory volume, again consistent with previous literature.
CHAPTER VI
SUMMARY AND CONCLUSIONS

This study investigated the effects of a breathing exercise program on the observed behavior of asthmatic children. The statistical value of the data derived from questionnaires administered to the parents and teachers proved to be highly significant. Percentages of change on certain items suggest an optimistic educational outlook for asthmatic children, who regardless of academic potential, do not progress normally because of school absence or illness while at school.

Results of this study tend to suggest even more implications related to the classroom. If the child's ability to stand before the class has improved, following a program such as this one, other factors related to this type of behavior might also improve. This increased ability to stand before the class may possibly reflect the child's potential performance in relation to other activities or more academic consequences, i.e., completion of school work, more active participation in extracurricular activities, and more active participation in class discussion type interactions. The fact that teachers and parents observed an increased ability in independence, on the part of the child, in managing himself during an asthma attack, leads one to wonder if the child might then be more confident of his participation in many class activities which before produced a threat of interruption by labored breathing. For example, with a decreased threat of labored breathing, one would be left to wonder what bearing this possibility of increased social confidence would play upon the student's performance in group
achievement testing. Without dyspnea, anxiety of impending dyspnea, or the social stigma of leaving the test due to an asthma attack, the child's confidence and attention would therefore be devoted to the test instrument.

Additional research is necessary to support the implications already cited in relation to actual academic performance, using control children and basing the research in the school setting. A study similar to the present one should be undertaken, for this may make possible more precise conclusions as to the relationships among self-concept, psychodynamic factors, such as internal-external locus of control, and emotional variables manifested during the program. Also, further investigation is needed regarding the idea of possible implied progress of the asthmatic child due to the increased awareness of the child's condition on the part of the parents and teacher. That is, could the positive attitudes expressed by the parents and teacher be such that the child felt more comfortable with his daily activities? Or, because the child was a participant in a program for asthmatic children, the parents' and teachers' anxiety related to anticipation of an asthma attack may not have been communicated to the child. If this speculation were true, then the program model would need to include methods of asthma management oriented towards parents and teachers. This would then encompass the hypothesis of improving the child's physiological, psychological, and sociological behavior as well as laying the groundwork for improving parent and teacher attitudes.

Inasmuch as industrial and agricultural factors tend to play predisposing roles in symptomatology, a similar study in a different climate and at a different time of the year might produce additional
data related to this chronic health problem in children.

The potential worth of such a program can therefore be recognized. It should be inexpensive to implement within a school physical education program, with great dividends not only measurable in dollars and cents, but also in its contribution to the welfare and happiness of deserving children. The feasibility of remedial physical education programs with their carry-over to other areas of adjustment in school children's lives should be considered by school boards, with encouragement and counsel from physicians and other qualified personnel.
LIST OF REFERENCES


American Academy of Pediatrics, Section on Allergy, Exercises for Asthmatic Children.


Hirt, M. "Physical Conditioning in Asthma II," International Archives of Allergy, 26: 191.


Miller, James O. CLOE - C Scale, George Peabody College for Teachers.


**PATIENT DIARY FORM**

**SYMPTOMS**

Please enter night scores on waking; enter day scores before retiring.

Month in which the Diary was kept: [ ]

<table>
<thead>
<tr>
<th>SYMPTOMS</th>
<th>Enter Here the Days of the Month in which the Diary was kept</th>
<th>Please Leave Blank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheeze</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Breathlessness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tightness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cough</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Times Awakened by Asthma</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>During Night</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheeze</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Breathlessness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tightness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cough</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. of Asthma Attacks</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Chest Symptoms - Grade on a 0-6 scale as shown below:

- 0 = None
- 1 = Trivial or doubtful
- 2 = Mild, clearly present but causing little or no discomfort
- 3 = Annoying but not causing marked discomfort
- 4 = Moderately severe, causing marked discomfort but not interfering with routine
- 5 = Severe, some interference with sleep activity but not incapacitating
- 6 = Very severe - intolerable

Blank = Don’t know
## MEDICATIONS

<table>
<thead>
<tr>
<th>Current Anti-Asthma Drugs</th>
<th>No. Mg. per Dose</th>
<th>Enter here the Days of the Month this Diary was kept</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
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<tr>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### EXERCISES

<table>
<thead>
<tr>
<th>EXERCISES</th>
<th>Enter here the Days of the Month this Diary is kept</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breathing Exercises</td>
<td></td>
</tr>
<tr>
<td>Posture Exercises</td>
<td></td>
</tr>
<tr>
<td>Fitness Exercises</td>
<td></td>
</tr>
</tbody>
</table>

**INSTRUCTIONS** Place an "X" in the square each day the child completes the specified exercises.
<table>
<thead>
<tr>
<th></th>
<th>Excellent</th>
<th>Good</th>
<th>Fair</th>
<th>Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Your child's appetite is:</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>2. Your child's normal daily activity:</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>3. Your child's posture:</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>4. The degree of independence your child handles his own medicine is:</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>5. The degree of independence your child shows during a mild asthma attack is:</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>6. The degree of independence your child shows during a moderate asthma attack is:</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>7. The degree of independence your child shows during a severe asthma attack is:</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>8. Your child's relationship with other children at school or at play is:</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>9. Your child's breathing ability is:</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>10. The degree of improvement you expect from your child's participation in this clinic:</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>11. Your child's leadership characteristics are:</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>12. Your child's school attendance is:</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>13. Your child's relationship with his teacher is:</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>14. Your child's self-composure during daily activities is:</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>15. Your child's self-composure during an asthma attack is:</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>16. Your child's ability to get along with others is:</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>17. The degree to which your child is accepted by other children is:</td>
<td>x</td>
<td>x</td>
<td>.</td>
<td>x</td>
</tr>
<tr>
<td></td>
<td>Excellent</td>
<td>Good</td>
<td>Fair</td>
<td>Poor</td>
</tr>
<tr>
<td>---</td>
<td>-----------</td>
<td>------</td>
<td>------</td>
<td>------</td>
</tr>
<tr>
<td>18. The degree to which your child is accepted by other teachers, coaches, etc., is:</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>19. Your child's ability to raise questions at home is:</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>20. Your child's participation in hobbies-extra curricular activities is:</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>
APPENDIX D

Please complete the following questions by one response, ranging from excellent to poor:

<table>
<thead>
<tr>
<th>Question</th>
<th>Excellent</th>
<th>Good</th>
<th>Fair</th>
<th>Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. School attendance is:</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>2. Student's ability to manage his asthma at school is:</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>3. Student's ability to display leadership is:</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>4. This student is able to modify his behavior to function with his asthma to what degree:</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>5. Student's ability to work with general class objectives without modification due to asthmatic conditions or symptoms:</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>6. Student's ability to complete assigned work on time is:</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>7. Student's ability to raise questions is:</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>8. Student's ability to stand before class in a group is:</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>9. Your contact with the student's parents is:</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>10. The frequency of your contacts with the student's parents is:</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>11. Participation by this student during recess or play activity is:</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>12. Peer interaction by this student is:</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>13. Degree to which student manages his own asthma medications at school is:</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>
## APPENDIX E
TEXAS TECH UNIVERSITY SCHOOL OF MEDICINE
DEPARTMENT OF PHYSIOLOGY
PULMONARY FUNCTION LABORATORY

**AME**

**REFERRED BY**

**PATIENT #**

**DATE**

**SEX**

**WEIGHT, ACTUAL**

**HEIGHT**

**ESTED:**

**AGE**

**WEIGHT, IDEAL**

**BSA, IDEAL**

## ALL VOLUMES AND CAPACITIES IN LITERS, BTPS

<table>
<thead>
<tr>
<th>TEST</th>
<th>PREDICTED</th>
<th>OBSERVED</th>
<th>% OF PRED.</th>
<th>OBSERVED</th>
<th>% OF PRED.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vital Capacity (VC)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inspiratory Capacity (IC)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IC as % of VC</td>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>EXP. Reserve Volume (ERV)</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Residual Volume (RV)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RV as % of TLC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Functional Residual Capacity (FRC)</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>FRC as % of TLC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F/P Predicted TLC %</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Total Lung Capacity (TLC) He</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forced VC (FVC)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EV-1 (Liters/Sec.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EV-1 as % Best VC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MEF (Liters/Sec.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Compliance (Ct) L/cm. H2O</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oxygen Consumption L/min</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vent. Equivalent for O2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LCO mLCO/1mm/min</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**ow Patient Feels Prior to Testing:**

<table>
<thead>
<tr>
<th>Poor</th>
<th>Fair</th>
<th>Good</th>
<th>Excellent</th>
</tr>
</thead>
</table>

**ow Patient Feel After Bronchodilator:**

<table>
<thead>
<tr>
<th>Poor</th>
<th>Fair</th>
<th>Good</th>
<th>Excellent</th>
</tr>
</thead>
</table>

**ow Patient Feels After Exercise:**

<table>
<thead>
<tr>
<th>Poor</th>
<th>Fair</th>
<th>Good</th>
<th>Excellent</th>
</tr>
</thead>
</table>
EXERCISES FOR ASTHMATIC CHILDREN

DO YOU KNOW HOW TO BREATHE?
ASK A "BUCKIN BRONCHO"
PREFACE TO PARENTS

The asthmatic child tends to develop faulty breathing habits and loses the mobility of his lower chest. His upper chest becomes overworked, and he needs to learn to increase the movement of his lower chest. The abdominal muscles must be trained to assist the diaphragm in some of the work of breathing, enabling the asthmatic child to breathe more easily and efficiently.

The improvement in respiratory function demonstrated in normal children after exercise has encouraged pediatric allergists to add breathing exercises to the total treatment program for asthmatic children. The goals sought are:

1. To teach the child the basic breathing exercises for the maximum use of respiratory muscles, especially the diaphragmatic muscle,
2. To learn to use these exercises to stop an asthmatic episode early,
3. To improve exercise tolerance and correct postural defect,
4. To develop self-confidence.

These breathing exercises will have to be taught to the child initially by the physician or therapist. This booklet is designed to help children institute and maintain correct breathing patterns. The exercises are most beneficial when performed daily, preferably on arising and before bedtime.

It should be emphasized that these breathing exercises are not curative; but, they represent an additional aid in the entire management program needed to prevent recurrence of asthma in children.
BREATHING EXERCISES

The way to start is:
1. Lie down on the floor
2. Bend your knees and keep your feet on the floor
3. Put one hand on your abdomen, and the other hand on the top of your chest.

Now . . . take a deep breath . . . and let it out . . . slowly. Watch your abdomen go out like a balloon, and your chest stay still.

When you take a deep breath, breathe in through your nose and blow out through your lips holding them slightly closed. This is called pursed lip breathing.
When you blow air out with pursed lips you are able to blow out more air.

BOOK LIFT

Now, just for fun, put a book on your abdomen.

See if you can make the book fall off as you take in air and make your abdomen round. Your abdomen should get flat again as you blow all the air out through pursed lips. Remember to keep your chest and neck still.
FINGER TIP BREATHING

Place your finger tips together against your lower ribs. As you take in a deep breath the finger tips go apart since the ribs expand. Now blow the air out through pursed lips and watch the fingers go back together.

TOWEL BREATHING

Place a towel around the chest at the lower part of the ribs and pull it together snugly by crossing the arms to grasp the ends of the towel. The towel should be tight when you take a deep breath, and should go slack when you blow the air out through pursed lips.
REST POSITIONS

When you feel short of breath after exercise, running or at the start of an asthma attack, sit or lay in a rest position to relax and start doing the breathing exercises you have learned.

Remember, breathe in through the nose, then blow all the air out through the mouth slowly, keeping your chest still. Breathing this way will make you feel better and less tired.
POSTURE EXERCISES

Posture is very important to keep the chest moving freely so that air can get in and out of the lungs. The muscles of the chest, shoulders and back must be strong yet must move easily.

SHOULDER EXERCISES

Pretend you are a windmill and swing your arms in a big circle in one direction and then the other. This will help loosen and strengthen the shoulder muscles and the chest muscles.
Now pretend you are a small windmill with your elbows being the end of the windmill arms. We will call this elbow circle.

ELBOW CIRCLE

BACK EXERCISES

The back muscles keep you standing straight and tall. Try putting a book on the top of your head and walk so that it does not fall off. You must keep a good posture by remembering to stand up straight with your shoulders relaxed.
Now lie face down with your arms at your side. Try lifting your head and legs as high as possible and rock back and forth like a rocking horse. Do this exercise on a rug to comfort your stomach. This exercise will strengthen your back muscles and loosen your chest.

**ROCKING HORSE**

![Rocking Horse Illustration]

Stay in the same position but with your arms straight out from your body, like a swan diver. Try to lift your chest off the floor as high as possible as if you were doing a swan dive. Your feet should stay close to the ground.

**SWAN DIVE**

![Swan Dive Illustration]
LOW BACK EXERCISES

Your back has a natural curve that develops as you grow. Sometimes because of bad posture these curves become increased. This causes problems when you try to breathe properly. So do this wall sliding exercise for good back posture.

1. Starting position:
   (A) Heels 3 inches from wall with legs spread comfortably apart.
   (B) Bottom touching the wall with muscles tightened.
   (C) Shoulder blades pulled together and touching the wall.

2. Keep chin tucked in and bend knees until small of back touches the wall.

3. Straighten knees holding small of the back against the wall. Be sure to keep chin tucked in with the back of the head touching.
Position 1. Upper Lobe
Lean back 20° while sitting.
Clap over collar bone, both sides.

Position 2. Upper Lobe
Lean forward 20° while sitting.
Clap over both shoulders.

Position 3. Upper Lobe
Lying, face up, with bed level, clap just below collar bone, halfway between neck and shoulder.

Position 4. Upper Lobe
Lying on left side, 3/4 turn toward face down, bed level, clap over the right shoulder blade.
Position 5. Lower Lobe
Face down, with bed level, clap just below the shoulder blades.

Position 6. Upper Lobe
Lying on right side, 3/4 turn toward face down, bed level, clap over the left shoulder blade.

Position 7. Lower Lobe
Lying face up with foot of bed elevated 12” - 14”, clap over the lower ribs.
Lying on left side with foot of bed elevated 12" - 14", clap over the lower ribs.

Position 9. Middle Lobe
Lying on left side and rolling 1/4 turn back onto pillow, while foot of bed is elevated 12" - 14", clap over the right upper chest at the angle of the shoulder.

Position 10. Lower Lobe
Lying on right side with foot of bed elevated 12" - 14", clap over lower ribs.
Position 11. Middle Lobe
Lying on right side and rolling 1/4 turn back onto pillows while the foot of the bed is elevated 12" - 14", clap over the left upper chest at the angle of the shoulder.

Position 12. Lower Lobe
Lying face downward across a bed or table while the upper part of the body hangs toward the floor, clap over the lower ribs.
Buckin' Bronchos

Physical Fitness Class for Children with Breathing Problems
Certificate of Attendance

This is to certify that ____________________________
has attended the course in Physical Fitness and Breathing Exercises—
offered by the West Texas Area, American Lung Association, of
Texas in cooperation with Texas Tech University, and Texas Tech
University School of Medicine—

_________________________  ___________________________
Medical Director  Area Director
W.T.A. American Lung Assn. of Texas