Principles and Practice of
RESPIRATORY THERAPY

Second Edition

Edited by

JIMMY ALBERT YOUNG, A.R.R.T., M.Ed.
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Preface to the Second Edition

The practice of respiratory care has undergone tremendous changes, especially within the past 5 years. These changes have been due to advances in knowledge of pulmonary disorders and to new advances in the principles and practice of respiratory therapy. Technologic advancement has brought into being many new devices that are valuable adjuncts to the modalities of respiratory care.

The knowledge necessary for effective and adequate respiratory care is generally agreed to span a variety of subject matter. Clinicians in many branches of medicine have found that their specialty demands an extensive knowledge of respiratory physiology and clinical practice. This applies, particularly, to respiratory therapy personnel, nurses, chest physical therapists, cardiopulmonary technologists, emergency medical technicians and physicians engaged in the practice of medicine.

This text is intended to bridge the gap between pure respiratory physiology and the clinical treatment of patients with respiratory abnormalities. It has two aims: (1) to provide basic theoretical knowledge for respiratory therapy personnel, nurses, chest physical therapists, cardiopulmonary technologists and physicians, and (2) to provide a basis of current clinical practices and procedures to allow for a more scientific base in caring for patients.

Chapters have been designed to be read separately, and this has required some content to be repeated in some chapters for clarity and completeness. There are also frequent cross-references among the chapters.

This second edition includes discussions of recent technical advances and methods of respiratory care for the neonate, as well as for adult patients with acute respiratory failure or chronic airway disease.

The explosion of new knowledge and its application has resulted in revision of all chapters in the first edition of this volume: extensive revision of four; complete revision of sixteen; deletion of two, and addition of nine new chapters (Alveolar Ventilation and Gas

Exchange, Approach to Clinical Medicine, Pediatric Respiratory Therapy, Patient Care: The Team Approach, Cardiac Monitoring, Positive End Expiratory Pressure and Continuous Positive Airway Pressure, Outpatient and Home Care, Interviewing and Counseling Respiratory Therapy Personnel, and The Role of Respiratory Therapists as Emergency Medical Technicians).

The first edition contained 162 figures. This second edition contains 260 figures, of which 204 are new and another 56 figures have been redrawn or revised.

We would like to express our sincere appreciation to the following: secretaries: Mrs. Joan Hoffman, Miss Nancy Langsam and Miss Jean Gaynor; illustrators: Mrs. Edith Tagrin, Mr. Paul Andriesse, Mr. John Limoli and Miss Kathryn Brown Mercer.

JIMMY ALBERT YOUNG
DEAN CROCKER

Preface to the First Edition

As one observes the historical evolution of health care, certain patterns occur again and again. One of these, which is a direct result of forces such as the "medical and technological knowledge explosion" and the greatly increased demand for services, is the emergence of groups of specialty practitioners to bridge the gap between knowledge and delivery of care.

No area of specialty illustrates this evolutionary pattern better than "Inhalation Therapy." From the early days of administration of oxygen to the development of complex mechanical devices, the duration of years has been very short indeed. This development has been so rapid that the term "Inhalation Therapy" at present is probably a misnomer. Perhaps a more appropriate term to encompass what is done would be "Life Support Systems Specialist," with particular emphasis on internal and external environmental control.

The need to train large numbers of physicians and therapists to provide this care to infants, children, and adults has been painfully apparent. The authors have been engaged in formal training programs for "Inhalation Therapy" during the past 5 years. This book is an outgrowth of the course structure of these training programs. Accordingly, appreciation is expressed to the Harvard Teaching Hospitals and Northeastern University School of Inhalation Therapy for use of course materials.

We would like to thank Rex O. Matthews, Head, Special Publications Section of the National Aeronautics and Space Administration, and also to thank the Manned Spacecraft Center, Houston, Texas, for their help and advice in the preparation of this manuscript. Much assistance was obtained from William E. Kroll of the Puritan-Bennett Corporation for graphic presentation of data. Particular thanks go to J. H. Emerson of the Emerson Company for historical notes and equipment information. Also many thanks are extended to Dr. Robert M. Smith, Dean Edmund McTernan, Mrs. Gretchen Riley, and others of our associates who have contributed many valuable suggestions.

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Chapter 1

Organization and Administration of Clinical Departments of Respiratory Therapy

Jimmy Albert Young

With the advances in engineering design and the increased knowledge in respiratory physiology that have evolved since 1950, major changes have taken place in the overall management of patients with respiratory complications. Changes in medical care, surgery, rehabilitation of the respiratory cripple, hospital administration and nursing care have occurred along with technologic advances.

Today physicians, allied health professionals and patients, as well as politicians, are all aware of the critical need for the efficient, effective and equitable delivery of health care to the general population throughout the world.

It has been clearly pointed out that the number of patients requiring respiratory care is growing. The rapidly increasing incidence and/or recognition of chronic airway obstruction (CAO), particularly emphysema and chronic bronchitis, has become a matter of grave concern if not alarm. Chronic airway obstruction, according to some authorities, is rapidly becoming one of the most severe health problems of our time. The magnitude of this problem can be observed from the statistical graph (Fig. 1–1).

The health care needs of some 2,000,000 patients in the United States, with an estimated additional 14,000,000 or more Americans with CAO, represent one of our major health challenges today. In addition, Social Security disability benefits to victims of CAO amount to approximately $90,000,000 yearly.

Patients who require respiratory care have one or more of the following defects: alveolar hypoventilation, abnormal ventilation-perfusion relationship, reduced gas transfer, hypoxia, acidemia, acidosis and reduced ventilatory reserve.

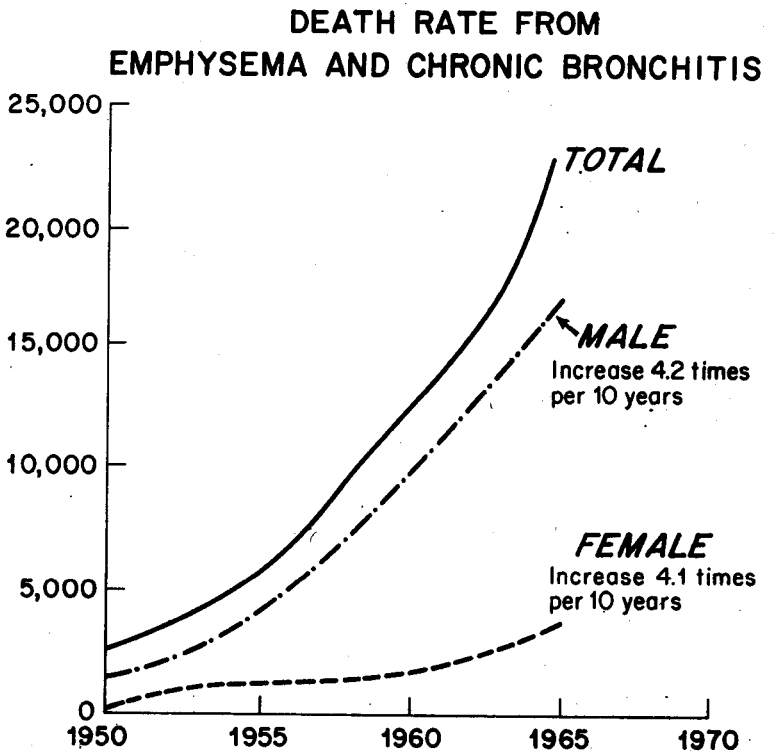

Fig. 1–1.—Mortality rate of patients with emphysema and bronchitis in the United States, 1950–1965. The number of deaths has increased almost 8 times, from 3,157 to 23,700.

Since 1958 there has been a marked increase in the use of therapeutic gases, aerosols and humidity, mechanical ventilation, chest physical therapy, pulmonary function testing and rehabilitative measures.

Many hospitals in the past decade had so-called "oxygen therapists" whose primary functions were to control the supply of medical gases, clean the equipment and deliver it to the various patient care areas throughout the hospital. The role of the respiratory therapy department of today has greatly changed from the role of the oxygen therapy department of the past. For a department to be clinically effective, the following categories must be well thought out and planned for:

1. Organization and functions
2. Responsibilities of personnel in respiratory therapy departments