A STUDY IN THE CORRECT USE OF THE DEVILBISS NEBULIZER 40

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INTRODUCTION

CHAPTER I

INTRODUCTION

The therapeutic use of inhalations dates at least as far back as the oldest written medical history. Hippocrates advocated the use of aerosols and described how they were to be administered. A reed was placed through a lid into a boiling pot, and the patient put moist sponges in his mouth to prevent scalding while he inhaled the vapors. Today the use of aerosols is recognized as an essential part of the treatment of various acute and chronic respiratory disorders. In order for aerosols to be effective, they must be administered properly; and to accomplish this, individuals must be taught the proper mode of treatment.

Today, the goal of physicians and nurses is no longer to do something <u>to</u> the patient, but to work <u>with</u> the patient in order to promote self-care. It is generally agreed that the teaching of patients is an essential component and independent function of nursing practice. It has been included in the American Nurses' Association statements on functions, standards, and qualifications for practice. The International Council of Nurses has endorsed health teaching as an essential

part of nursing practice.[1]

Since nebulization of aerosols is recognized as an essential part in the treatment of the respiratory patient, it was the intent of this investigation to study the use of a hand powered nebulizer by chest clinic outpatients in the clinic setting. A teaching plan was formulated and implemented, and its results were evaluated.

Statement of the Problem

The problem of this study was to determine if outpatients in a chest clinic had a knowledge of the correct use of the DeVilbiss Nebulizer 40.

Purposes

The purposes of this study were:

1. To develop a checklist of criteria indicative of correct use of the DeVilbiss Nebulizer 40 which could be used as a tool to assess the patients' knowledge.
2. To determine if outpatients in a chest clinic were using the DeVilbiss Nebulizer 40 correctly.
3. To determine if a one-to-one teaching session influenced the patients' method of self-treatment with the DeVilbiss Nebulizer 40.
4. To determine most frequently made errors in the use of the DeVilbiss Nebulizer 40.

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[1]Mary Lock Palm, "Recognizing Opportunities for Informal Patient Teaching," Nursing Clinics of North America, VI (December, 1971), 669.

Background and Significance

Many adults suffer from a group of chronic, often progressive, respiratory disorders which seem related but have no single cause. Chronic obstructive pulmonary disease is a term which applies to those patients with emphysema, chronic bronchitis, or asthma. In any case, there is an obstruction to air flow.[1] Despite the progress in decreasing the incidence of contagious respiratory disorders, there has been a sharp rise in the incidence of asthma, chronic bronchitis, and emphysema in the United States and other industrialized countries. Emphysema is now the second leading cause of disability and killing more people than ever before.[2] The estimated incidence of bronchial asthma in the United States is 2.3 per cent of the population, and the average death rate from this disease is 1.5 deaths per 1,000 population per year.[3]

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[1] Chronic Obstructive Pulmonary Disease - A Manual for Physicians, James F. Morris, Chairman (New York: National Tuberculosis and Respiratory Disease Association, 1972), p. 11.

[2] Ruth Brecher and Edward Brecher, Breathing... What You Need to Know (New York: National Tuberculosis and Respiratory Disease Association, 1968), p. 63.

[3] The Committee on Therapy American Thoracic Society, Management of Status Asthmaticus (New York: National Tuberculosis and Respiratory Disease Association, 1968), p. 3.

In patients with bronchial obstruction, bronchodilator agents given by aerosol are most effective.[1] [2] [3] There is no doubt that the treatment of various bronchopulmonary disorders has been facilitated by the use of aerosols.[4] Full use of the spectrum of nebulization therapy is seen in the treatment of patients whose airways are constricted, congested, edematous, or obstructed.[5]

The unique use of nebulization is that of delivering small amounts of topical agents to the depths of the lungs. Since sympathomimetic bronchodilators are potent enough to have a topical effect in minute amounts, the fine aerosol will produce effective bronchodilatation with minimal systemic reaction. The ultimate goal is to obtain both a bronchodilator and decongestant effect in the airways ranging from

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[1]Mary G. Helming, "Nursing Care of Patients with Chronic Obstructive Lung Disease," Nursing Clinics of North America, III (September, 1968), 416.

[2]The Committee on Therapy American Thoracic Society, Management of Status Asthmaticus, p. 3.

[3]Morris, Chronic Obstructive Pulmonary Disease, p. 78.

[4]Frank W. Lovejoy and Paul E. Morrow, "Aerosols, Bronchodilators and Mucolytic Agents," Anesthesiology, XXIII (July - August, 1962), 465.

[5]Ivan E. Cushing and William F. Miller, "Nebulization Therapy," in Respiratory Therapy, ed. by Peter Safar (Philadelphia: F. A. Davis Company, 1965), p. 171.

the periphery of the lungs up to at least the medium sized bronchi.[1] The spectrum of aerosol therapy ranges anatomically from the smallest to the largest airways; physically from fine, relatively dry aerosols to dense humid mists; and pharmacologically, from bland aqueous solutions to extremely potent drugs.[2] Substances which are commonly used in nebulization therapy of the respiratory tract are: bronchodilators and decongestants which are mainly sympathomimetic drugs; bland moistening, thinning, and detergent solutions; enzymes and other mucolytic agents; and miscellaneous substances such as antibiotics, steriods, and anti-foaming agents.[3] In this study the bronchodilator solution used was Aerolone and the detergent solution used was water.

Aerolone affects the respiratory tract by relaxing circumferential smooth muscle fibers of the airways, by shrinking mucosa, and by decreasing secretory activity through vasomotor effects.[4] Kennedy and Kallos found that the addition of cyclopentamine hydrochloride to

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[1]Cushing and Miller, "Nebulization Therapy," p. 170.

[2]William F. Miller, "Aerosol Therapy in Acute and Chronic Respiratory Disease," Archives of Internal Medicine, CXXXI (January, 1973), 149.

[3]Cushing and Miller, "Nebulization Therapy," p. 191.

[4]Ibid., p. 192.

isoproterenol hydrochloride, which is Aerolone, prolongs the above three actions.[1]

There is no standard dose of bronchodilator for nebulization because of certain variables such as inefficient inhalation, trapping of the medicine in excessive secretions, mist flow to the air during expiration, and solution being left in the nebulizer or deposited in the equipment. A rough guide is 0.25 to 1 milliliter of bronchodilator solution. The detergent solution used is water which is intended to break the vicious cycle of hypertrophy of the mucous glands leading to increased production of thick secretions and mucosal metaplasia with the loss of cilial functions. Due to this process, the natural cleansing mechanisms of the lungs and airways are lost which cause more secretions to be retained, leading to further bronchitis. Eventually irritation and infection destroy the lungs unless bronchial hygiene is given regularly and consistently.[2] Water has been shown to be a non-irritating, effective detergent solution.[3]

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[1]M. C. Kennedy and D. Thursby-Pelham, "Some Adrenergic Drugs and Atropine Methonitrate Given by Inhalation for Asthma: A Comparative Study," British Medical Journal, I (April 18, 1964), 1018-1021; P. Kallos, "Comparison of the Protective Effect of Isoproterenol-phenylephrine Aerosols in Asthmatics," International Archives of Allergy and Applied Immunology, XXIV (January, 1964), 17-26.

[2]Cushing and Miller, "Nebulization Therapy," pp. 193-196.

[3]K. N. V. Palmer, "The Effect of an Aerosol Detergent in Chronic Bronchitis," The Lancet, I (March 23, 1957), 611-613.

The dilution of the bronchodilator agent (Aerolone) with an aqueous solution spreads the administration over a period of time so that penetration to poorly ventilated areas is improved. It also lessens the likelihood of serious systemic reactions and combines bronchodilator treatment with bronchial therapy.[1]

Slow, deep breathing is the first prerequisite of efficient nebulization treatment. Slow breathing increases the ventilation of the obstructed areas and also increases the penetration of larger droplets. Furthermore, deep breaths open atelectatic areas, increases airway diameter, and carry aerosol deep into the lungs. Maximum efficiency is accomplished when the patient empties his lungs well below the normal and expiratory position but not to the point of straining; then, aerosol is slowly inhaled to full lung capacity, holding the inspiratory position for several seconds to let the fine particles settle out into the depths of the lungs. Throughout the treatment program, steps must be taken to assure that the loosened secretions are promptly evacuated, using postural drainage, deep breathing, chest percussion, and coughing. Adequate home treatment offers

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[1]B. M. Cohen and C. Crandall, "Physiologic Benefits of 'Thermofog' as a Bronchodilator Vehicle: Acute Ventilation Responses of 93 Patients," American Journal of the Medical Sciences, CCXLVII (January, 1964), 57.

the only hope for stopping or reversing the usual downhill course of chronic inflammatory pulmonary disease. In addition to all possible measures to prevent further bronchial irritation and infection, a routine program of maintaining bronchial hygiene and dilatation is an important ingredient of therapy.[1]

As has been mentioned previously, the device used to administer treatment is called a nebulizer. The principle of a nebulizer is a simple one; the liquid (in this instance water and Aerolone) and air are pumped through a narrow opening with enough force to produce a spray of particles small enough to be inhaled deep into the bronchioles.[2] The DeVilbiss Nebulizer 40 (Appendix A) produces air blast atomization of liquids. It is one of the simplest and most widely used devices, usually made of glass or plastic and holds up to 3 to 4 milliliters of solution. It is used to deliver a specific dose of reasonably potent agents and is driven by a hand bulb which is powered by the patient. Air mixing nebulizers, such as this one, provide concentrated mist for the full inhaled volume, thus delivering large amounts of material and preventing evaporation.[3] Air enters

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[1]Cushing and Miller, "Nebulization Therapy," pp. 199-200.

[2]Rena Corman, "Is This Machine Necessary?" Bulletin of National Tuberculosis and Respiratory Disease Association, LVIII (January - February, 1972), 3.

[3]Cushing and Miller, "Nebulization Therapy," p. 202.

the nebulizer at a mass flow rate that depends primarily on the diameter of the air inlet opening and the pressure drop across it. A venturi effect at the mouth of the liquid inlet tube causes a drop in pressure at that point which causes liquid to flow into the air stream. The liquid breaks up to form droplets of various sizes. When the air vent is open there is a marked increase in the output of useful aerosol per minute.[1]

Smelzer and Barnett studied sixteen patients with chronic obstructive airways disease to determine if a simple powered nebulizer, such as the DeVilbiss 40, was as effective as an Intermittent Positive Pressure Breathing (IPPB) machine. The results showed similar changes in forced vital capacity and forced expiratory volume in one second, no matter which method was used, indicating that therapeutic benefit from an IPPB machine was not significantly different from that of a simple powered nebulizer. They further reviewed the literature and found only one study of eight that concluded the use of IPPB offered an advantage to other simpler means of aerosol administration; hence, the widespread use of this

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[1]Thomas T. Mercer, "Production and Characterization of Aerosols," Archives of Internal Medicine, CXXXI (January, 1973), 42.

simple and inexpensive device.[1]

Since nebulization allows for direct treatment of the bronchial tree, it is imperative that the therapy be done correctly to ensure maximum effectiveness. The nurse is in a strategic position to instruct and supervise the patient when he is ready to learn.[2] The time allowed for teaching patients is a reflection of the nurse's commitment to patient education as an important part of professional practice. The fact that patients are not adhering to medical regimens prescribed for them is difficult to deny or ignore. This is a relevant aspect because there is an increasing number of patients undergoing home treatment and a normative expectation that patients will follow what doctors recommend. The nurse is in a unique position to increase compliance with the medical regimen.[3]

Patients with chronic illness may find it necessary to follow medical recommendations long after the initial episode of illness. Changes in routine daily activities become necessary due to partial, but nevertheless permanent,

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[1]Timothy Smelzer and Thomas B. Barnett, "Bronchodilator Aerosol," Journal of the American Medical Association, CCXIII (February 19, 1973), 884-889.

[2]Helming, "Nursing Care of Patients with Chronic Obstructive Lung Disease," p. 416.

[3]Pauline Vincent, "Factors Influencing Patient Noncompliance: A Theoretical Approach," Nursing Research, XX (July - August, 1970), 312-323.

incapacitation. In a review of the literature by Marston, there was found to be a wide variety of compliance with medical regimens. In summarizing the eighty-five studies, she concluded that compliance could not be correlated with age, sex, socioeconomic status, educational background, marital status, or religion.[1]

Opportunities for teaching patients exist in a variety of environmental settings such as outpatient clinics, homes, physicians' offices, hospitals, extended care facilities, and nursing homes. Fink suggest that patients attending clinics are more amenable to learning about self-care than are hospitalized, acutely ill patients. The reason lies in the priority of needs of the patient. In acute illness there is a deficiency of basic biological needs, but in the recovery phase there is an emergence of growth needs. If the individual has been hospitalized, his experience with the necessity and reality of self-care outside the institutional setting may increase his level of awareness and readiness for learning.[2] Learning needs are evidenced by direct questions by the patient, indirect verbal expressions, the patient's overt behavior, and knowledge of an event that

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[1]Mary-Vesta Marston, "Compliance with Medical Regimens: A Review of the Literature," Nursing Research, XIX (July - August, 1970), 312-323.

[2]Stephen Fink, "Crisis and Motivation - A Theoretical Model," Archives of Physical Medicine and Rehabilitation, XLVIII (1967), 596-597.

will occur which will alter what the patient can do (for example, surgery).[1]

Teaching is generally aimed at behavioral change in the areas of understanding, performance of psychomotor skills, and conscious attitudes in receptive individuals. In essence, it is basically aimed at modifying inadequate behavior, often with the purposes of preventing a health crisis. Since it is goal-directed toward accomplishing particular learning, it is necessary to be able to identify goals which are appropriate to the situation and which the learner is likely to reach.[2] Patient teaching has been said to be that aspect of health care which is best given by the professional nurse to the patient. It is she who knows the plan of treatment, the patient's level of acceptance of his health problems and its treatment, and most important, she knows the physical, social, and intellectual make-up of that individual. Furthermore, it is the nurse who has the most contact with the patient.[3]

Mild anxiety and awareness of a need to know are highly

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[1]Palm, "Recognizing Opportunities for Informal Patient Teaching," 676-677.

[2]Barbara K. Redman, "Patient Education as a Function of Nursing Practice," Nursing Clinics of North America, VI (December, 1971), 574.

[3]Palm, "Recognizing Opportunities for Informal Patient Teaching," p. 675.

motivating factors. The teacher will be most effective if she recognizes this state and helps develop it by having the learner participate in setting short and long term goals. Once short term goals are achieved, further motivation is generated.[1] Learning must start at the particular stage of the learner's capabilities, experiences, and readiness. The motivation to learn arises from the learner's perception of his own needs and desires. He tends to retain only that content that is visibly relevant to his personal needs and life styles. Furthermore, he needs frequent reinforcement regarding his progress, especially in times of failure.[2]

The factors that need to be considered in teaching a patient fall into three categories: the nurse and the patient involved in the teaching-learning situation, the content relevant to the situation, and the space and time dimension in which the nurse and the patient operate. Both the patient and the nurse bring to the learning situation their particular set of differences which result from the variability that exists between persons. The content to be learned which refers to aspects of self-care may be related to basic human needs, physical or psychologic

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[1]Pamela A. Culbert and Barbara A. Kos, "Aging: Considerations for Health Teaching," Nursing Clinics of North America, VI (December, 1971), 610.

[2]Jean E. Schweer, "Teaching Students to Teach Health Care to Others," Nursing Clinics of North America, VI (December, 1971), 683.

dysfunction as experienced by the patient, necessary modifications of activities of daily living, and/or various medical regimens prescribed by the physician. The space and time dimension must be considered in order to enhance learning. The space is ideally quiet and devoid of visual distraction. The time selected for teaching should be at the beginning of the clinic visit, because at the conclusion of the visit the patient is invariably tired; he has already experienced many demands on his physical and psychologic endurance level and just wants to get home. Additional input at this time is not only ineffective, but is often irritating, if not confusing, to the patient.[1]

A planned program for patient teaching encompasses assessing the patient's needs, developing individual objectives based upon needs perceived by the patient, planning and implementing appropriate learning experiences according to the patient's readiness to learn, and evaluating the patient's behavioral response to determine if objectives have been met.[2]

The learning of skills may be expedited by supplying a model through demonstration or illustration. It is

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[1]Jeanne C. Hallburg, "Teaching Patients Self-Care," Nursing Clinics of North America, V (June, 1970), 224-226.

[2]Virginia Haferkorn, "Assisting Individual Learning Needs as a Basis for Patient Teaching," Nursing Clinics of North America, VI (March, 1971), 199-200.

essential to have didactic interaction with both teacher and learner involved in exchanging information, especially when the goal is concerned with behavior rather than just the acquisition of knowledge and skills. When the goal of learning is to develop skills in self-care, demonstrations followed by practice sessions is most effective. The teacher guides the initial trials, evaluates the learner's performance, and keeps him informed of his progress.[1] Evaluation may be done directly through observation of the learner in a natural situation in which the learned behavior is required or in a contrived situation using verbal or written criteria to determine the learner's understanding of what was taught.[2]

Despite the advantages of aids such as pamphlets, films, and lectures, professionals have generally agreed the best method of giving instruction is the tutorial system in which one professional speaks to one patient. The disadvantage is that this method is time consuming and seems to conflict with the increasing demands on the time of all medical and paramedical personnel.[3]

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[1]Hallburg, "Teaching Patients Self-Care," 226-227.

[2]Redman, "Patient Education as a Function of Nursing Practice," p. 578.

[3]Delores Kucha, "An Evaluation of the Methods of Patient Instruction," Supervisor Nurse, III (March, 1972), 32.

The following propositions are related to learned material: retention of learned material increases when the material is organized, meaningful, and related; and the retention rate increases as the material is overlearned. Conventional teaching, a planned sequence of didactic and demonstrative instruction which may include handouts, enhances retention on the part of the learner.[1]

There have been no studies done which determine how long after the teaching-learning session the individual should be tested. However, the immediate performance should be evaluated and practice sessions allowed, before the final test or evaluation of a change in behavior. The performance discrepancy must first be determined and its importance evaluated. If the discrepancy is a skill, the learner must have the physical and mental capacity to perform the desired behavior.[2]

Since there had been no studies done on the patient's correct use of the DeVilbiss Nebulizer 40, it was the intent of this investigation to determine if chest clinic outpatients had a deficiency skill in hand nebulization, to correct the deficiency if one existed, and to evaluate the results.

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[1]Delores Kucha, "An Evaluation of the Methods of Patient Instruction," Supervisor Nurse, III (March, 1972), p. 35.

[2]Robert F. Mager and Peter Pipe, Analyzing Performance Problems or 'You Really Oughta Wanna' (Belmont, California: Faron Publishers, 1970), p. 100-103.

Hypotheses

The following hypotheses were tested:

1. A significant number of the outpatients in a chest clinic would be using the DeVilbiss Nebulizer 40 incorrectly.

2. A teaching-learning session on a one-to-one basis, which included a return demonstration and a one week practice session, would significantly correct the patients' incorrect uses of the DeVilbiss Nebulizer 40.

3. Certain items on the checklist would be missed more frequently than others.

Definition of Terms

For the purposes of this paper, the following terms were defined:

1. Nebulization - reduction of a solution of Aerolone and water into a mist or fine spray so that it may be inhaled into the lungs.

2. Forced Vital Capacity - the largest volume of gas measured on forceful, rapid expiration after the deepest inspiration.

3. Forced Expiratory Volume in one second - the volume of gas exhaled in one second after the deepest inspiration.

4. Pre-test - a set of criteria directly related to the content of the learning experience, which is given to determine what the subject knows about the desired information prior to beginning the learning experience.

5. Post-test - a set of criteria identical to that given on the pre-test to determine what the subject knows about the desired information after completing the learning experience.

6. Comprehension - amount of knowledge possessed by the patient immediately after the teaching-learning session as determined by a return demonstration.

7. Retention - amount of knowledge possessed by the patient one week after the teaching-learning session as determined by the post-test.

Limitations

The limitations of this study were:

1. There would be different learning abilities and previous knowledge among individual subjects.

2. There would be different levels of motivation among individual subjects.

3. There would be no way to control how the subject used the acquired knowledge in his own home.

4. There would be no way to ensure the return visits of subjects.

Delimitations

The following delimitations were observed in this investigation:

1. The population was chosen from an outpatient chest clinic in a city-county hospital district in Dallas, Texas.

2. Prior to the day of the initial test, the subjects had been given a prescription for the DeVilbiss Nebulizer 40 to be used with ten drops of Aerolone and forty drops of water four times daily.

3. The subjects were able to speak and understand English.

4. The subjects had the strength to completely compress the hand bulb of the nebulizer.

5. No subjects were chosen who had been diagnosed as having brain damage or impaired sensory modalities.

Assumptions

The following assumptions basic to this investigation were:

1. Health education is desirable for the outpatient in a chest clinic.
2. The outpatient in a chest clinic is concerned about and desires the knowledge necessary for his self-care, and this is considered beneficial.
3. To follow the regimen of bronchopulmonary hygiene is desirable for outpatients in a chest clinic.
4. An important function of the nurse is teaching.
5. Motivation is essential to the learning process.
6. Individuals are more attentive to information which they perceive to be important.
7. Learning in the form of a change in behavior or response of an individual is the goal of teaching.
8. Utilization of appropriate teaching methods affects learning.

Summary

Nebulization of aerosols has been recognized as a beneficial component in the treatment of various respiratory disorders when the therapy is administered correctly. If the patient is to administer this mode of therapy properly, he must be instructed as to the necessary steps of effective hand nebulization. The nurse has the knowledge of and the

responsibility for the teaching of patients which will ultimately result in the promotion of health. Chapter II, the review of literature, consists of an in depth study of aerosol therapy and the teaching-learning process. Chapter III, the procedure for collection and treatment of data, contains the development and validation of the tool used to assess the patients' knowledge of the use of their nebulizers as well as the method of data collection. Chapter IV is concerned with the analysis of this data. Chapter V of the paper contains a summary with recommendations, implications, and conclusions.

CHAPTER II

REVIEW OF LITERATURE

CHAPTER II

REVIEW OF LITERATURE

Introduction

The abundance of bronchodilators and the abundance of racks of equipment found in inhalation therapy departments attest to the present widespread use of nebulization therapy. The therapeutic use of aerosols began in Germany when patients with bronchial asthma and bronchospastic emphysema were treated with the inhalation of dilute solutions of epinephrine. The introduction of the hand bulb nebulizer, in 1935, resulted in its widespread use as a substitute for an injection of adrenalin.[1] Much has been written about nebulization therapy, mostly because the subject is related to problems of disease transmission, chemical warfare, nuclear fallout, and air pollution. However, basic information is fragmented and not organized into a coherent whole, suitable for the use of personnel working with respiratory disease patients. Recommendations as to the proper use of therapy are many and varied, and full data on nebulizer performance are almost non-existent.[2]

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[1]Alvan L. Barach, "Historical Background of Inhalation Therapy," Anesthesiology, XXIII (July - August, 1962), 413.

[2]Cushing and Miller, "Nebulization Therapy," p. 170.

Chapter II deals with a review of the literature concerning chronic obstructive pulmonary disease, aerosol therapy, and hand nebulization with the DeVilbiss Nebulizer 40.

Chronic Obstructive Pulmonary Disease

The term obstructive pulmonary disease includes pulmonary emphysema, chronic bronchitis, and bronchial asthma.[1] Chronic obstructive pulmonary disease (COPD) is, by far, the most common chronic pulmonary disease making it an important public health problem. In recent years, its prevalence and death rate have increased to epidemic proportions. In 1970, there were an approximated 30,000 deaths in the United States from emphysema, chronic bronchitis, and asthma. These conditions ranked ninth in the causes of death from disease. In the decade ending in 1970, deaths attributed to emphysema increased by 145 per cent, and those from chronic bronchitis increased by 72 per cent.[2]

There are four physiological changes which can occur in patients with COPD: airway obstruction, reduced elastic recoil, reduced gas exchange, and increased sputum production. Characteristically, airway obstruction is present

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[1]H. H. Bendixen, L. D. Egbert, J. Hedley-Whyte, M. B. Laver, H. Pontoppidan, Respiratory Care (St. Louis: C. V. Mosby Company, 1965), p. 21.

[2]Morris, Chronic Obstructive Pulmonary Disease, p. 20.

primarily as an obstacle to expiration. During inspiration the alveolar pressure around the bronchioles decreases, allowing air to flow into the lungs. During expiration, the alveolar pressure surrounding the bronchioles is greater than that pressure within the bronchial lumen; thus, there is a tendency for air flow obstruction and this tendency is exaggerated in patients with emphysema. Other mechanisms which cause obstruction in asthma and bronchitis are excessive mucus production, mucosal edema, and smooth muscle spasm. In patients with bronchitis, the ducts to the mucus-secreting glands are often dilated and there is marked hypertrophy of the mucus-secreting cells which leads to an increased production of mucus. This mucus often obstructs the bronchiolar lumina. Vasodilation often leads to submucosal edema and along with cellular infiltration, causes a thickening of the bronchiolar wall, further narrowing the bronchiolar lumen. The smooth muscle surrounding the bronchioles may be hypertrophied and spastic in patients with bronchitis and asthma which compounds the problem of airflow obstruction.[1] [2]

Reduced elastic recoil is due to loss of elastic fibers in the lung. This requires extra use of the

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[1]H. Corwin Hinshaw, Diseases of the Chest (Philadelphia: W. B. Saunders Company, 1969), pp. 253-330.

[2]Morris, Chronic Obstructive Pulmonary Disease, pp. 31-33.

expiratory muscles in the effort to expel the tidal volume. There is also a reduced gas exchange area which is the result of progressive obstructive parenchymal changes. It is this physiological change, which in time, makes the prognosis hopeless and the therapy ineffective.[1]

There are reversible and irreversible mechanisms of airway obstruction, any or all of which may occur in patients with COPD. A patient with asthma or chronic bronchitis has air-flow obstruction due to obstructing mucus, bronchial edema, and bronchospasm, all of which are amenable to therapy and thus, are reversible. Therapy consists of liquification and mobilization of the secretions, reduction of vasodilatation, and relaxation of smooth muscle. A patient with emphysema usually has bonchioles which collapse readily during expiration. This is an essentially irreversible phenomenon. However, most patients tend to have coexisting bronchitis and emphysema, with their respective reversible and irreversible components.[2] [3]

Aerosol Therapy

There is no doubt that the treatment of various bronchopulmonary disorders has been facilitated by the use of

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[1]Bendixen, Respiratory Care, p. 211.

[2]Morris, Chronic Obstructive Pulmonary Disease, p. 33.

[3]Milton B. Cole, "Some Pointers for Recognizing Early Emphysema," Consultant (February, 1964), 21.

aerosols. Although many of the goals of aerosol therapy, such as bronchodilatation and antibiotic treatment, can be obtained by oral or parenteral therapy, other benefits such as humidifying, loosening, and liquifying secretions may be readily obtained through aerosol therapy. In addition, prompt efficient relief of bronchospasm can usually be obtained by a bronchodilator aerosol without the systemic side effects which usually accompany the parenteral use of a drug like epinephrine.[1]

The nature of airway obstruction and bronchodilator action in diseases such as asthma and bronchitis is neither always apparent nor understood. Different pharmocologic types of drugs produce the same clinical effect, while many reflex mechanisms, as well as direct and environmental stimuli cause bronchospasm and mucosal swelling. These reactions, together with the pooling of obstructing secretions, are the major causes of reversible dyspnea and ventilatory insufficiency.[2] Retained secretions in the airways are a common complication of patients with chronic respiratory disease. Nebulization and the instillation of aqueous solutions are important adjuncts in liquifying, loosening, and eliminating thick tenacious secretions in

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[1]Lovejoy and Morrow, "Bronchodilators and Mucolytic Agents," 465.

[2]Cushing and Miller, "Nebulization Therapy," p. 192.

the tracheo-bronchial tree. This mode of treatment is based on the principle that the aqueous solutions, by reducing surface tension, will promote the loosening of secretions.[1]

Many drugs and combinations of drugs are available for use in aerosol nebulization. Bronchodilator drugs in appropriate doses should be considered as an essential part of aerosol therapy. Side effects, other than slight nervousness or tachycardia, are rarely produced by therapeutic doses of bronchodilators drugs.[2] However, in choosing a bronchodilator agent, some precautions should be taken. There should be no irritating substances in the selected solution since these will destroy delicate lung tissue. Bronchodilators which are strong vasoconstrictors should be avoided, since these will raise the pulmonary artery pressure. Finally, the solution used should have some added hygroscopic agent such as glycerin or propylene glycol to prolong the life of the droplet and prevent its evaporation before reaching areas distal to the terminal bronchioles. Aerolone, the solution used in this study, consists of cyclopentamine hydrochloride 0.5 per cent, isoproterenol hydrochloride 0.25 per cent, and procaine

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[1]Lovejoy and Morrow, "Bronchodilators and Mucolytic Agents," 465.

[2]Cushing and Miller, "Nebulization Therapy," pp. 192-197.

hydrochloride in a solution containing 80 per cent propylene glycol and 20 per cent water. Cyclopentamine is a sympathomimetic drug and a bronchodilator with vasopressor activity as well.[1]

Once the solution to be nebulized is determined, it is delivered to the patient in the form of an aerosol. An aerosol is a system of liquid or solid particles which are small enough to have a low settling velocity. It is this characteristic which makes the particle capable of stability when suspended in air. All people today continuously inhale particles which are suspended in the air; when these aerosols are visible, they are called dust, fog, mist, fume, smog, smoke, or soot. Fortunately, healthy lungs have extremely efficient ways to clear these particles from the human system, but disease or other factors can significantly alter this ability. Besides the above manufactured aerosols, which are not ideally inhaled, aerosols may be produced for medical purposes by nebulizers or generators for the purpose of inhalation into the lungs.[2] Aerosol therapy by nebulization may be given continuously or intermittently. In the treatment of chronic respiratory disease patient, the intermittent therapy is preferred,

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[1]Lovejoy and Morrow, "Bronchodilators and Mucolytic Agents," 466.

[2]Ruy V. Lourenco, "Inhaled Aerosols," Archives of Internal Medicine, CXXXI (January, 1973), 22.

four to six treatments per day being most effective, so that secretions are not allowed to accumulate and form mucus plugs.[1]

Nebulization Therapy

The spectrum of nebulization therapy can be divided into four categories: treatment of the depths of the lungs with fine particle bronchodilators, treatment of the lungs with larger amounts of bronchodilator solution or less potent drugs, treatment of the entire respiratory tract with large amounts of aqueous solutions, and humidification of inspired air. The full use of this spectrum of nebulization therapy is seen in the treatment of patients who are severely ill with an exacerbation of chronic bronchitis or emphysema. All the airways are constricted, congested, or edematous, and obstructed with thick secretions. When the airway lumen is decreased by one-half, the effort to breathe is increased to thirty times that of normal; thus, acute bronchospasm and retention of secretions can cause overwhelming dyspnea. Effective bronchodilator and mucosal decongestion must be maintained even though many areas of the lung are hypoventilated. There is a need for continuous, rather than sporadic, use of bronchodilators in patients with chronic asthma and bronchitis, since smooth muscle

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[1]Jane Secor, Patient Care in Respiratory Problems (Philadelphia: W. B. Saunders, 1969), pp. 107-108.

fibers are hypertrophied, suggesting a chronic state of contraction.[1] In these patients with constant bronchospasm and edema, prophylactic use of bronchodilator aerosols is necessary for maximum effectiveness. Waiting for symptoms to become severe only leads to intractability.[2] In conjunction with the administration of bronchodilator therapy, direct attacks on obstructing and retained secretions are basic to a complete program of nebulization therapy. This may be accomplished through prolonged nebulization of aqueous solutions which must be done regularly and consistently, probably for the rest of the patient's life. Full doses must be inhaled for long enough periods of time to penetrate hypoventilated areas.[3] The nebulizer produces greater benefit when a full treatment is taken at the prescribed times rather than brief whiffs being taken frequently.[4]

In treating the patient with bland aqueous solutions one caution is necessary: treatment must always be

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[1]Cushing and Miller, "Nebulization Therapy," pp. 192-197.

[2]William F. Miller, "Aerosol Therapy in Acute and Chronic Respiratory Disease," 149.

[3]Cushing and Miller, "Nebulization Therapy," pp. 192-197.

[4]Marjorie Kinney, "Rehabilitation of Patients with COLD," American Journal of Nursing, CXVII (December, 1967), 2534.

directed toward loosening and evacuating secretions. The secretions tend to thicken on the airway walls and lodge in poorly ventilated areas. When the moistening and loosening regimen begins, there is often a period of increased functional obstruction since the secretions begin to swell and move out to better ventilated areas, temporarily blocking them off. If measures are not taken to evacuate these secretions, the patient may literally drown in them. Maneuvers which aid in the evacuation of secretions are deep breaths, coughing, activity, frequent changes of position, chest percussion, postural drainage, and suctioning. Mucolytic agents are sometimes good for an aggressive attack on obstructing secretions, but they are irritating and expensive and do not substitute for a more sustained treatment with bland aqueous solutions.[1]

There are many different types of nebulizers used to deliver aerosols. The practical differences between nebulizers are differences in size, construction, and flexibility of use. Small nebulizers, such as the DeVilbiss Nebulizer 40, are usually made of glass or plastic and hold up to 3 to 4 milliliters of solution. These are used to deliver a specific dose of a reasonably potent agent. The nebulizer may be driven off compressed air or oxygen,

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[1]Miller, "Aerosol Therapy in Acute and Chronic Respiratory Disease," 149.

or by a hand bulb or tire pump which is operated by the patient. The drawbacks of this kind of nebulizer include breakage of delicate glass parts, deterioration of the plastic, spilling of the solution, difficulty in cleaning, and leakage in screwed connections.[1] The DeVilbiss Nebulizer 40 (Appendix A) has a straight vertical air nozzel which ends immediately below the curved inlet tube. The liquid inlet tube is open into the liquid when the nebulizer is filled. The liquid is drawn part way up this tube by capillary action; then, when the hand bulb is compressed, the liquid is sucked out of the tube due to the negative pressure created by the burst of air. The jet of air breaks up the liquid into small particles as it emerges from the tube. The large outlet tube is curved 90° to trap the spray.[2]

Technique of Nebulization

The proper use of nebulizing equipment is necessary for optimal effect. Slow, deep breathing is the first prerequisite for effective nebulization since it increases ventilation of obstructed areas and increases penetration of larger droplets. Deep inspiration opens atelectatic

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[1]Cushing and Miller, "Nebulization Therapy," p. 184.

[2]Arnold E. Reif and Margot P. Halcomb, "Operating Characteristics of Commercial Nebulizers and Their Adaptation to Produce Closely Sized Aerosols," Annals of Allergy, XVI (November - December, 1968), 629.

areas, increases airway diameter, and carries aerosol deep into the lungs. Fast, shallow breathing directs most all the aerosol to already healthy parts of the lungs and wastes medication.[1] The degree and duration of improvement probably depends somewhat on the actual area of the bronchial mucosa which comes in contact with the drug. The aerosol can be deposited only where the air goes; therefore, the importance of a proper breathing pattern is obvious.[2]

The patient is first instructed to exhale slowly and completely, since trapping of air in the lung is common in patients with lung disease, and is apt to be increased after taking a deep breath which is not preceeded by a forced expiration. In such instances, the aerosol will not be delivered to the smaller airways. After exhaling, the patient should slowly inhale through the mouth to open all the air spaces, and, at the same time, he should compress the hand bulb several times. The patient is then instructed to hold the full inspiration for a few seconds to ensure optimal distribution of the aerosol to poorly ventilated spaces and optimal deposition of the droplets. This procedure should be repeated until all the medication

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[1]Cushing and Miller, "Nebulization Therapy," pp. 199-200.

[2]Miller, "Aerosol Therapy," 149.

has been used.[1] [2] [3] The treatment will be more effective if the patient is able to cough and expectorate prior to starting nebulization. He should be sitting up and holding the jet stem within the bowl in a vertical position. Only the prescribed amount of solution should be added since over-filling the bowl will drown the jet capillary junction.[4] Occasionally patients have abandoned aerosol therapy as ineffective because they had not been using the device correctly.[5]

The Teaching-Learning Process

The correct use of the DeVilbiss Nebulizer 40 can be accomplished only if the patient knows how to operate the device; he must be instructed as to the proper mode of nebulization therapy. The idea of patient-teaching as a function of nursing practice is not new. It has always been considered a part of nursing practice, and is but one phase of good nursing care.[6] The teaching function in

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[1] Secor, Patient Care in Respiratory Problems, p. 109.

[2] Lovejoy and Morrow, "Bronchodilators and Mucolytic Agents," 467.

[3] Miller, "Aerosol Therapy," 149.

[4] Secor, Patient Care in Respiratory Problems, p. 109.

[5] Hinshaw, Diseases of the Chest, p. 336.

[6] Frances Storlie, "Bridging the Information Gap," Supervisor Nurse, III (March, 1972), 62.

nursing can be said to be one aspect which may be used to accomplish the fundamental purpose of nursing--the promotion of health. Opportunities for teaching are unlimited; limitations arise only when the nurse does not recognize and use the opportunities appropriately.[1] The teaching role is one of helping the learner identify alternatives, giving him factual data and principles, and offering him assistance in achieving self-actualization. Although motivation is inherent in the learner when the material to be learned is meaningful, the teacher must continually assess the learner's readiness and wish to learn.[2]

A great deal of general research about the teaching-learning process has been done and is useful. However, much of the knowledge about teaching has been focused on the school as society's major educational institution outside the family. A great deal remains to be discovered about the teaching-learning experience and needs in health and illness.[3] Although research about patient-teaching in nursing has been limited, and this is especially true for

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[1]Margaret L. Pohl, Teaching Function of the Nursing Practitioner (Dubuque, Iowa: Wm. C. Brown Company Publishers, 1970), pp. 1-4.

[2]Culbert and Kos, "Aging: Considerations for Health Teaching," 610.

[3]Redman, "Patient Education as a Function of Nursing Practice," 579.

informal teaching, various studies have shown that patients want to be taught and that nurses value teaching.[1] Patient-teaching seems to be an area of nursing practice with considerable potential for improving patient welfare, but it is in need of development, including consideration by the entire health team.[2]

The ultimate goal of teaching can be said to be a change of behavior; that is, learned behavior. The single most characteristic thing about human beings is that they learn. Learning is so deeply ingrained in man that it is almost involuntary.[3] The ability to learn is one of man's most necessary talents, not only for his own survival, but for the benefit of all civilization as it is known today. Without this ability, it would be necessary for each individual to rely on the amount of knowledge he acquired in his lifetime. Any accumulation of knowledge between generations simply would not be possible. Some basic conditions recognized as being present in almost all types of learning, from skill acquisition to problem solving, include genetic endowment, motivation, practice,

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[1]Palm, Recognizing Opportunities for Informal Patient Teaching," 671.

[2]Redman, "Patient Education as a Function of Nursing Practice," 580.

[3]Jerome S. Bruner, Toward a Theory of Instruction (Cambridge, Massachusetts: The Belnap Press of Harvard University Press, 1967), p. 113.

discrimination, generalization, and reinforcement.[1] Learning is an activity which is necessary for the development of the individual as an independent person and social being. It may be described as the process by which changes are brought about in the way an individual responds to his environment. His learning will depend on the nature of his physical, mental, and emotional development, as well as his past and present experiences.[2]

People do not learn in a general sense, but always in the sense of a change of behavior which can be described in terms of an observable change in human performance. A successful act of learning is inferred from the fact that an individual can now do something which he could not do before. There must be a planned sequence of steps within the content area, and ways to accomplish them should be devised. Each step must be attained before proceeding to the next in order to prevent mistakes which result from skipping essential steps during the acquisition of knowledge. The initial step in determining the conditions for learning is to define the objectives of the teaching-learning process. The desired nature of the change in

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[1]Barbara Brodie, "Reexamination of Reinforcement in the Learning Process," The Journal of Nursing Education, VIII (April, 1969), 27.

[2]Pohl, Teaching Function of the Nursing Practitioner, p. 6.

behavior must be decided in order to determine the input needs of the learner. By doing this, the type of learning situation which needs to be established to bring about the desired change in behavior can be determined.[1]

A theory of instruction has four major features: it should specify the activities which will give the learner a predisposition toward learning; it must spell out the organization of the body of knowledge so that the learner may readily grasp it; it must specify the most effective sequence in which to present the material to be learned; and the theory of instruction should specify what types of rewards and punishments should be given, and how often, in the teaching-learning process. These features must be considered when preparing curriculum materials whether one is concerned with writing a textbook, a lesson plan, a unit of instruction, a program, or a conversation with didactic ends in view.[2]

In developing the teaching regimen, the instructor may plan <u>for</u> and/or <u>with</u> the patient. Planning for the patient is based on the premise that the nurse is the holder of knowledge which the patient should be taught

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[1]Robert M. Gagné, <u>The Conditions of Learning</u> (United States of America: Hart, Rinehart and Winston, Inc., 1966), pp. 172-173,241.

[2]Bruner, <u>Toward a Theory of Instruction</u>, pp. 40-41, 70.

and that once this knowledge is transmitted, it will influence the patient's subsequent behavior. The nurse is actively involved in identifying and conveying the information needed by the patient. The goal is the acquisition of specific knowledge and a specific skill which is given to the patient by the nurse. Questions and answers are provided for, and content brought by the patient is not ignored. Evaluation is accomplished through verbal response of the patient, questions, tests, or return demonstrations. However, the evaluation is not indicative of what the patient does with the information or how he uses the skill. Planning with the patient is based on the assumption that both the patient and the nurse will actively participate in the teaching-learning process. The content brought to the situation by both the patient and nurse includes material specifically related to the aspect of self-care to be learned. An essential part of this interaction is that both teacher and learner give to, and take something from, the interaction. The goal is related to the patient's subsequent behavior regarding self-care.[1]

In selecting the method of teaching, several criteria can be used. The teacher's abilities, interests, and knowledge of the subject matter should be suited to the

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[1]Hallburg, "Teaching Patients Self-Care," 226-227.

teaching-learning situation. The student's verbal and psychomotor abilities must be considered, as well as the time and place context of the situation. The number of students being taught must be decided and the teaching-learning situation suited to their interests and experiences. The teacher's relationship to the student during the learning process is also an important factor.[1] If visual aids are used, they should be considered just that--aids. They cannot do the entire teaching job or even a major portion. The physician and nurse should be ultimately responsible for the education of their patients.[2]

There are many principles of learning. The first of these is that an individual must be motivated to learn. Motivation is a force or drive within an individual which stimulates him to do something. This state may be aroused by a physical need, an emotion, or an idea; it may be a fleeting impulse or a prolonged, sustained force. Motivation takes place within an individual and cannot be superimposed by someone else; it must persist throughout the entire learning process. The potential learner's motivation will automatically be directed toward his most pressing need at the moment. He can only be motivated to

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[1]Ronald T. Hyman, Ways of Teaching (Philadelphia: J. B. Lippincott, 1970), pp. 35-36.

[2]Storlie, "Bridging the Information Gap," 67.

learn when the desire to learn is stronger than other needs.

Physical and mental readiness are necessary for learning. Readiness for learning refers to the individual's physical and mental capacities to learn and not to his desire to learn. Physical readiness depends primarily on the individual's neuromuscular system, while mental readiness depends on the individual's intellectual development.

Effective learning requires active participation on the part of the learner. He learns by doing. The more thoroughly an individual participates, the more effective the learning will be.

New learning must be based on previous knowledge. Learning is an evolving process and each new step must be mastered before the next step can be learned. The learner must have the necessary prerequisite knowledge of experience in order to master the present learning task.

The emotional climate of the teaching-learning situation affects learning. If the emotional climate is extremely positive or extremely negative, little, if any, learning can occur. However, if the climate is neutral or just positive or negative enough to produce motivation, effective learning will ensue.

Another principle of learning is that repetition strengthens the acquisition of knowledge. Different learners need different amounts of repetition in order to learn,

but all learners need a certain amount of it. A large part of learning occurs through the formation of habits; and, to maintain these habits, repetition must be frequent lest the behavior be forgotten.

Lastly, satisfaction reinforces learning. All people like to do those things they enjoy or those things which obviously benefit them. Satisfaction often makes the learner want to learn more. Moderate amounts of dissatisfaction can also stimulate learning. However, if failure is too great or too often, the result will usually be discouragement in further attempts to learn.[1]

Stevens cites the following propositions related to learning: the learner's motivation is the most important variable controlling the amount of learning that occurs; reward is a stronger motivating factor to the learner than is punishment; prompt, accurate feedback is of critical importance; acquisition of knowledge is quicker if the content taught is relevant to the learner; effectual learning involves active response on the part of the learner; and lecturing or telling people what to do tends to violate the principle of feedback.[2] The most rapid learning occurs

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[1]Pohl, Teaching Function of the Nursing Practitioner, pp. 16-25.

[2]S. Stevens, Handbook of Experimental Psychology (New York: John Wiley and Sons, Inc., 1951), p. 198.

when every correct response is reinforced.[1]

Teacher-learner rapport is essential in enhancing the learning process. The nurse must establish a good teacher-learner relationship in order to create a climate that will be conducive to learning and encourage the learner's co-operation. Rapport is important to both the teacher and the learner. It enables the teacher to assess those elements which determine how effective the teaching-learning process will be. The learner will feel free to ask questions and make mistakes which are a part of learning if he feels comfortable with the nurse.

Teaching requires effective communication. The most common mistake made is the assumption that all people use words in the same way, so no attempt at definitions is made. Non-verbal communication also has an effect on the teaching-learning process. Facial expressions and gestures of the learner provide cues to the teacher about the progress of learning. Conversely, non-verbal communication on the part of the nurse may provide cues which reinforce or weaken the teacher-learner relationship.[2]

When the material to be taught is a skill, learning

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[1]Delores Kucha, "An Evaluation of the Methods of Patient Instruction," 33.

[2]Pohl, Teaching Function of the Nursing Practitioner, pp. 29-32.

is expedited by supplying a model through demonstration or illustration.[1] Demonstration is a method of teaching skills and techniques which are related to nursing care, and can be used with equal effectiveness for both individual and group teaching. This method consists of the teacher's demonstration, then supervised practice, and the learner's return demonstration. The demonstration should be introduced with an explanation of the procedure, its purpose, and expected effects. The equipment should be examined and parts named, and the learner should be allowed to ask questions. During the actual demonstration, any questions or reactions which indicate confusion or misunderstanding should be clarified promptly. The individual should then be allowed to practice the skill. The amount of practice necessary to master the technique will depend on the general ability and manual skills of the learner. The initial practice should be supervised so that errors can be corrected immediately. After the learner has been given the opportunity to practice and feels confident, he should perform the task from start to finish without interruption from the nurse. If the nurse gives him cues or help as he works, there will be no guarantee that he can perform independently. If mistakes are made, there should be further practice and

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[1]Culbert and Kos, "Aging: Considerations for Health Teaching," 611.

another return demonstration.[1]

Evaluation is an integral part of teaching; it is the appraisal of the outcomes of an activity. The difficulty of predicting outcomes of teaching intervention indicates the importance of securing constant feedback in an evaluative process. This may be obtained by observation of the learner in a natural or contrived situation where the learned behavior is required, or by obtaining written or verbal evidence of the learner's understanding or attitude.[2]

Shore states that learning by participants in a particular program can be measured in four major areas: knowledge or information that is acquired, change in attitudes on the part of the learner, skills which are learned, and acceptance of new ideas or practices by the learner. The adoption concept can be used as a measure of the effectiveness of an educational program. Adoption of a new idea or practice means the integration of that practice into the normal behavior pattern of the learner. The time from the initial knowledge until final acceptance may range from a few days to many years.[3]

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[1]Pohl, Teaching Function of the Nursing Practitioner, pp. 75-81.

[2]Redman, "Patient Education as a Function of Nursing Practice," 578.

[3]Helen L. Shore, "Adopters and Laggers," Canadian Nurse, LXVIII (July, 1972), 38.

Summary

The teaching of patients is a recognized part of nursing practice. The acquisition of knowledge or successful learning depends on a variety of factors. Since patients are becoming more responsible for, and involved in, their own home care, it is necessary that they have the proper training to perform these self-care skills. Hand nebulization with the DeVilbiss Nebulizer 40 is an accepted mode of treatment in patients with chronic lung disease and must be done by the patient himself on a consistent basis and away from hospital supervision. For effective nebulization to occur, the skill must be done correctly lest the regimen be abandoned or used to no avail. The nurse is in a prime position to teach the chronic lung patient the proper mode of hand nebulization with the DeVilbiss Nebulizer 40 and evaluate the results.

CHAPTER III

PROCEDURE FOR COLLECTION OF DATA

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PROCEDURE FOR COLLECTION OF DATA

Introduction

This study was a survey in which thirty chest clinic outpatients were tested as to their knowledge of how to use the DeVilbiss Nebulizer 40 using a checklist of criteria developed by the investigator. A teaching-learning session was implemented and its results evaluated one week later.

Locale

Written permission from hospital administration was obtained before beginning the study (Appendix B). The outpatient chest clinic chosen was in a city-county hospital district in Dallas, Texas. In 1972, according to the hospital district's annual report, 7521 chest clinic appointments were made; however, 2571 of these appointments were not kept, leaving a total of 4950 treated patients. There were no data available categorizing the total number of patients according to race or diagnosis.

Population

A minimum of thirty patients was chosen by convenience sampling since this number was necessary in order to approach a normal distribution using the Student's *t* test.

The convenience sampling method was used to avoid the bias of volunteer sampling. The patients were chosen from the clinic itself rather than by random sampling from a register so that the subject would only be required to make one extra visit to the clinic instead of two. Since this study was concerned only with the correct use of the DeVilbiss Nebulizer 40, any outpatient with any diagnosis was sampled as long as he had met the established delimitations.

Methodology

Initially, the patients were individually taken by the investigator to an examining room free of noise and visual distraction. This was done before the patient was examined and did not cause him any delay in returning home or in seeing the physician. The prescription for the DeVilbiss Nebulizer 40 to be used with ten drops of Aerolone and forty drops of water four times a day was verified by the investigator by checking the chart for a written order from a licensed physician. Prior to the initial testing, each patient had been given a nebulizer with the DeVilbiss Company's written instructions for use found on the back of the box. These instructions are found in Appendix C. The patient was briefly interviewed in order to obtain demographic data (Appendix D). He was then asked to empty his mouth, expectorate any loosened secretions, and show the investigator his method of self treatment. His

performance was compared to the checklist of established criteria for correct use of the DeVilbiss Nebulizer 40. For each item on the checklist which the patient completed successfully, he was given one point, a total of ten points indicating correct use of the DeVilbiss Nebulizer.

Each item done incorrectly was discussed with the patient, and he was then shown how to do the procedure correctly. The items were repeated by the investigator and practiced by the patient as many times as necessary until the subject was able to go through the complete maneuver of hand nebulization without coaching from the investigator. He was then asked to return in one week for evaluation of his ability to use the nebulizer correctly. That week gave the patients time for practice at home, since practice is considered necessary for learning.

At the return visit, one week later, the patient was given the identical test to determine the effectiveness of the teaching-learning session. It was scored the same way as before. However, completion of the established criteria was recorded by another professional nurse experienced in respiratory treatment, especially in the use of the DeVilbiss Nebulizer 40, in order to minimize bias on the part of the investigator. The differences in scores prior to and after the teaching-learning session were used to evaluate the effectiveness of the teaching-learning

experience, thereby testing the second hypothesis.

Tabulation of the scores for completion of established criteria for the correct use of the DeVilbiss Nebulizer 40 prior to the learning experience was used to test the first hypothesis. Throughout the investigation, tallies of which items were missed, and how often, by all subjects were recorded in order to test the third hypothesis.

Procedure for Treatment of Data

The first and second hypotheses were tested by using the Student's t-distribution. Significance was determined at the .001 level of significance for the first hypothesis and at the .05 level of significance for the second hypothesis. The third hypothesis was tested by using the test of Least Significant Difference.

Description of the Instrument

For this investigation, a Checklist of Criteria for Correct Use of the DeVilbiss Nebulizer 40 was used. The checklist of ten items was compiled by the investigator from a review of the literature and from recommendations for use by the DeVilbiss Company. Since more than one source was used in the development of the checklist, it was submitted to a panel of three experts for validation. A panel of judges is considered appropriate in this instance since "Polled judgements increase the accuracy of

any rating scale".[1] Any number of judges can be used, but they should be "selected on a basis of expertness in relation to the continuum to be examined".[2] The judges were a physician, a nurse, and an inhalation therapist who were considered to be experts in the field of respiratory therapy. The physician is an Associate Professor of Pulmonary Medicine at Southwestern Medical School. The nurse has a Master of Science Degree and has taught respiratory nursing at Texas Woman's University. The inhalation therapist is certified by the American Registry of Inhalation Therapy and is an instructor of respiratory therapy at El Centro Junior College. The judges had 100 per cent agreement on each item included in the Checklist of Criteria for Correct Use of the DeVilbiss Nebulizer 40. This checklist appears in Appendix E.

Summary

A Checklist of Criteria for Correct Use of the DeVilbiss Nebulizer 40 was developed by the investigator and validated by a panel of experts. Thirty patients were asked to demonstrate how they used their nebulizers and

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[1] William J. Goode and Paul K. Hatt, Methods in Social Research (New York: McGraw-Hill Book Company, 1952), p. 256.

[2] Ibid., p. 216.

were given one point for each step performed correctly during the nebulization process. A total of ten points indicated proper usage. A teaching-learning session was implemented, the patient was given one week to practice correct use of the nebulizer at home, and was reevaluated at the end of that time according to the same criteria in order to evaluate the effectiveness of the teaching-learning experience.

CHAPTER IV

ANALYSIS OF DATA

CHAPTER IV

ANALYSIS OF DATA

Introduction

This study was concerned with the correct use of the DeVilbiss Nebulizer 40 by outpatients in a chest clinic. The checklist was developed by the investigator and validated by a panel of judges. Thirty outpatients were tested and the results are discussed in this chapter.

General Description of the Sample

The sample population consisted of thirty patients. Twenty-nine of these patients, or 97 per cent of the population, had the diagnosis of chronic obstructive pulmonary disease. One patient had the diagnosis of interstitial fibrosis. Table 1 lists each patient according to the order in which he was included in the study. This number will remain the same for each patient throughout the analysis. This table indicates each patient's age, sex, race, and the length of time he had used his nebulizer.

As can be seen from the table, the age range was from 31 years to 74 years, the mean age being 60.66 years. There were 11 males and 19 females, 13 Negroes and 17 Caucasians. The average length of time the patients used

nebulizers was 4.06 years with a range of 2 weeks to 15 years.

TABLE 1

DEMOGRAPHIC DATA OF THE SAMPLE POPULATION*

Patient Number	Age	Sex	Race	Length of Time He Had Used the Nebulizer
1	63	M	N	10 years
2	54	F	N	1½ years
3	67	F	C	2 years
4	66	F	C	3 years
5	58	F	N	11 years
6	69	M	C	1½ years
7	56	M	N	6 years
8	62	F	N	3 years
9	66	F	N	9 months
10	72	F	C	10 years
11	65	F	C	1 year
12	73	F	C	9 years
13	31	F	N	8 months
14	64	M	C	2 years
15	63	F	C	10 years
16	65	M	C	2 weeks
17	59	F	N	1 year
18	64	M	C	3½ years
19	52	F	C	2 years
20	68	M	N	6 months
21	64	F	C	10 years
22	55	M	N	1 year
23	66	M	C	2 years
24	55	F	N	4 years
25	67	M	C	5 years
26	74	F	N	4 years
27	51	F	N	15 years
28	57	M	C	3 months
29	42	F	C	1 year
30	52	F	C	1 year

*N--30

The patients were also asked who had provided their

initial instruction of the nebulizer. Table 2 summarizes this information. It is categorized according to the person who was named instructor, the number of subjects instructed, and the per cent of subjects instructed.

TABLE 2

MODE OF INSTRUCTION OF THE SAMPLE POPULATION*

Instructor	Number of Sample	Per Cent of Sample
Physician	13	44
Respiratory Therapist	6	20
No one	6	20
Nurse	3	10
Nurse and Physician	1	3
Respiratory Therapist and Physician	1	3

*N--30

As can be seen from the table, the physician instructed most of the patients in the sample population and the combinations of nurse and physician and respiratory therapist and physician instructed the least amount of patients in the population. It is unfortunate to note that the nurse did not play a major role in the initial instruction of patients concerning the use of their DeVilbiss Nebulizers. However, the chest medicine clinics are primarily physician managed clinics with the nurse playing a minor role in the care of the patients.

Treatment of Data

The first hypothesis tested was that a significant number of the outpatients in a chest clinic would be using the DeVilbiss Nebulizer 40 incorrectly. A checklist of ten criteria indicative of correct use of the DeVilbiss Nebulizer 40 was used in order to test the sample patients regarding their knowledge of how to use their nebulizers. For each item that the patient completed successfully, he was given one point; a score of ten points indicated correct use of the nebulizer. Upon initial testing twenty-eight, or 93 per cent of the thirty sample population, were using their nebulizers incorrectly. The mean score on the initial test was 5.3; the range was from two to ten points. The Student's *t*-distribution was used to determine if there was a difference between the average score and the total. The average difference from the total, or the average number of items missed, was 4.7. The standard deviation was 2.20 and the standard error was .402. Using $t = \frac{\bar{x}}{S_{\bar{x}}}$, or $t = \frac{\text{average}}{\text{standard error}}$, it was found that $t = 11.69$. For the *t*-distribution table, the significance probability is less than .001 or $P = <.001$; therefore, the first hypothesis was accepted.

The second hypothesis was that a teaching-learning session on a one-to-one basis, which included a return demonstration and a one week practice session, would significantly correct the patients' incorrect uses of the DeVilbiss

Nebulizer 40. Before the teaching-learning session, the mean score of the sample population was 5.3 ± .8 at the 5 per cent level of significance. After the teaching-learning session, the mean score of the retested population was 9.0 ± .5 at the 5 per cent level of significance. The mean difference between the two sets of scores was 4.0 ± .8 at the 5 per cent level of significance. Using the Student's *t*-distribution it was determined that there was significant improvement in the scores after the teaching-learning session at the 5 per cent level of significance. Table 3 summarizes the scores before and after instruction.

TABLE 3

TEST SCORES BEFORE AND AFTER THE TEACHING-LEARNING SESSION

Patient Number	Score Before Instruction (A)	Score After Instruction (B)	Score Difference (B-A)
1	5	9	4
2	5	9	3
3	6	9	3
4	6	7	1
5	6	10	4
6	10	Not re-tested	-
7	7	10	3
8	4	9	5
9	4	9	5
10	10	Not re-tested	-
11	2	10	8
12	5	10	5
13	6	9	3
14	5	7	2

TABLE 3--Continued

Patient Number	Score Before Instruction (A)	Score After Instruction (B)	Score Difference (B-A)
15	4	10	6
16	4	10	6
17	3	7	4
18	5	9	4
19	5	9	4
20	5	9	4
21	7	9	2
22	2	5	3
23	8	9	1
24	7	10	3
25	3	10	7
26	4	9	5
27	8	10	2
28	3	9	6
29	2	9	7
30	9	10	1
Average	5.3 ± .8	9.0 ± .5	4.0 ± .8

As can be seen from the table, patients number 6 and 10 completed all items successfully the first time they were tested and were not retested. Referring back to Table 1, no correlations can be drawn between the two.

It should be pointed out that even though the scores improved significantly after the teaching-learning session, 72 per cent of the retested population still did not meet all ten criteria for correct use of the DeVilbiss Nebulizer 40. This may be due, in part, to the fact that the patients

had been using their nebulizers incorrectly for a period of time and that it is difficult to break already formed habits and relearn behavior. However, it should be emphasized that 88 per cent of the retested population missed only one item or less; therefore, the second hypothesis was accepted.

The third hypothesis was that certain items on the checklist would be missed more frequently than others. Throughout the testing of the population, a record was kept of each item and how often it was missed. The total number of times an item was missed was determined before and after the teaching-learning session. A summary of how frequently the items were missed is found in Table 4.

TABLE 4

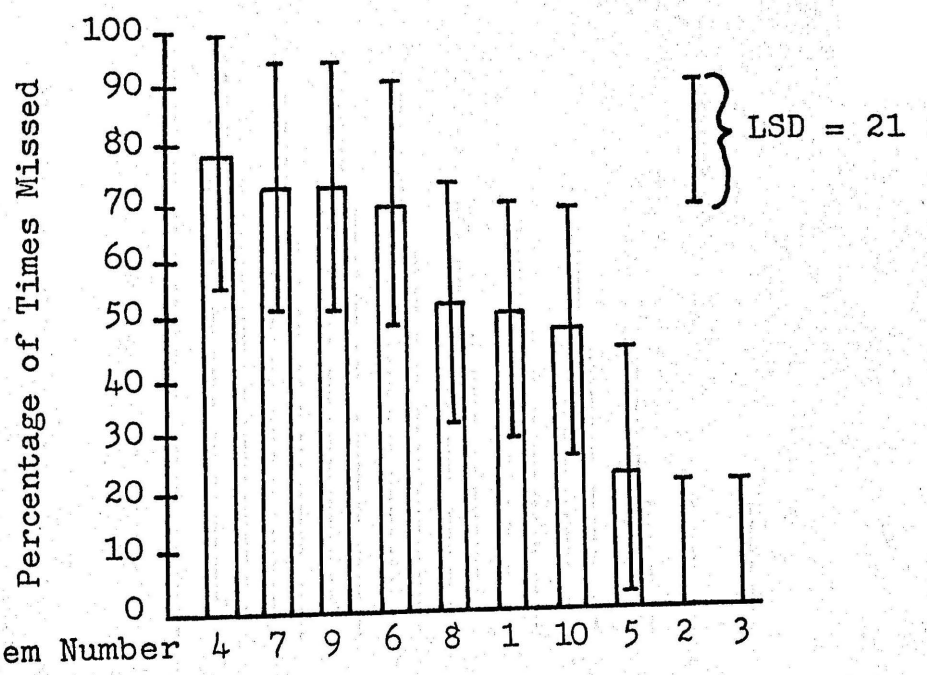
FREQUENCY OF ITEMS MISSED BEFORE AND AFTER THE TEACHING-LEARNING SESSION

Item Number	Times Missed Before	Times Missed After
1	15	1
2	0	1
3	0	0
4	23	10
5	7	0
6	21	6
7	22	4
8	16	0
9	22	5
10	14	5
Total	104	27

The table shows that the frequency of errors decreased after the teaching-learning session; but, the important question is whether some items were missed significantly more often than others. To determine this, the test for Least Significant Difference (LSD) as described by Snedecor and Cochran was used.[1] The LSD is the number by which the percentage of times missed must differ from another percentage of times missed in order for the items to be significantly different from each other. The differences between the ten checklist items prior to the teaching-learning session are found in Graph 1.

GRAPH 1

DIFFERENCES BETWEEN MISSED ITEMS
BEFORE THE TEACHING-LEARNING SESSION



[1]George W. Snedecor and William G. Cochran, Statistical Methods (Ames, Iowa: The Iowa State University Press, p. 272.

The bar graph indicates the percentage of times an item was missed and the lines superimposed on the bar graph indicate the points of least significant difference. An item is considered to be significantly different from another item when the percentage of times that item was missed does not fall within the points of least significant difference of the item to which it is being compared. It can be seen that prior to the teaching-learning session, item number 5 was significantly different from all other items. Item number 5 states that the patient opens his mouth wide and places the throat tube just inside his teeth and directs the tube toward the back of the throat. This item was missed significantly less often than all the other items except for numbers 2 and 3 which define the fluid level in the nebulizer bowl and instruct the patient to grasp the hand bulb with his hand. Item number 5 may have been missed less often than item numbers 1, 4, 6, 7, 8, 9, and 10 since most patients know that the nozzle is to be put into the mouth. However, item number 5 may have been missed more often than numbers 2 and 3 since it is difficult to fill the nebulizer above the fluid line when an eye dropper is used to measure the solution to be nebulized and most patients can readily see that the hand bulb is to be grasped in the hand. It can also be seen that items 2 and 3 are not significantly different from each other, but were missed

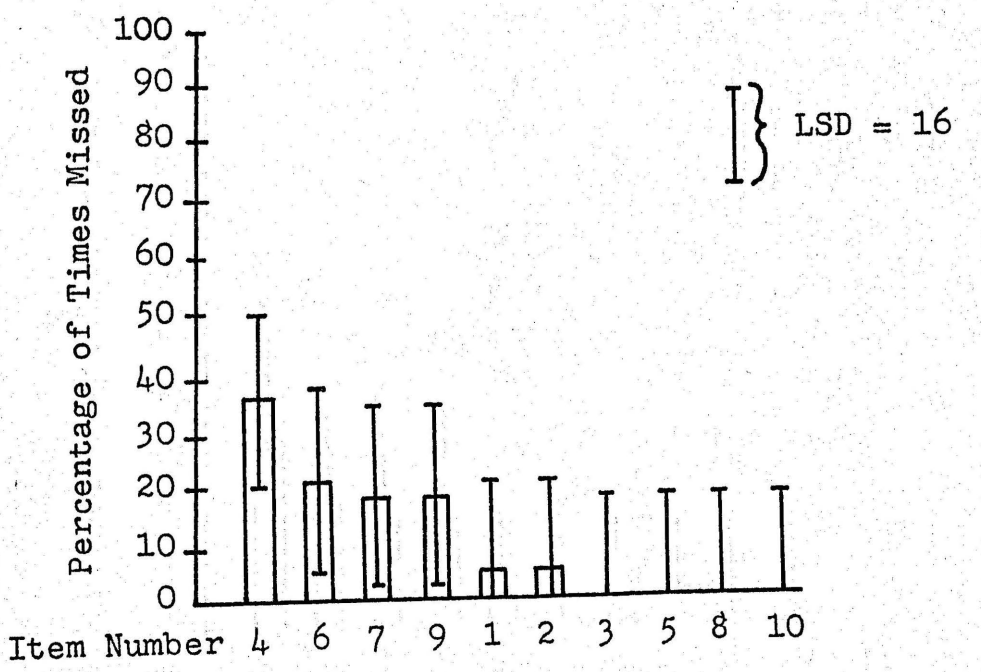
significantly less often than all the other items.

The bar graph indicates how often each item was missed in relation to all the other items. Item number 4 which states that the patient empties his lungs well below the normal end expiratory position without straining, was missed most often. This may be due to the fact that patients who have chronic obstructive pulmonary disease have airway collapse on expiration; thus, it is uncomfortable and difficult to exhale.

The differences between the ten checklist items after the teaching-learning session are summarized in Graph 2.

GRAPH 2

DIFFERENCES BETWEEN MISSED ITEMS AFTER THE TEACHING-LEARNING SESSION



Once again, the bar graph indicates the percentage of times and item was missed and the lines superimposed on the bar graph indicate the points of least significant difference. Significance is determined in the same way as it was in Graph 1. As can be seen from the graph, no one item was significantly different from all other items. However, item number 4 which states that the patient empties his lungs well below the normal end expiratory position without straining, was missed significantly more often than all other items except for number 6. Item number 6 states that the patient inhales slowly, at the same time squeezes the hand bulb several times, until full inspiration is reached. These items may not be significantly different from each other since it is difficult to coordinate inhalation with several squeezes of the hand bulb. It is interesting to note that even after the teaching-learning session item 4 was still missed more often than any other item; the phenomenon of airway collapse still being responsible.

In order to summarize the significant differences between items as found on the graphs, Tables 5 and 6 have been prepared. Table 5 shows the significant differences between checklist items before the teaching-learning session and Table 6 summarizes the significant differences between checklist items after the teaching-learning session.

TABLE 5

SIGNIFICANT DIFFERENCES BETWEEN CHECKLIST ITEMS BEFORE THE TEACHING-LEARNING SESSION

Item Number	Is Not Significantly Different from Item Number	Is Significantly Different from Item Number
4	6, 7, 9	1, 2, 3, 5, 8, 10
7	4, 6, 8, 9	1, 2, 3, 5, 10
9	4, 6, 7, 8,	1, 2, 3, 5, 10
6	1, 4, 7, 8, 9	2, 3, 5, 10
8	6, 7, 9, 10	2, 3, 4, 5
1	6, 8, 10	2, 3, 4, 5, 7, 9
10	1, 8	2, 3, 4, 5, 6, 7, 9
5		1, 2, 3, 4, 6, 7, 8, 9, 10
2	3	1, 4, 5, 6, 7, 8, 9, 10
3	2	1, 4, 5, 6, 7, 8, 9, 10

TABLE 6

SIGNIFICANT DIFFERENCES BETWEEN CHECKLIST ITEMS AFTER THE TEACHING-LEARNING SESSION

Item Number	Is Not Significantly Different from Item Number	Is Significantly Different from Item Number
4	6	1, 2, 3, 5, 7, 8, 9, 10
6	4, 7, 9	1, 2, 3, 5, 8, 10
7	1, 2, 6, 9	3, 4, 5, 8, 10
9	1, 2, 6, 7	3, 4, 5, 8, 10
1	2, 3, 5, 7, 8, 9, 10	4, 6
2	1, 3, 5, 7, 8, 9, 10	4, 6
3	1, 2, 5, 8, 10	4, 6, 7, 9
5	1, 2, 3, 8, 10	4, 6, 7, 9
8	1, 2, 3, 5, 10	4, 6, 7, 9
10	1, 2, 3, 5, 8	4, 6, 7, 9

Since some items were missed more frequently than others, the third hypothesis was accepted.

Summary

Thirty outpatients in a chest clinic were tested on the use of their DeVilbiss Nebulizers, a teaching-learning session was implemented, and its results were evaluated. Analysis of the data has been discussed in this chapter and the three hypotheses were accepted. The results were that a significant number of outpatients in a chest clinic were using the DeVilbiss Nebulizer 40 incorrectly; that a teaching-learning session on a one-to-one basis, which included a return demonstration and a one week practice session, did significantly correct the patients' incorrect uses of the DeVilbiss Nebulizer; and, that certain items on the check-list were missed more frequently than others.

CHAPTER V

SUMMARY, RECOMMENDATIONS, IMPLICATIONS, AND CONCLUSIONS

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Summary

The problem of this study has been to determine if outpatients in a chest clinic had the knowledge of the correct use of the DeVilbiss Nebulizer 40. A Checklist of Criteria for Correct Use of the DeVilbiss Nebulizer 40 was extrapolated from the literature and validated by a panel of judges. A teaching-learning session was implemented and the results were evaluated one week later.

A review of the literature showed chronic obstructive lung disease to be a major health problem in the United States. An accepted mode of treatment, according to the literature, is the nebulization of aerosols. However, the nebulization process must be done correctly in order for the treatment to be effective.

The Checklist of Criteria for Correct Use of the DeVilbiss Nebulizer was given to the thirty outpatients in a chest clinic to determine whether or not they were using their nebulizers correctly. The patients were selected by convenience sampling without regard to diagnosis. It was found that 93 per cent of the outpatients selected were

using their hand nebulizers incorrectly; thus, the first hypothesis that a significant number of outpatients in a chest clinic would be using their DeVilbiss Nebulizers 40 incorrectly was accepted.

A teaching-learning session was implemented with each patient who did not use his hand nebulizer correctly. Each patient practiced the steps of hand nebulization with the investigator until he was able to perform a return demonstration without coaching. He was then sent home to practice the skill for one week. When he returned to the clinic, he was retested according to the same criteria by a different professional nurse. Using the Student's *t*-distribution, it was found that the teaching-learning session on a one-to-one basis, which included a return demonstration and a one week practice session, significantly improved the patients' use of their nebulizers; thus, the second hypothesis was accepted.

Throughout the testing of the population, a record was kept of each item and how often it was missed to determine if certain items on the checklist would be missed more frequently than others. The most frequently missed item states that the patient empties his lungs well below the end expiratory position without straining. The next most frequently missed item was that the patient inhales slowly, and at the same time, squeezes the hand bulb several

times until full inspiration is reached. The least frequently missed item was that the patient grasps the hand bulb firmly, using the fingers against the palm of the hand. The third hypothesis that certain items on the checklist would be missed more frequently than others was accepted.

Recommendations

Based on the findings of this study, the following recommendations are offered for research:

1. That a similar study be conducted to determine if a group teaching-learning session would be as effective as a one-to-one teaching-learning session.
2. That a similar study be conducted using an audio-visual film demonstrating hand nebulization with the DeVilbiss Nebulizer 40 which could be shown to patients in conjunction with a follow-up teaching-learning session.
3. That a similar study be conducted to determine how patients who are under a private physician's care are using their DeVilbiss Nebulizers 40.
4. Further research in evaluating the teaching-learning process of patients who had never had a nebulizer prior to the time of the teaching-learning session.
5. Further research using spirometry in order to objectively evaluate improvement of lung function when the patient correctly uses the DeVilbiss Nebulizer 40.

Implications

Based on the findings of this study, several implications can be made concerning the correct use of the

DeVilbiss Nebulizer 40.

Physicians, nurses, and respiratory therapists all offer services to chronic lung patients who have prescriptions for the DeVilbiss Nebulizer 40 as one part of their total medical regimen. In planning a program for the care of chronic lung patients, it is the responsibility of all health team members to evaluate what the patient knows and what his capabilities are. There should be no assumptions made about how the patient is complying with his medical regimen or how he is performing his own self-care. The Checklist of Criteria for Correct Use of the DeVilbiss Nebulizer 40 provides a simple and straight forward means for all health personnel to evaluate how the patient uses his nebulizer.

In medical and nursing education programs, more emphasis must be placed on the importance of patient teaching as a means to improving the quality of patient care. Members of the health team must communicate through verbal and written means so that each member is aware of established goals set forth for a particular patient and his steps toward achieving these goals.

It is important to interact with the patient rather than for or at him. Members of the health team must be aware of each patient's own unique situation and this can only come about when there is open communication between

the patient and health team members. The quality of care that a patient receives and its effect on his well being must constantly be evaluated and new methods of reaching desired goals must be devised. The chronic lung patient, by the nature of his disease, must actively participate in his medical regimen. This participation can only be achieved if he is aware of what must be done and the correct way to accomplish it.

Conclusions

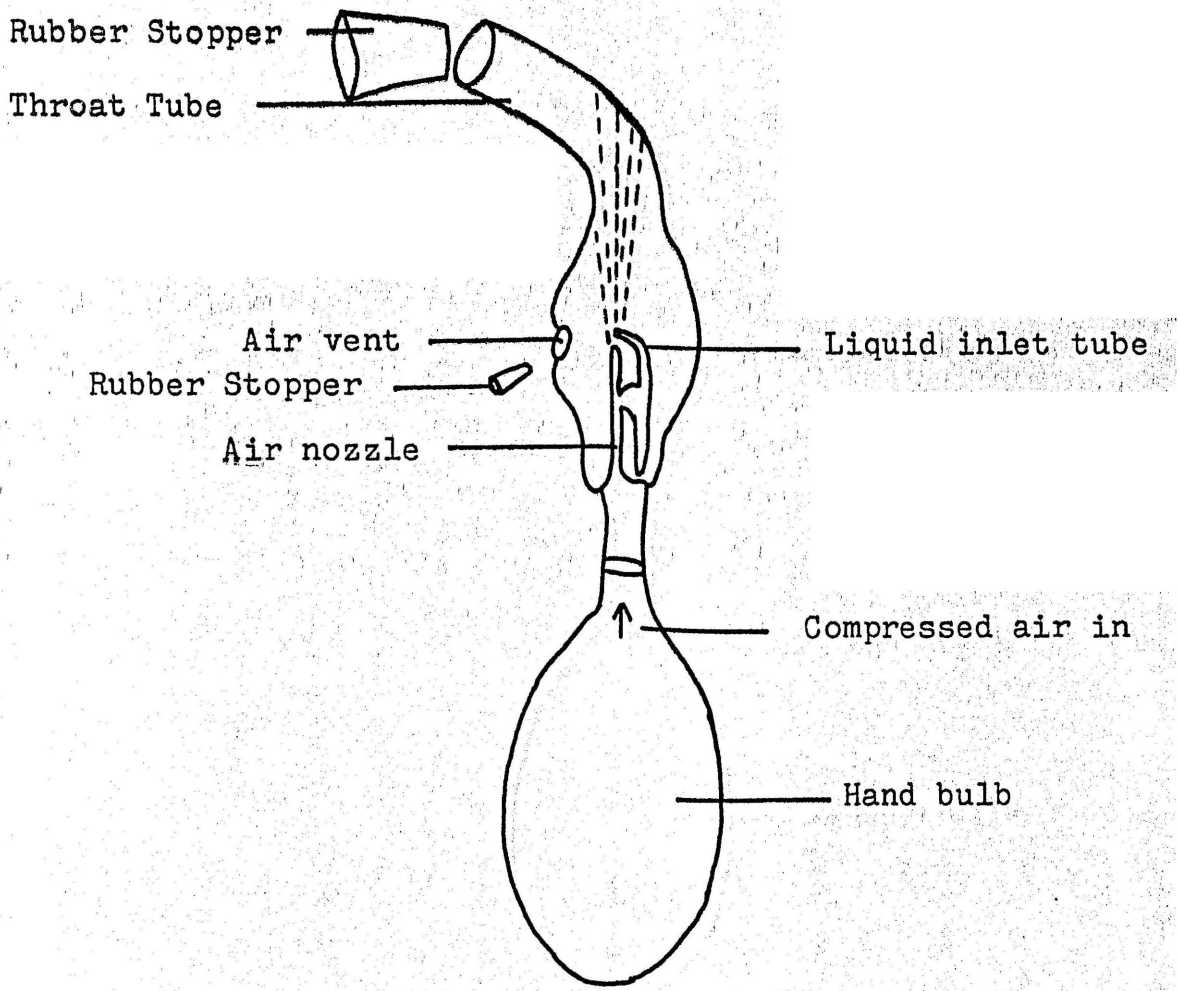
Based on the findings of this study, the following conclusions are offered. Hand nebulization is an important adjunct in the treatment of patients with chronic lung disease, but must be done correctly in order to obtain maximum effectiveness. However, a significant number of outpatients in a chest clinic were using their DeVilbiss Nebulizers 40 incorrectly. No correlation between the length of time the patient had used his nebulizer and correct use could be made. A teaching-learning session on a one-to-one basis, which included a return demonstration and a one week practice session, did significantly improve the patients' test scores. The most difficult item for patients to perform was exhaling prior to beginning nebuliation. The Checklist of Criteria for Correct Use of the DeVilbiss Nebulizer 40 is a beneficial tool in assessing

how a patient uses his nebulizer and contains all necessary steps for correct nebulization.

APPENDIXES

APPENDIX A

DeVilbiss Nebulizer 40



APPENDIX B

TEXAS WOMAN'S UNIVERSITY
COLLEGE OF NURSING
DENTON, TEXAS

DALLAS CENTER
1810 Inwood Road
Dallas, Tx. 75235

HOUSTON CENTER
1130 M.D. Anderson Blvd.
Houston, Tx. 77025

AGENCY PERMISSION FOR CONDUCTING STUDY*

THE Dallas County Hospital District

GRANTS TO Elizabeth A. Sprenger

a student enrolled in a program of nursing leading to a Master's Degree at Texas Woman's University, the privilege of its facilities in order to study the following problem:

A Study in the Correct Use of the DeVilbiss Nebulizer.

The conditions mutually agreed upon are as follows:

1. The agency (may) ([redacted]) be identified in the final report.
2. The names of consultative or administrative personnel in the agency (may) ([redacted]) be identified in the final report.
3. The agency ([redacted]) (does not want) a conference with the student when the report is completed.
4. The agency is (willing) ([redacted]) to allow the completed report to be circulated through interlibrary loan.
5. Other Would like to know results of study.

Date May 10, 1973

Signature of Agency Personnel

Elizabeth Sprenger
Signature of Student

Betty Henderson
Signature of Faculty Advisor

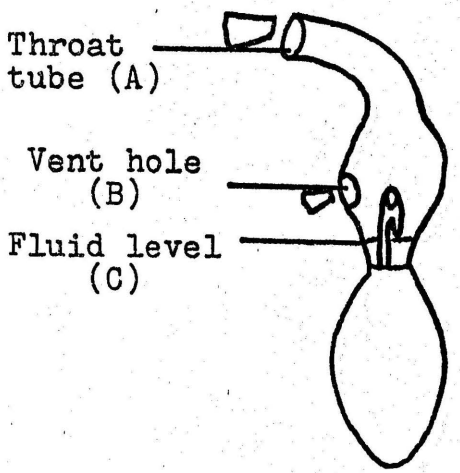
*Fill out and sign three copies to be distributed as follows: Original-Student; first copy-agency; second copy-TWU College of Nursing.

White/jmm/9/17/70

APPENDIX C

Instructions for Use*

Remove stopper from throat tube (A) and vent hole (B). Fill bowl of nebulizer through (A). Do not have fluid level above (C). Grasp bulb firmly, using fingers against palm of hand. Keeping mouth wide open, place throat tube (A) just inside the teeth and direct it toward the back of the throat. Inhale deeply while compressing the bulb. If less volume is desired, cover vent hole (B) with finger or stopper. After using nebulizer, always replace both stoppers to prevent entry of dust or dirt. WARNING - Always remove the stopper from throat tube (A) before using the nebulizer. TO CLEAN - Put about twenty drops of vinegar (white vinegar is preferable) or grain alcohol into nebulizer. Shake, then hold instrument with tube down and compress bulb several times to clean air and fluid passages. Rinse with rubbing alcohol



*Taken directly from the packing box of the Nebulizer.

or water that has been boiled. CAUTION - Do not use water that is too hot. TO STERILIZE THROAT TUBE - Clean carefully with alcohol.

APPENDIX D

Demographic Data

Name _____

Age _____

Sex _____

Race _____

Diagnosis _____

Length of time patient has had the Nebulizer _____

Has the patient ever had a Nebulizer prior to this time _____

Who showed the patient how to use the Nebulizer? _____

Comments about how the patient was shown:

APPENDIX E

Checklist of Criteria for Correct Use of the DeVilbiss Nebulizer 40

(Refer to Diagram in Appendix C)

	Yes	No
1. The patient removes both stoppers and puts ten drops Aerolone and forty drops water through throat tube A.		
2. The fluid level is not above line C.		
3. The patient grasps the hand bulb firmly, using fingers against palm of hand.		
4. The patient empties his lungs well below the normal end expiratory position without straining.		
5. The patient opens his mouth wide and places the throat tube just inside his teeth and directs the tube toward the back of the throat.		
6. The patient inhales slowly, at the same time squeezes the hand bulb several times until full inspiration is reached.		
7. The patient holds the inspiratory position for several seconds before exhaling.		
8. Throughout the treatment the patient expectorates loosened secretions.		
9. The patient uses all of the medication in the bowl of the nebulizer during a treatment.		
10. The patient cleans the nebulizer after use with vinegar or alcohol.		

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